EVALUATION DE L'IMPACT ENVIRONNEMENTAL DE L'ORGANISATION COMMUNE DE MARCHE DES CULTURES PERMANENTES

ANNEXE 2 : OCM OLIVE
ETUDE NATIONALE ESPAGNE et
ETUDE DE CAS ANDALUCIA

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GLOSSARY

AEM = Agri-Environmental Measures

ASAJA = Asociación de Jóvenes Agricultores (Young Farmers Organization)

ATRIA = Asociación para el Tratamiento Integrado de la Agricultura (Agriculture Joint Treatment Association)

CCAA = Communidades Autónomas (Autonomous Regions)

CMO = Common Market Organization

COAG = Coodinadora de las Organizaciones de Agricultores y Ganaderos (Farmers Organizations Coordinator)

EC = European Commission

EU = European Union

FEGA = Fondo Español de Garantía Agraria (Spanish Fund of Agrarian Guarantee)

GD = General Direction

INE = Instituto Nacional de Estadística (Spanish Statistic Institute)

MAPA = Ministerio de Agricultura Pesca y Alimentación (Ministry of Agriculture, Fisheries and Food of Spain)

OP = Operational Programs

PO = Producers Organization

UPA = Unión de Pequeños Agricultures (Small Farmers Union)

VMP = Value of Marketed Production

UAA = Useful Agricultural area

NOTE: If the is not said anything different, every economic figures present in the document are expressed in current terms.
We have realized that several numeric data in charts are written using the Spanish notation system: a point as thousand separator and a comma for the decimal point. We apologize for the mistake. It will be correct for next deliveries

1. CONTEXT OF OLIVE OIL AND TABLE OLIVES PRODUCTION IN SPAIN

1.1 Main characteristics of the olive oil production in Spain

The exploitation of olive in Spain, as in many other countries, is associated with the origin itself of Mediterranean crops. Grown Olive, *Olea europea sativa* comes fron a Sylvester variety, *Olea chrysophylla Lam*, by means of Acebuche *(Olea oleaster L)* or Oleastro *(Olea europea oleaster)*, all of them common species in the Spanish Sylvester flora. As a typical Mediterranean plant the olive is a rustic, longevous and resistant plant. For this reasons, traditional farming systems have consigned olive grove to the less fertile lands, usually in sloped areas, dry zones with low rain, even arid zones or in land with erosion risk. This farming system feature remains, with several variations, actually and will be one of the most important conditions to take into account in this study in order to consider Olive grove environmental impacts.

The modernization of Spanish agriculture during the second half of the 20th century modified that traditional farming system. In those farming systems where olive grove was linked to subsistence agriculture and self-sufficiency, it mainly disappeared in favour of extensive herbaceous agriculture, and in those where it was a production element it remained or developed. By the time Spain entered to the ECC, olive was a specialized crop highly developed in several areas where the climatic and cultural condition was favourable to it (AAO, 2005).

Spain has olive over almost all the territory. Thus is the first olive producer over the world. Olive surface in Spain is 2,423,841 has which contain over 307,758,000. Their distribution by regions is:

Table 1 : Olive Area (ha) and number of trees – by aggregated regions in 2003

Region	Surface (ha)	Nº trees
Andalucía	1,480,162	185,653,000
Extremadura	267,284	36,676,000
Centro	332,463	36,700,000
Ebro	178,803	21,879,000
Levante	165,129	26,850,000

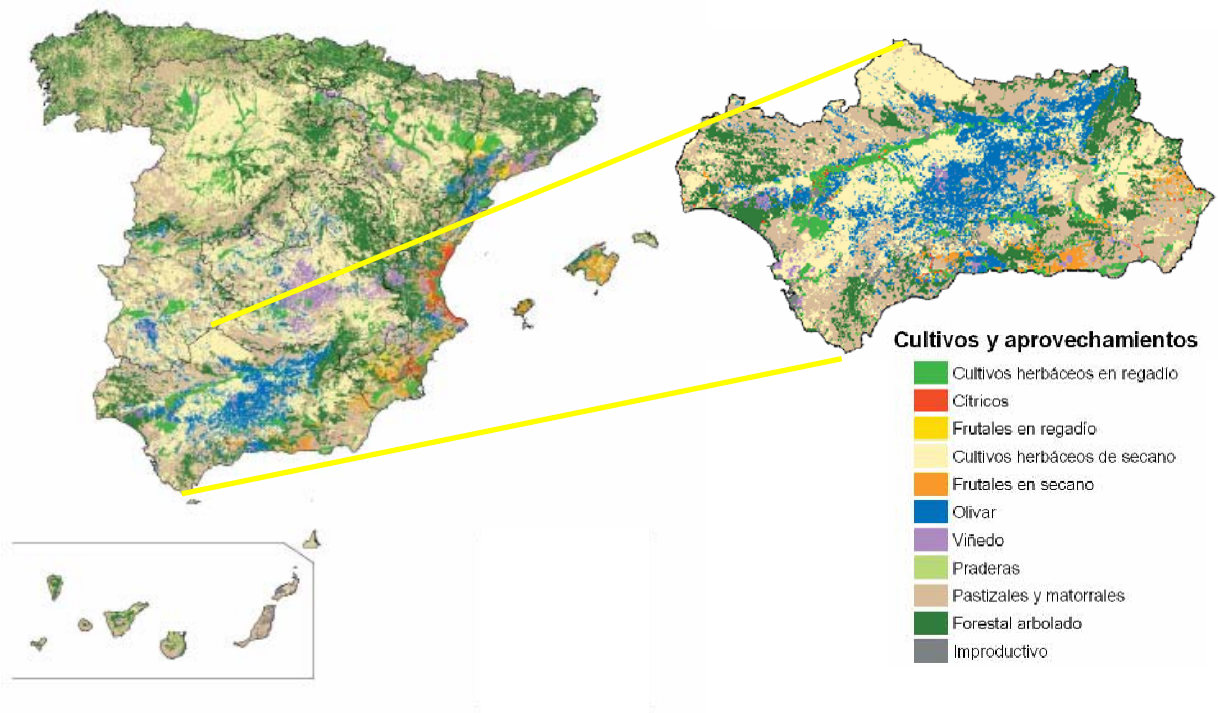
Source: AAO

As we can see, olive is a very important crop in Spain, because in terms of surface takes up over 13 % of the entire Spanish useful farming surface, and 48.5 % of the permanent crop surface. The environmental role of olive is also detachable because this high surface represents a fundamental landscape element comparable to forest areas. This relevance is highly marked in Andalucía, as it contains over 60% of Spanish olive surface and trees. As shown above the most important concentrations of olive tree over the world is in Andalucía (blue area in the map) which constitutes a really significant environmental element.

Environmental function of olive grove is also relevant in all the Spanish growing area, because as said, olive trees are located in many lands that in absence of olive grove should probably be abandoned and under risk of wind erosion.

We can also mark that the number of cultivated varieties is high, but the most representative are the following: picual, hojiblanca, cornicabra, lechín, manzanilla, verdial de Badajoz, empeltre y arbequina.

Chart 1 : Olive surface in Spain and in Andalucía



Source: Agriculture White Book. (MAPA 2003)

The following table shows a summary f the main figure of the olive grove production sector in Spain:

Table 2 : General Data of Olive grove production in Spain in 2003

Growing surface (ha)	2,400,000
Number of growers	650,000
Olive oil production (t)	900,000
Table olive production (t)	450,000
UE aids (€ millions)	1,005
Average farm size (ha)	3.5
% Olive oil fro final agricultural production	6.9
% Table olive from final agricultural production	1.9
% Of grown surface	13.3

Source: Agriculture White Book. (MAPA 2003)

Olive grove is also important in terms of rural employment, mainly in Andalucía, where olive recollection has been the most important support to temporal rural employment for many years. In Spain olive grove produce about 46 million of daily pays each year (MAPA, 2003).

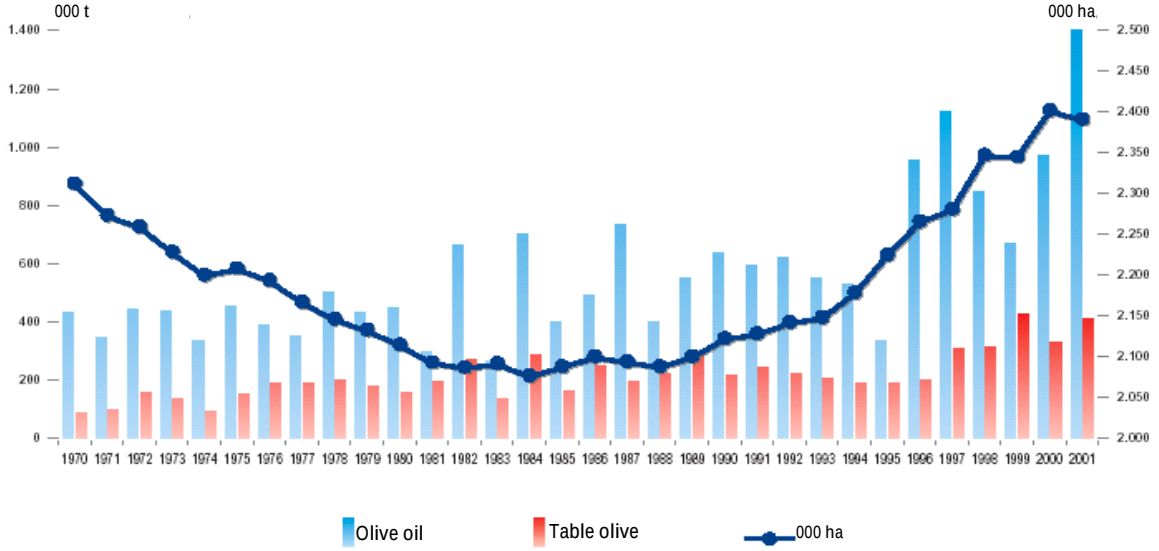
Spanish Olive grove covers 34 out our 52 provinces, thus there are many deferens situations concerning environment and the crop itself. This situation produces a wide cross section of exploitations, although the extensive production is predominant. In the last years the number of intensive farms has increased with production systems far different from traditional ones. Nevertheless they are still little relevant.

1.1.1 Evolution of the olive groves area - 1990 to 2003,

Olive groves area in Spain has not kept stable during the years, but has changed depending on various situations. There are some conditions previous to the studied period that must be taken into account. Spanish olive grove surface suffered during the period from 1970 to 1984 a continuous decreasing from 2,363,800 ha to 2,075,500 (about 12%). In the eighties decade were applied some restructuring programs to stop that tendency. From this moment consumers mind changed about the product and consumption increased. In addition, the favourable conditions

of CMO regulation since the entering of Spain in the EEC help to restore the productive surface, reaching in 1998 the level of 1970 (MAPA, 2003).

Chart 2 : Historic tendency of olive groves surface and production



Source: Agriculture White Book. (MAPA 2003)

The table below contains the data for the period. As shown there is a difference between the total surfaces and those under production. Depending on the year those differences are between 2% and 7%. It is also significant the difference between mill olive and table olive groves. The first one increases continuously during the period, but table olive surface decreases 35% from 1990 to 1997, increasing the following years but without reaching the original surface.

Table 3 : Olive surface at production (000 ha) by final destination

Year	Table Olive		Mill Olive		Total	
	Total	At production	Total	At production	Total	At production
1990	193.8	186.1	1,927.4	1,877.5	2121.2	2063.5
1991	182.6	178.2	1,944.5	1,896.0	2127.1	2074.2
1992	190.4	187.6	1,950.6	1,864.3	2141.0	2051.9
1993	138.7	138.1	2,008.3	1,953.8	2147.0	2091.9
1994	130.0	128.2	2,047.3	1,966.2	2177.3	2094.4
1995	127.6	125.5	2,096.1	1,993.9	2223.7	2119.4
1996	133.3	130.4	2,122.3	1,995.2	2255.6	2125.6
1997	124.1	122.7	2,156.0	2,034.8	2280.1	2157.5
1998	124.5	119.5	2,221.9	2,074.6	2346.4	2194.1
1999	169.7	162.1	2,194.9	2,039.6	2364.6	2201.7
2000	174.3	164.7	2,231.6	2,088.0	2405.9	2252.7
2001	163.8	156.0	2,265.5	2,135.4	2429.3	2291.4
2002	164.3	157.4	2,266.2	2,144.0	2430.5	2301.4

Source: Anuario de Estadística Agraria (MAPA).

The table below shows the evolution of irrigation in Spanish olive groves from 1994 to 2003. There has been a significant increase of irrigation. Thus, in 1994 only 5% of was an irrigated surface. That percentage increased continuously as shown until the current 19%. Irrigation increase has been higher in table olive than mill olive.

Table 4 : Irrigated olive surface (ha) by final destination

Year	Table olive	Mill olive
1994	8,148	109,631
1995	18,252	102,902
1996	21,398	173,748
1997	17,569	191,710
1998	27,816	222,736
1999	32,650	295,585
2000	35,808	372,258
2001	34,051	398,665
2002	36,898	419,943
2003	35,403	437,277

Source: Encuesta sobre superficies y rendimientos (MAPA).

That continuous increase of surface shows that olive grove has suffered a recovering process during the period, inverting the decreasing process of the previous decades. The intensification of irrigation points a change of growing practice. A significant amount of new olive groves paced in high productive irrigation lands can also be expected.

1.1.2 Evolution of the number of producers - 1990 to 2003,

The tables below present the structural distribution of Spanish olive groves in 1989 and 1999. There is no information about the evolution of data between the two years, because the Agricultural Census is done every ten years.

Table 5 : Spanish olive groves Structure in 1989 and 1999

	Farm size (ha)	Nº of farms	%	Aggregated surface (ha)	%
1989	<0,5	35,503	6.39	8,399	0.47
	0,5 to 2	148,948	26.79	109,214	6.10
	2 to 5	144,703	26.03	232,463	12.99
	5 to 30	176187	31.69	669,630	37.41
	30 to 70	31,092	5.59	288,963	16.14
	70 to 200	14,263	2.57	258,161	14.42
	200 to 1000	4,814	0.87	190,937	10.67
	> 1000	448	0.08	32,074	1.79
	Total	555,958	100.00	1,789,841	100.00
1999	**Farm size (ha)**	**Nº of farms**	**%**	**Aggregated surface (ha)**	**%**
	<0,5	173,418	26.7	43,066	1.9
	0,5 to 2	255,618	39.4	268,677	11.8
	2 to 5	126,342	19.4	389,409	17.1
	5 to 30	84,060	12.9	876,346	38.5
	30 to 70	7,283	1.1	316,502	13.9
	70 to 200	2,414	0.4	258,540	11.4
	200 to 1000	351	0.1	104,073	4.6
	> 1000	10	0.0	16,967	0.8
	Total	649,496	100.0	2,273,580	100.0

Source: Own wok from: Censo Agrario (MAPA).

In the table we can see that in 1989 59 % of olive farms surface was under 5 ha, and in 1999 the percentage was 85%. There has been a increase of the number of little farms. That increase belongs to little olive groves abandoned during the seventies. The new CMO aids system enhances producers to restore little olive groves exploitations.

1.1.3 Evolution of the oil production - 1990 to 2003, and if known of table olives,

Spanish olive production represent about 40% of world's production, reaching 46.7% in the campaign 2001-2002 (IOOC). Production is mainly characterized by high oscillations during the time. The main reason is the *vecería* a physiology feature of olive trees that produce biennial yield oscillations naturally. *Vecería* is enhanced by dryness and reduced by irrigation in intensive production. Therefore, as main surfaces of Spanish olive groves are managed according to traditional systems and in dry lands, its effect is still high.

Nevertheless we can point a remarkably intensification of production. As showed in chart 2 the reduction of surface during the previous decades to the regarded period, did not supposed a production decrease. Contrary yield increased, and continued increasing during the regarded period linked to growing surface increase.

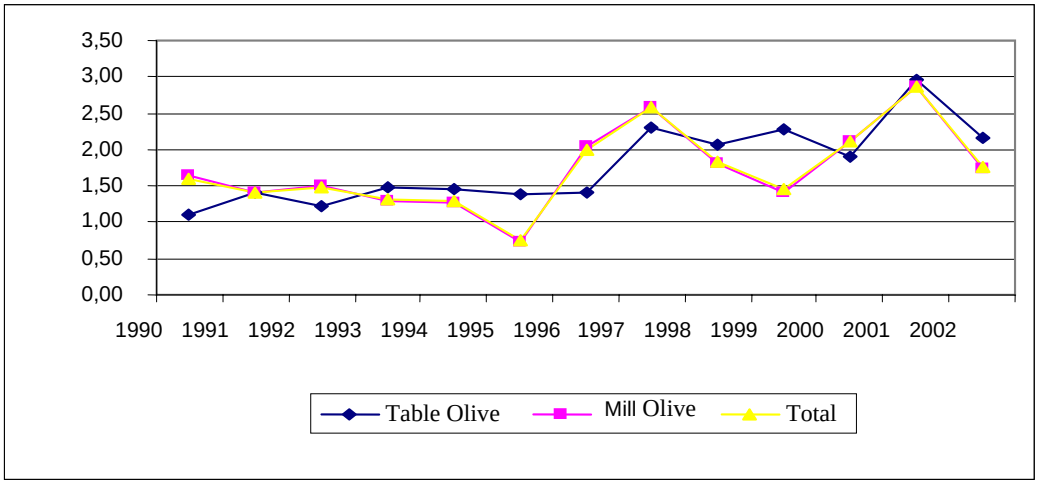
As seen in table and chart below, there are significant differences between higher and lower yields during the period. Those differences reach 49 % for table olive and 76.6 % for mill olive. The lower yields were produced in 1995, which was an especially dry year in Andalucía and in all Spain. Those adverse environmental conditions affected outstandingly to olive groves production sector.

Table 6 : Olive production (000 t)

Años	Table olive	Mill olive	Total
1990	216.0	3,153.2	3,369.2
1991	257.6	2,725.4	2,983.0
1992	232.1	2,945.8	3,177.9
1993	204.2	2,605.7	2,809.9
1994	190.8	2,608.0	2,798.8
1995	177.5	1,516.7	1,694.2
1996	189.0	4,328.3	4,517.3
1997	286.8	5,592.8	5,879.6
1998	258.5	4,020.7	4,279.2
1999	387.8	3,072.3	3,460.1
2000	331.2	4,729.1	5,060.3
2001	485.9	6,496.6	6,982.5
2002	354.2	3,924.3	4,278.5

Source: Anuario de Estadística Agraria (MAPA).

Chart 3 : Olive grove yield. (t/ha)



Source: Own work from Anuario de Estadística Agraria (MAPA).

1.1.4 Evolution of the number of mills - 1990 to 2003

Nowadays there are 1774 olive oil mills authorized which about 60% are cooperatives. Those mills employ about 10.000 people. During the last campaigns where the Spanish Olive Oil Agency (AAO) began controlling these industries, olive oil mills number has stayed virtually constant, despite of the production increase. Thus an increasing of olive oil milling capability might be found. Nevertheless, the structure show a highly atomized sector with a great number of little milling industries.

Table 7 : Evolution of number of olive mills registered by region

Region	1997	1998	1999	2000	2001	2002	2003	2004
ANDALUCIA	812	840	851	838	832	837	847	836
ARAGON	150	104	110	104	106	105	105	106
BALEARES	1	3	4	4	3	4	5	5
CASTILLA Y LEON	18	20	21	20	22	17	19	21
CASTILLA LA MANCHA	213	228	258	252	241	238	240	240
CATALUÑA	226	230	227	210	214	208	217	214
EXTREMADURA	109	115	131	118	117	116	117	118
MADRID	18	19	18	19	20	19	20	20
MURCIA	31	33	35	39	40	37	37	37
NAVARRA	11	12	11	10	12	13	13	13
PAIS VASCO	2	2	3	3	4	4	4	4
RIOJA (LA)	13	15	16	17	13	13	14	15
VALENCIA	140	141	152	146	144	143	142	145
TOTAL	**1,744**	**1,762**	**1,837**	**1,780**	**1,768**	**1,754**	**1,780**	**1,774**

Source: AAO

Table 8 : Number of entamadoras registered by region in 2005

Region	*Nº entamadotas*	*Region*	*Nº entamadoras*
Andalucia	237	Extremadura	88
Aragon	40	Madrid	1
Illes Balears	1	Murcia	12
Castilla-La Mancha	6	Navarra	1
Castilla Y Leon	1	Comunidad Valenciana	5
Cataluña	16	Total	408

Source: AAO

Regarding the number of e*ntamadotas*, (the Spanish industries dedicated to table olive transformation) and the evolution of olive mills, we can see that the olive transformation industry is linked to production in terms of spatial location. The structure is that of a highly atomized sector with a great number of little milling industries and *entamadoras*. The processing capability of *entamadoras* industries is lower than mills ones, because they represent 19 % of industries and process only 8.3 % of production.

1.1.5 Producers organisations (PO)

Cooperative and associative movement are widely spread in the olive sector. In Spain there are about 500.000 olive growers who receive aids, which 76 % belong to producers organizations recognized according to the regulations 136/66/CEE and 1513/2001/EC.

In 2000 there were in Spain 69 olive oil PO which grouped 377,789 olive growers. The bigger number is located in Andalucía with 52 PO and 218,000 olive growers associated. Moreover there are several Unions that groups PO:

- UNAPROLIVA (11 OPR y 78,000 olive growers).
- OLEOUNION (23 OPR y 104,003 olive growers).

Other representative operators organizations are: OPEOLIVA, UPROL, UNASUR, CJAJ, OPRACOLEX, UPA-UCE and OPOC.

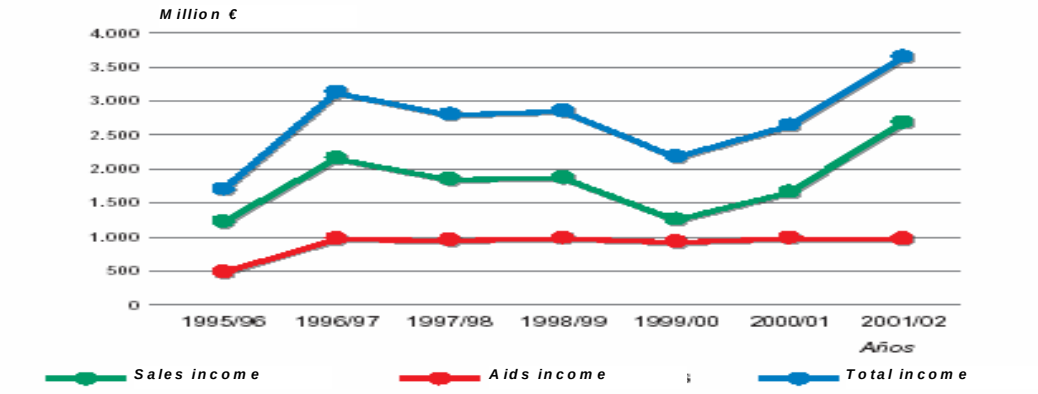
Operators organizations are responsible for applying the Operative Program settled up by the Interbranch organization: *Asociación interprofesional del Aceite de Oliva*. This program was approved according to the regulation 1334/2002(CE) for the campaigns 2003/03 and 2003/04. It had a budget of 7,034,310.46 € which 5,937,412.53 came from Communitarian founds, 445,009.55 from National founds and 651,888.39 from sector founds.

ASOLIVA is an interbranch organizations created to support olive oil exporting activities. Moreover there are 50 Producers Groups which include 135,665 members, marketing 70 % of the final production.

1.2 Level of implementation of the various measures of the CMO in Spain

As shown before in point 1.3 the Spanish organism charged of aid paying and monitoring is the FEGA. All the data concerning have been taken from this institution information. The expenses in Spanish olive oil sector to support production and to provide market equilibrium show their relevance in the following chart:

Chart 4 : Olive oil sector income levels



Source: Agricultural white book (MAPA).

In the table below appears the level of budget for each of the main aid lines paid by FEGA according to sector CMO. The main aid line is for production, with 79 % of the global average for the regarded period. Aids for table olive production began to be applied after CMO reform in 1998, but in table appear to aids in 1995 and 1996. These two aids belong to specific aids to table olive consumption paid in that years, we have consigned them separately from general aids to consumption according to FEGA information.

Aids to private storing are directly linked to production. Thus as shown after, in 1995 production decrease drastically, due to draughts, so there was no need of private storing for two years, the appearing in the market of private stored amounts compensated draught effects over market, so in that year export restitutions did not suffer significant changes.

The aid to use olive oil in cans is interesting because constitutes an element of inter-territorial solidarity. Can factories are mainly placed in the Cantábrico region, where there are no olive groves. Aid is paid to industries that create a linkage between different production sectors and regions, by means of the olive oil trading.

Table 9 : OCM olive oil budget 1990-2003

Year	Aid to production	Aid to table olive production	Aid to consumption	Aid to private storing	Air to using olive oil at cans	Oil register and quality improvement	Export restitutions
1990	180,055.41	-	0.00	10.82	3,068.17	5,400.09	39,274.34
1991	260,473.84	-	159,092.11	0.00	4,053.23	3,833.26	27,595.47
1992	222,376.88	-	203,456.42	7,837.20	447.75	5,944.01	8,055.37
1993	339,883.76	-	261,339.30	10,844.06	6,765.59	6,943.49	18,154.77
1994	380,813.29	-	259,117.35	12,121.81	8,754.34	13,411.59	13,236.69
1995	70,259.52	1,262.13	61,594.12	12.02	6,466.89	7,872.66	11,567.08
1996	478,609.38	628.06	43,117.81	0.00	4,989.00	13,675.43	16,769.44
1997	916,010.96	-	63,863.55	0.00	7,492.22	14,929.14	11,684.28
1998	807,565.54	-	71,542.68	6,780.02	15,380.50	9,309.08	4,213.09
1999	885,476.54	12,311.73	7,887.68	6,517.38	9,517.63	16,479.15	399.07
2000	830,054.81	47,928.31	3.61	21.04	10,682.99	8,638.95	18.03
2001	892,471.90	59,968.00	33.30	818.40	8,524.80	13,074.80	11.70
2002	1,065,056.75	47,238.82	-18.80	9,065.09	14,458.24	11,803.03	0.24
2003	990,850.03	47,913.27	70.47	-	15,085.21	9,322.25	6.40

Source: FEGA (MAPA).

1.3 Institutional framework of the olive oil production in Spain

The institutional framework in the Spanish olive oil sector presents a complex structure due to the decentralization of Spanish public administration and also to the relevance given to private organizations. Therefore there are different institutions charged on the following tasks:

1.3.1 Public administrations

They are the responsible of direct CMO planning, funding, control and monitoring:

Planning

CMO measures were approved by the European Commission in 1966 and 1998 and the National Administration is the institution charged of planning the policy at the European level, by means of the MAPA responsible. The MAPA is in close touch to CCAA agricultural responsible in order to plan a CMO policy as close as possible to the different regional needs.

Management monitoring and auditing system:

Olive oil CMO management system is similar to the rest of CMO in Spain. The competences distribution between National and Regional Public Administrations awards agriculture competences to Regional Governments, but general economic regulation to National Government. Thus the MAPA is responsible of:

- Relation with EC to coordinate the national program,
- The funding coordination by means of FEGA
- Regional management bureaus coordination by means of several Agriculture Ministry departments at General Directorate level.

Finally CCAA are in charge of direct aids management and divulgation.

MAPA gets funding from EC and distributes them to CCAA by means of FEGA. In addition the Agriculture General Direction gets in touch with regional management bureaus to control the program application an to inform European Commission. There is a monthly meeting between the national administration responsible and the ones of the 17 CCAA to monitoring the CMO campaign development.

Farmers and industries must address their aid application forms to the CCAA where their farm (or its main part) is located.

Funding

As CMO is a horizontal policy the funding is calculated in the European level to the whole country, therefore, although the CCAA are autonomous to managing many policies CMO is a global policy applied in the same way all over the country. Regional governments are responsible of those competences into the CMO organization transferred by national government. In this case these are the direct pays to producers. But there is a national institution responsible of global pay management, The FEGA. This institution transfers direct pays from EU to CCAA, and these last are the responsible of paying the producers.

Control and monitoring

The monitoring program is based on specific physical and financial indicators established by the European legislation. According to regulation EC 445/2002 which establish the monitoring system of the regulation measures EC 1257/1999 (in substitution of the 1750/1999), a monitoring report is presented to the European Commission. There are two controls:

- Administrative controls
- Farm survey.

Administrative controls are the base of the control and monitoring system. Besides farm survey controls are the responsible of assuring that each surveyed producer is carrying out the condition to receive aids according to EC regulations. These controls carried in all applications and are responsibility of regional institutions.

For the Olive Oil CMO there is a separate monitoring institution: The Spanish Agency to Olive Oil (AAO) It was created by lay 28/1987 as an autonomous organism attached to MAPA by means of the Sub-secretary. It is charged of surveys to guarantee a right application of aids regimes to the sector at the following programs:

- Olive mills.
- Olive producers.
- Recognized producers organizations.
- Homogeneous production zones yields.
- Estimation of productions by regions.
- Cross controlling.
- Market analysis
- Table olive
- Private storing

These programs belong to a yearly activity program proposed by the AAO and approved by the national government and the EC. These activities are regulated by the RD_257/1999.

Subsequently, there is a yearly control plan which is applied to the current year. Those controls are previous to aids payment. If necessary they are on ground controls, and are suspected to be applied over a yearly sampling of at least the 5 % of the beneficiaries. The technical staff in charge of that controls belongs to both to AAO and CCAA administration institutions. As far as possible when controlling a beneficiary all their commitments are controlled.

1.3.2 Private organizations

Interbranch organizations

The *Organización interprfesional del Aceite de Oliva* is the interbranch organization representative from the sector. Within it are represented the producers organizations: UNAPROLIVA, OLEOUNION, OPEOLIVA, UPROL, UNASUR, CJAJ, OPRACOLEX, UPA-UCE and OPOC.
Another interbranch organization specialized at exporting tasks is ASOLIVA: *Asociación Española de la Industria y el Comercio Exportador del Aceite de Oliva*.

Producers organisations at national level

CCAE *Confederación de Cooperativas Agrarias de España*: Joint the main part the Agricultural Cooperative Societies. Some of them are olive producer cooperatives.
The most important producers organizations specialized at Olive oil are:

- UNAPROLIVA: Joints 11 PO y 78,000 producers. Ii is operating into the sector since 1987
- OLEOUNION: Joints: 23 PO y 104.003 producers.

Unions

The following unions have a national scope, and are the most representative in Spanish Rural Domain:

- ASAJA: *Asociación de Jóvenes Agricultores.*
- UPA,: *Unión de Pequeños agricultures.*
- COAG: *Confederación de agricultores y Ganaderos.*

Besides of their particularities all of them are organized with a federal mode, with a national structure and particular organizations at each region. In Olive oil sector is also representative the SOC: *Sindicato de obreros de Campo*, because of their relevance amongst olive workers mainly in Andalucía.

Research and technical institute

The *Sistema de Información sobre el Aceite de Oliva* is a national research network created to link all the national research Works. This network operates through a national program of funding, embrace the research of all the regional and national olive oil research centres. This program focuses at:

- Crop improvement
- Transformation process improvement
- Calcification improvement
- Market and socioeconomic studies

The most relevant Spanish research centres are:

- IAMZ: *Instituto agronómico Mediterráneo de Zargoza*
- INIA: *Instituto Nacional de Incvestigación Agraria y Alimentaria*
- CSIC: *Consejo Superior de Investigaciones Científicas*
- IFAPA: *Instituto Andaluz de Investigación y Formación Agraria, Pesquera, Alimentaria y de la Producción Ecológica*
- IRTA: *Institució per a la Recerca i el Desenvolupament Tecnològic Agroalimentari*
- IMIDRA: *Instituto Madrileño de Investigación y Desarrollo Agrario y Alimentario*
- INTAEX: *Instituto de Tecnología Agroalimentaria de Extremadura*

Markets

Since 2004 the society MFAO: (*Mercado de Futuros del Aceite de Oliva)* is operating. This society created and manages the first olive oil Futures Market over the world. Although this institution is outside the evaluation period we mention it for its singularity and because it is an indicator of the sector expected future dynamism.

Origin Denominations

Finally we mention the origin denominations regulator councils, because they can act as market and production regulators. In Spain there are 20 Virgin Olive Origin denominations. The distribution by regions is as follows:

Table 10 : Number of Olive oil Origin Denominations by regions

CCAA	Nº OD
Andalucía	10
Aragón	1
Castilla la Mancha	1
Cataluña	4
Extremadura	2
Islas Baleares	1
La Rioja	1

Source: Dirección General de Alimentación (MAPA).

1.4 CMO implementation context in Spain

The application of the CMO measures related to Olive groves do not provide for any obligation related with AE actions, such as those provided for by REG. (CE) Nº 1257/1999.

The application of REG. (CE) N.º 1257/1999 has two measures (3, 4) concerning Olive groves production:

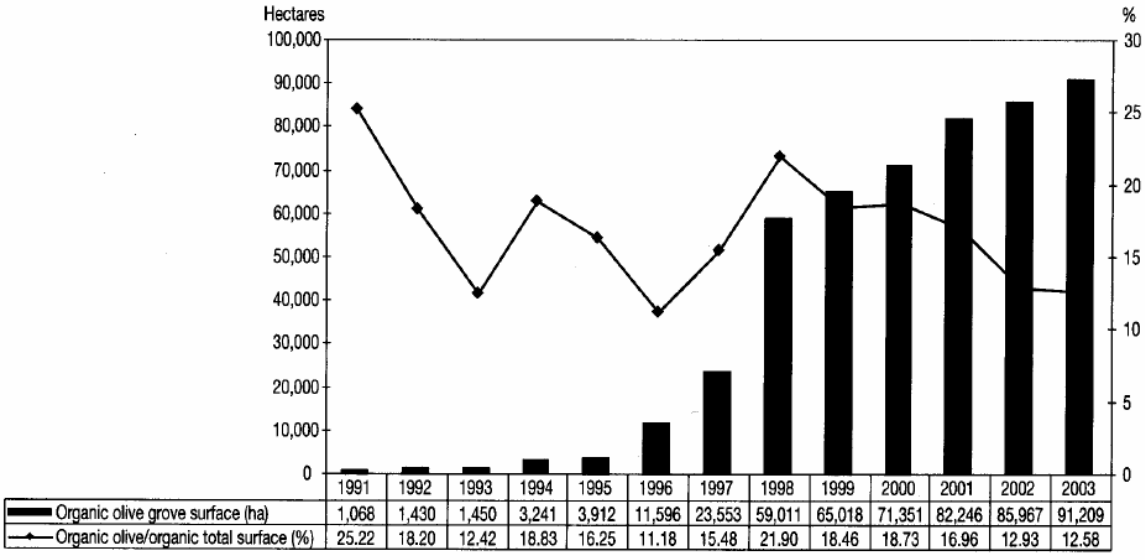
- Measure 3: Environmental techniques or rationalizing chemical products use
  - Measure 3.2 Integrated Control
  - Measure 3.3 Integrated Production
  - Measure 3.4: Ecological agriculture
- Measure 4: Fight against erosion at fragile environments
  - Measure 4.1: Woody crops at slopes or terrace.

Measure 3 is not a specific measure for olive groves, but the tree sub-measures related present many synergies with this production.

In olive grove it is significant the development of integrated control practices through the ATRIAs, associations for the integrated treatment and agriculture. Theese organizations have developed at the olive oil sector separately from the implementation of AEM measures due to the need of controlling plagues. But by the time of the intermediate evaluations of the AEM / RDR measures at year 2003, measures 3.2 and 3.3 have not been opened at olive oil production regions.

Measure 3.4 is relevant for olive oil production because as seen in the chart bellow organic olive oil production has developed reaching a surface of 91.209 ha at 2003 representing 12.6% of all Spanish organic surfaces.

Chart 5 : Organic olive oil surface evolution from 1991 to 2003

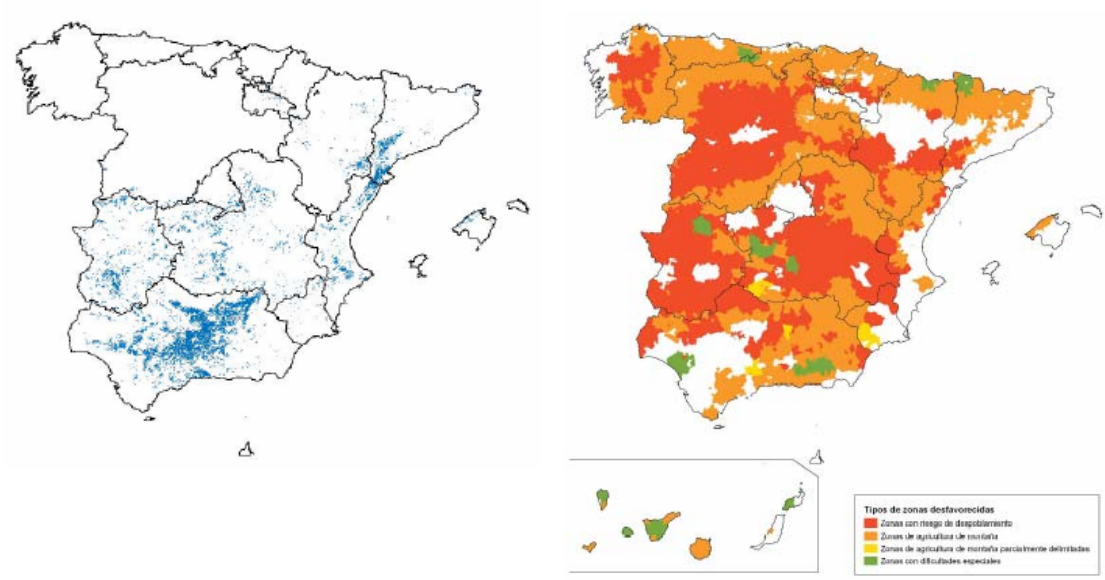


	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Organic olive grove surface (ha)	1,068	1,430	1,450	3,241	3,912	11,596	23,553	59,011	65,018	71,351	82,246	85,967	91,209
Organic olive/organic total surface (%)	25.22	18.20	12.42	18.83	16.25	11.18	15.48	21.90	18.46	18.73	16.96	12.93	12.58

Source: SJAR, 2005.

Measure 4.1 is strongly related to olive grove, because as shown in the chart below there is a significant surface of olive groves (blue area) at mountain zones orange area),

Chart 6 : Olive groves at mountain regions.



Source: Agriculture white book (MAPA).

2. CONTEXT OF OLIVE OIL AND TABLE OLIVES PRODUCTION IN ANDALUCÍA

2.1 Main characteristics of the olive oil production in Andalucía

Andalucía is the most important olive producer region in Spain and it has the most extensive olive grove surface of the whole country. It consists of 8 provinces: Huelva, Cádiz, Sevilla, Jaén, Córdoba, Granada, Málaga and Almería. Traditionally olive grove surface was that where no other grow was able to develop, thus is a marginal land grow. During the last two decades olive grove surface has increased at high productive lands such as Guadalquivir Valley fertile meadows.

Andalucía has a total of 1,503,276 Olive grove hectares on average, with 185,635 millions of trees. Production at year 2001 was 1,131,620 tons of olive oil and 415,800 tons of table olive. This meant 83% and 78% of global national production respectively, and 42% and 38% of world production.

The main olive tree varieties cultivated are listed in the tables bellow. As shown there are 7 main varieties which are placed at 90% of production surface. There are 8 secondary varieties placed at an additional 5% of surface. The rest 5% of growing surface are occupied by the minority varieties listed bellow.

Table 11: Olive tree varieties grown at Andalucía at 1994, 2002 and surface increase.

Main Varieties		Secondary Varieties	
ROE code	**Variety name**	**ROE code**	**Variety name**
1	Picual	5	Arbequina
3	Lechín de Sevilla	11	Gordal Sevillana
4	Hojiblanca	17	Aloñera
8	Picudo	18	Verdial de Vélez Málaga
10	Manzaniñlla de Sevilla	36	Lechín de Granada
16	Verdial de Huévar	47	Pico Limón
45	Nevadillo Negro	53	Manzanilla Serrana
		104	Alameño Blanco
Minority Varieties			
ROE code	**Variety name**	**ROE code**	**Variety name**
2	Cornicabra	89	Ocal
7	Morisca	100	Zorzariega
15	Carrasqueña	101	Acebuche
22	Azulejo	102	acebuchina
23	blamquillo	115	Campiñera
24	Canetera	123	Castiza
29	Cuquillana	135	Gordalijja
38	Loaime	144	Manzanillera
39	Lucio	149	Morcal
41	Morona	151	Morenilla
43	Mollar	166	Picuda
66	Bical	182	Temprano
69	Cañivano Blanco	190	Verdala
84	Manzanilla deJaén	199	Otras variedades
87	Nevado Azul	200	Lentisco
88	Nevado Basto		

Source: Junta de Andalucía.

The dominant Variety at Andalucía is 'Picual' with 858,746 grown ha (representing the 58.2% of global regional surface). There is also the most used variety at new plantations because of their high productivity and their good fat yield performance. Its relevance is higher at the north-east

region because supposes 98.6% of olive grove surface at Jaen, 63.9% at Granada, and 39.8% at Córdoba.

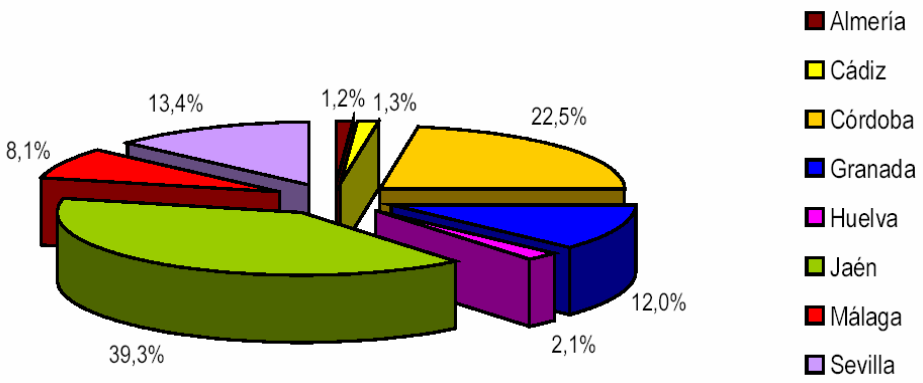
The next variety in terms of regional surface is 'Hojiblanca' which supposes 267,199 ha (representing 18% of total). This variety is manily located at Southern Cordoba, Northern Málaga, and South-East of Sevilla.

The third variety is Manzanilla de Sevilla with 73,766 ha (representing only 5% of total). Its is mainly placed at Sevilla and a part of Huelva. The rest of varieties distribution range is lower and are placed mainly surrounding their origin zone. Their local relevance is high. Thus 'Verdial de Húevar' supposes 36.8% of total surface at Huelva province, and 'Lechín de Sevilla' represent 61% of regional surface at Cadiz province. 'Arbequina' variety is from Cataluña region, and has been recently introduced at new plantation all over Andalucía, but its relevance in terms of surface is low.

As said before, olive grove is also important in terms of rural employment, mainly in Andalucía, where olive recollection has been the most important support to temporal rural employment for many years.

At Andalucía Olive grove is located at all the related 8 provinces, but there are differences between them in terms of crop relevance. Thus as seen in the charts bellow there are thee provinces (almería, Huelva, and Cádiz) where olive grove is a minority crop.

Chart 7: Olive surface distribution at Andalucía.



2.1.1 Evolution of the olive groves area - 1990 to 2003,

As can be seen at table 10 there is a continuous increasing of olive grove surface during the regarded period. The whole region surface increase is 17%. As said before, global national increase was about 12%, this means that Spanish olive grove surface increase has concentrated at Andalucía, because general increase is about 5% higher than nationalaverage. There is only a surface decrease at Huelva province (3%), and there are also outstanding increasing at Cádiz (47%) and Almería (42%) provinces. With regard to the global regional surface, this tree figures belongs to low olive grove surface provinces. In all this tree cases the evolution depends on local production circumstances, and the regional situation evolution is determined by high production provinces such as Jaén(16%), Córdoba (15%) and Granada (19%).[1] As

The highest surface increases are located at Jaén (82,584 ha), Cordoba (44,111 ha) and Sevilla (37,619 ha) provinces. These provinces intake a great part of the regional Guadalquivir Valley Fertile meadows. This means that the olive grove development has concentrated at fertile and more intensive production areas[2].

[1] Regional managers point of view stated at interviews.
[2] Interviewed regional managers and researchers agree with this subject.

The incidence of restructuring programs referred at point 1.1.1 was centred at Andalucía, because this region is the most important olive producer at Spain.

Table 12: Evolution of oive grove surface at Andalucía (1992 to 2002).

	Almería	Cádiz	Córdoba	Granada	Huelva	Jaén	Málaga	Sevilla	Andalucía
1992	11,510	13,640	302,152	146,000	29,700	505,451	108,632	168,939	1,286,024
1993	11,690	13,653	304,510	145,700	29,689	508,438	109,230	173,400	1,296,310
1994	11,690	13,683	307,034	152,000	29,602	515,198	109,561	180,962	1,319,730
1995	11,690	14,816	313,944	152,000	29,006	539,579	111,692	180,879	1,353,606
1996	11,690	14,935	317,886	168,500	29,006	548,289	112,564	180,876	1,383,746
1997	13,390	15,312	320,853	171,250	28,503	552,804	114,903	180,876	1,397,891
1998	13,390	20,257	344,273	172,233	27,587	559,356	118,415	186,238	1,441,749
1999	15,500	20,061	344,874	172,233	30,266	562,761	120,719	188,176	1,454,590
2000	15,800	19,950	345,317	172,233	29,180	589,532	121,182	196,569	1,489,763
2001	15,900	19,900	345,962	174,197	28,688	590,920	121,465	206,208	1,503,240
2002	16,380	20,065	346,263	174,197	28,709	588,035	121,884	206,558	1,502,091

Source: Anuario de Estadística Agraria. MAPA.

Table 13: Regional olive grove surface increase at Andalucía (1992 to 2002).

	Almería	Cádiz	Córdoba	Granada	Huelva	Jaén	Málaga	Sevilla	Andalucía
%Increase	42	47	15	19	-3	16	12	22	17

Source: Own work. Data from Anuario de Estadística Agraria. MAPA.

Table bellow shows the evolution of irrigated olive grove surface at Andalucía by final destination. There can be seen that irrigated mill olive surface evolution is indeterminate, with increasing and decreasing several times during the period. This is a quality matter. Interviewed managers and producers[3] informed us about a common procedure at table olive production plots consisting on keeping low quality production olive groves to oil production. This is a decision taken yearly, thus table olive production surface yearly variation is higher.

Table 14: Evolution of irrigated olive surface at Andalucía by final destination (ha).

Year	Mill olive	Table olive	Total
1992	16,124	92,940	109,064
1993	16,907	92,644	109,551
1994	17,306	104,771	122,077
1995	23,114	116,726	139,840
1996	21,601	128,679	150,280
1997	20,430	158,769	179,199
1998	16,986	174,302	191,288
1999	25,078	179,292	204,370
2000	30,620	218,239	248,859
2001	32,414	231,970	264,384
2002	38,067	233,431	271,498

Source: Encuesta sobre superficies y rendimientos (MAPA).

About the global irrigation surface we find an increase of 162,432 ha. With regard to the national irrigation surface increase this supposes about 52% of global national increase. This percentage is lower than the percentage of olive grove national surface located at Andalucía which is about 62%. This means that the irrigation development has been less intensive at Andalucía than at other Spanish regions.

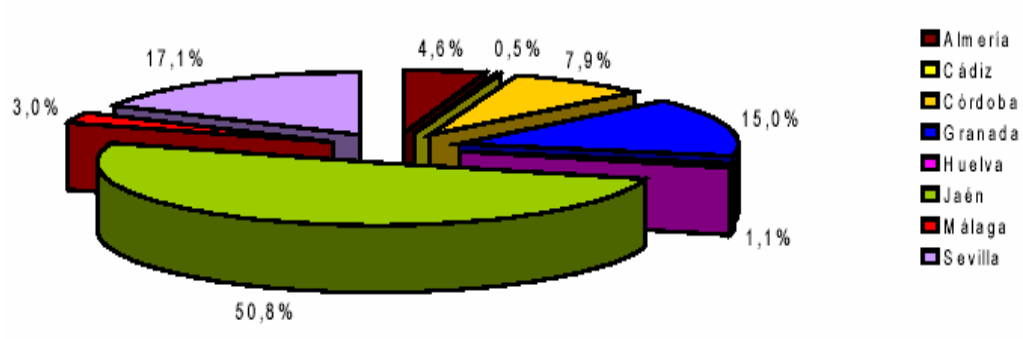
[3] No one of them was table olive producers, but several of them have responsibilities at producers organizations involved at table olive production, thus we recognize their opinion as an authorized one.

The chart below shows the distribution of irrigation olive grove surface at Andalucía. This surface is concentrated at those provinces where fertile irrigated meadows are located. That is the case of Jaén, Granada and Sevilla province. Whereas these provinces aggregated olive grove surface is about 39%, 11% and 13% of regional surface respectively, irrigated one raise to 50%, 15% and 17% also respectively. The outstandingly predominance of Jaén province is obviously because at this province olive grove supposes 90% of all the agricultural useful land.

There is also significant the case of Huelva province production, because supposes 4.6% of irrigated surface with only 1.1% of grown surface. This means that about 70% of olive groves at Huelva are irrigated. This means that in the case of this province is probably that olive grove should be near to disappear in absence of irrigation. At this point managers agree to assure that irrigation system is a feasible way to support olive grove production at marginal areas with low precipitations.

On the opposite irrigation level at Cadiz province (0.5%) is outstandingly lower than at Huelva. In Cadiz Olive groves are located at an area with a high raining level[4], thus the development of irrigation

Chart 8: Distribution of irrigated olive surface at Andalucía (2003).



Source: Junta de Andalucía.

2.1.2 Evolution of the number of producers 1990 to 2003,

The tables below present the structural distribution of olive groves at Andalucía at 1999. These data can be compared to national ones as follows.

With regard to aggregated national sector structure we can see that the average farm size at Andalucía is higher than at full country. In this case the average farm size is 6.65 ha, whereas the Spanish average size is 3.5 ha. As in the national case the grater number of plots is between 0.5 ha and 5 ha supposing 57.5% of regional total, but there is a significant increase of the number of plots between 5 and 30 ha of surface. At Andalucía them are 28% of total whereas at Spain are only 12.9%. For plots over 30 ha the case is similar at Andalucía them are 7% of total whereas at Spain are only 1.6%. This means that olive grove farms structure is better adapted to extensive production at Andalucía than in the rest of Spain. Interviewed managers agree with these figures, but they also point to that 38% of farms which surface is under 2 ha. This means a high number of farmers in rural areas usually under depopulation risk. And they call to enhance support systems to this population.

[4] Spanish highest raining point is located at Cadiz province, at Garzalema Sierra. This is due to a microclimatic special features because of the conjunction of Atlantic and Mediterranean seas.

Table 15: Olive groves structure at Andalucía in 1999

	Farm size (ha)	Nº of farms	%	Aggregated surface (ha)	%
1999	<0,5	18,348	7.5	5,118	0.4
	0,5 to 2	74,156	30.4	72,106	5.1
	2 to 5	36,357	27.1	164,143	11.5
	5 to 30	68,264	28.0	509,449	35.7
	30 to 70	9,687	4.0	224,733	15.8
	70 to 200	5,206	2.1	236,283	16.6
	200 to 1000	2,043	0.8	175,815	12.3
	> 1000	599	0.1	38,858	2.7
	Total	214,660	100.0	1,426,505	100.0

Source: Own wok from: Censo Agrario (MAPA).

2.1.3 Evolution of the olive oil and mill olive productions - 1990 to 2003

As said in the national description and can be seen again in the table and charts bellow, olive production suffers outstandingly variation from one year to an other. Also according to the national case description, there is a remarkably intensification of production. As showed in chart 2 the reduction of surface during the previous decades to the regarded period, did not supposed a production decrease. Contrary yield increased, and continued increasing during the regarded period linked to growing surface increase, and mainly to modern production techniques. Interviewed managers and researchers agree to assure that *vecería* is attenuated by irrigation, but also by growing procedures from pruning to collecting[5].

Table bellow describes mill olive evolution by provinces, and the following chart represents the actual situation. Comparing this chart with the following dedicated to table olive production we c an see that provices farmers tend to specialize themselves to one type of production. Thus olive oil production is higher at Jaén and Granada, whereas farmers at Sevilla, Huelva and Málaga tend to the production of table olive.

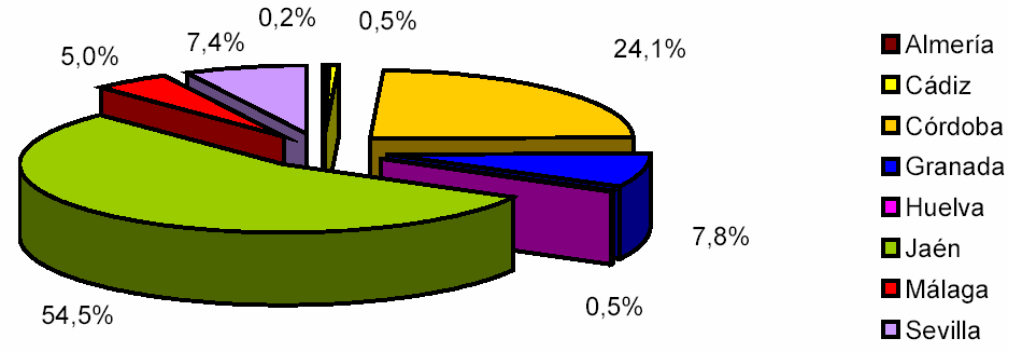
Table 16: Mill olive production evolution at Andalucía (000 t)

	Almería	Cádiz	Córdoba	Granada	Huelva	Jaén	Málaga	Sevilla	Andalucía
1992	8,647	17,360	717,745	211,733	17,141	1,139,573	223,134	122,256	2,457,589
1993	6,987	13,108	417,279	156,905	26,430	1,045,633	152,627	102,270	1,921,239
1994	4,590	10,860	728,544	156,162	23,902	930,289	231,447	149,332	2,235,126
1995	10,067	10,304	272,135	156,207	20,079	460,951	60,307	106,603	1,096,653
1996	13,327	15,614	1,021,175	282,945	15,656	1,822,327	288,205	163,600	3,622,849
1997	23,782	15,152	982,655	487,170	15,348	2,148,657	408,401	352,832	4,433,997
1998	17,785	31,899	888,297	204,901	8,865	1,680,964	194,407	362,158	3,389,276
1999	29,545	14,197	516,994	191,469	17,000	961,851	231,994	196,094	2,159,144
2000	28,630	25,910	1,037,404	357,717	12,737	2,228,424	264,357	223,456	4,178,635
2001	59,550	27,070	1,377,917	467,409	16,976	2,581,772	404,758	411,139	5,346,591
2002	40,913	27,787	837,157	321,683	18,134	1,626,827	197,001	200,448	3,269,950

Source: Anuario de Estadística Agraria (MAPA).

[5] Technical information about the influence of farming procedures on production is really wide. We have selected several studies and publications supporting this assessment in the bibliography point. There can be quoted: Guerrero, 2003; IFAPA, 2004; Pastor, 2001, 1999b, 1998, 1997b, 1991; García Ortiz, 1997, Corraliza, 1998; Navarro,1997; Vega, 1997; Troncoso, 1998.

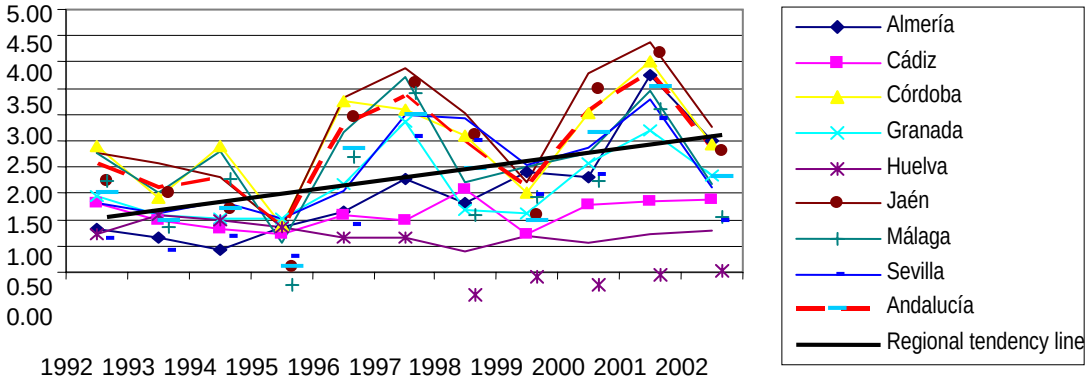
Chart 9: Regional distribution of olive oil production at Andalucía.



Source: Junta de Andalucía.

Chart bellow shows the referred yield variability. But there is also significant that yield is higher at those regions where olive grove surface is higher. So the highest yields are reached at Jaén and Córdoba, whereas at Huelva and Cádiz yield is lower.

Chart 10: Mill olive grove yield evolution at Andalucía. (t/ha)



Source: Own work from Anuario de Estadística Agraria (MAPA).

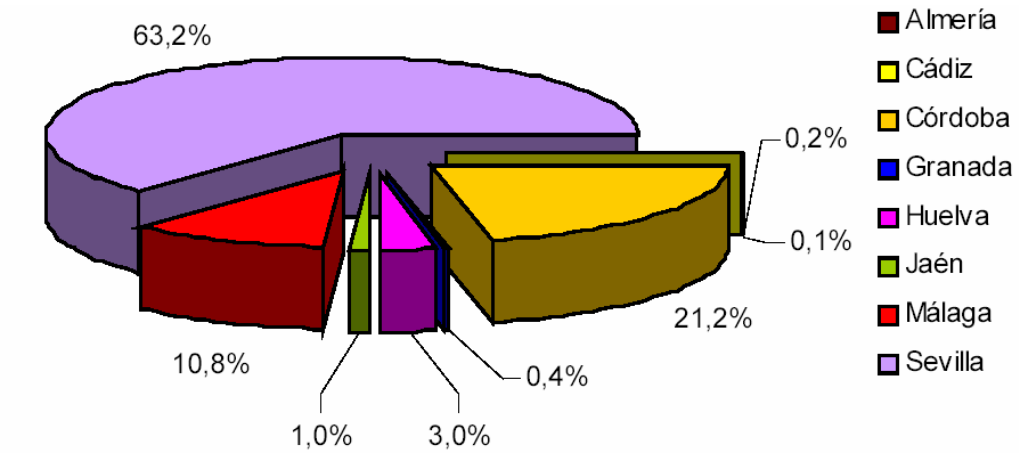
Table olive production at years 1994 and 1995 is dramatically low at those regions where irrigations is less developed. This is due to draught. As said before table olive quality requirements are higher than mill olive ones to determinate the acceptability of production. We can also see that table olive production is concentrated at Sevilla province as said.

Table 16: Table olive production evolution at Andalucía (000 t).

	Almería	Cádiz	Córdoba	Granada	Huelva	Jaén	Málaga	Sevilla	Andalucía
1992	2,158	755	10,475	1,840	4,797	2,972	8,349	145,532	176,878
1993	1,717	565	13,831	1,004	6,200	3,100	5,807	136,637	168,861
1994	1,197	483	9,616	589	8,517	2,393	11,116	115,144	149,055
1995		439	6,226	585	5,997	833	2,866	119,937	136,883
1996		577	10,894	1,323	4,124	4,831	5,542	122,778	150,069
1997			14,500	2,071	4,936	4,743	8,369	178,433	213,052
1998			13,994	671	4,197	4,361	7,544	178,463	209,230
1999			11,057	1,676	5,522	3,540	9,336	243,006	274,137
2000			12,129	1,655	5,101	4,712	10,316	226,940	260,853
2001			14,442	1,927	5,766	5,966	13,050	333,054	374,205
2002			15,590	1,628	5,260	3,967	12,038	220,467	258,950

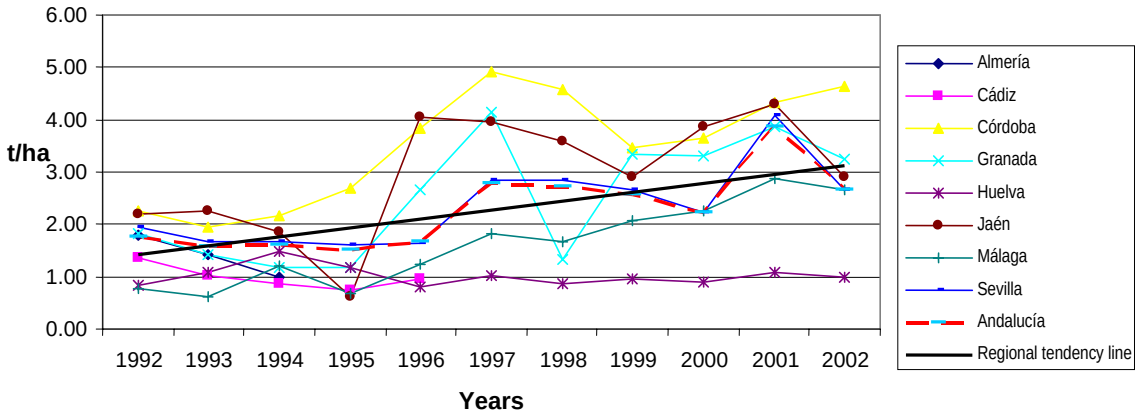
Source: Anuario de Estadística Agraria (MAPA).

Chart 11: Regional distribution of table olive production at Andalucía.



Global tendency of table olive yield is similar to mill olive one, and average production is quite similar.

Chart 12: Table olive grove yield evolution at Andalucía. (t/ha).



Source: Own work from Anuario de Estadística Agraria (MAPA).

2.1.4 Evolution of the number of mills- 1990 to 2003,

At table 7 we have presented the evolution of olive mills at Andalucía and other regions. For the case of Andalucía we can see that its number increases a 5% whereas production increases reach 45% for the same period. This means that olive mill sector evolves to increasing the processing capability. This should mean also an increasing efficiency.

Table 17: Olive mill distribution at Andalucía by provinces.

Province	*Nº Mills*	*Average production*
Almería	29	1411
Cádiz	11	2526
Córdoba	184	4550
Granada	116	2773
Huelva	21	864
Jaén	335	4856
Málaga	73	2699
Sevilla	84	2386

Source: AAO

Regarding previous table can be seen that olive mills are distributed according to surface production, but there are outstandingly differences between provinces. Milling capability is higher at Córdoba and Jaén, which means that in those regions where olive grove are widely developed, milling industries are also widerd.

This observation is also valid to table olive transformation industries, as we can see how the highest number of entamadoras is place at Sevilla Province, and that their transformation capability (with Huelva ones) is higher.

Table 18: Number of entamadoras registered at Andalucía by province in 2005

Province	*Nº entamadotas*	*Average production*
Almería	1	
Cádiz	1	
Córdoba	38	410
Granada	2	814
Huelva	3	1753
Jaén	7	567
Málaga	31	388
Sevilla	154	1432

Source: AAO

Finally we must mention that the transformation capability of *entamadoras* is outstandingly lower than olive mills one.

2.1.5 Producers organizations- 1990 to 2003,

Cooperative and associative movement are widely spread in the olive sector. In Spain there are about 500.000 olive growers who receive aids, which 76 % belong to producers organizations recognized according to the regulations 136/66/CEE and 1513/2001/EC.

Actually at Andalucía there are 52 olive oil Producers Organizations with 218.000 olive growers associated. This means 75% of all the Spanish ones and 57% of producers. The distribution by regions is as follows:

Table 19: Number of entamadoras registered at Andalucía by province in 2005

Province	*Nº PO*
Almería	2
Cádiz	1
Córdoba	12
Granada	3
Huelva	1
Jaén	23
Málaga	3
Sevilla	6

Source: Junta de Andalucía.

We do not present data about their evolution because their development is really recent due to the 1998 CMO modification. Before that producers organizations was linked to transformation and plant protection chemical treatments.

2.2 Institutional framework of the olive oil production in Andalucía

European Institutions

European Agricultural Guidance and Guarantee Fund (EAGGF)

Public Administration

Public Administrations are responsible for direct CMO planning, funding control and monitoring.

- MAPA: The Agriculture, Fisheries and Food Ministry is the national institution in charge of proposing and carrying out the Government guidelines about agricultural policies.

- FEGA: The Spanish Agricultural Guarantee Fund is in charge of coordinating the regional administrations for payments from the EAGGF. It is in tight contact with the EAGGF. Belongs to MAPA as an autonomous organism.

- AgenciaEspañola para el Aceite de Oliva: This institution is charged oncontroling and monitoring the correct aplication of aids regimens due to CMO regulation to olive oil and table olive sectors. Belongs to MAPA as an autonomous organism.

- Subdirección General de Materias Grasas: This section belongs to the General Directorate of Agriculture of the MAPA and its main function is elaborating state rules and regulations as well as coordinating CCAA activities related to olive production and markets. It must also cooperate with the Spanish regions in the elaboration of proposals for the Spanish position in the presence of the European Institutions.

- I.N.E: National Statistical Institute. It works in the elaboration and perfection of demographic, economical and social statistics of municipal and regional areas.

- Junta de Andalucía: Regional Administration charged on the application of CMO and direct contact to producers..

- IFAPA Instituto Andaluz de Investigación y Formación Agraria, Pesquera, Alimentaria y de la Producción Ecológica. Its main objectives are:
    - Expert training in olive grove sector
    - Investigation
    - Quality control for improving
    - Scientific support to Origin Denominations in Andalucía

Associations and Unions

There are four Farmers Unions at Andalucía. They have a federal structure whithan idependien union at each province and a federal regional union, thus the number of Recognized Unios is 36.

Regulation Councils of the Origin Denominations

There are 10 Virgin Olive Oil Origin Denominations at Andalucía which are:

- Estepa
- Antequera
- Baena
- Montes de Granada
- Poniente de Granada
- Priego de Córdoba
- Sierra de Cádiz
- Sierra de Cazorla
- Sierra de Segura
- Sierra Mágina

2.3 CMO implementation context in Andalucía

Legislation in Andalucía takes into account the existent regulations coming from the European Union and from Spain.

In Andalucía there is an Operational Integrated Program, financed by ERDF (European Regional Development Program), EAGGF (European Agriculture Guidance and Guarantee Fund), and ESF (European Social Fund); it is integrated under the Community Support Framework for structural measures in the Spanish Objective 1 regions from 2000 to 2006.

The regional Government of Andalucía has elaborated a ***Good Environmental Practices in Agriculture Code***, developing national Administration regulation according to UE regulation.

Law 19/1995 from July 4th about Agricultural farms modernization has had a relevant infruence on the structural changement of olive groves Duch as irrigation introduction and old olive groves conversión.

3. ANSWER TO EVALUATION QUESTIONS

3.1 Vertical questions relating to the olive oil CMO

3.1.1 Olive – Theme 1: production based subsidies

Question 1(O1): Does the production based subsidies of the CMO for olive oil provide an incentive for intensification and irrigated production and if so: what are the environmental impacts in terms of soil erosion, run-off to water bodies, degradation of habitats and landscapes and exploitation of scarce water resources ?

a) Question context in Spain

As we can see Olive is a very important crop in Spain, because in terms of surface takes up over 13 % of the entire Spanish useful farming surface, and 48.5 % of the permanent crop surface. The environmental role of olive is also detachable because of this high surface represents a fundamental landscape element comparable to forest areas. This relevance is highly marked in Andalucía, as contain over 60% of Spanish olive surface and trees. In Andalucía there is the most important concentrations of olive tree over the world (blue area in the map) which constitute a really significant environmental element.

As shown in chapter 1 Spanish olive grove began to decrease during the decades of 1960 and 1970. That tendency stopped in the eighties and inverted during the nineties with a progressive development of groves areas. That development during the regarded period was accompanied with a yield increasing. Thus there is obviously that certain intensification has been produced during the regarded period, and its linkage to CMO subsidies should be established as follow.

- **Measure description**

Production based subsides, as known link aids to farm yields, so as much as a farmer produce higher is the final subside amount received. Because of that CMO reform at 1998 established the National Guarantied Quiantity, in order to limit the uncontrolled production increasing. The result is that there appeared a secondary market, referring to subsidies. As there was a limited aid amount for the country, Spanish farmers began a concurrence process trying to get the bigger subsidies amount each one. Because of that, as can be seen bellow, production continued increasing despite of the reduction of the subsidy level by produced tm. During this period farmers intensified their production, as can be seen in chart 10.

- **Measure level implementation**

The way of reaching that production intensification was diverse, depending both on the farms structure and the production technology availability.

The main intensification procedure was irrigation at over the 10% of the growing surface, but also intensifying growing procedures such as pruning, fertilization and plant protection products treatments.

Other important way to intensify production was olive groves replanting according to modern mechanized production procedures. This last affected to final yield mainly reducing farming costs.

b) Advanced impacts

- **Effects on agricultural practices**

Answering the question we have focused on tree related aspects:

- Changing at supporting system, firstly entering the UE, and secondly with the 1998 CMO reform, should have given raise to several answer into the sector.

- That answers may have meant different reactions such as changing or adapting production structures in olive groves, or modifying farming procedures.

- **Possible effects on environment**

Both changing farming procedures and maintaining them have remarkable environmental effects:

- In the first case introducing new elements into ecosystem
- In the second one keeping former practices with a suspected positive or negative environmental impact.

c) Question Analysis

Crop intensification

The starting point is to determinate whereas has been a crop intensification during the regarded period. To do that there are three significant indicators: The use of land, production yield and the use of incomes like irrigation water, fertilizers and pesticides.

The analysis of surfaces shows how global growing surface has increases a 14.5% during the regarded period. The increase is higher at mill olive (17.6%) than at table olive which surface decreased a 15.3%. That should be due to market conditions because oil consumption has been easily developed ant table olive market is thigh and shorter (MAPA, 2003).

Table 20 : Olive surface (000 ha) by final destination

Year	Table Olive	Mill Olive	Total
1990	193.8	1,927.4	2,121.2
1991	182.6	1,944.5	2,127.1
1992	190.4	1,950.6	2,141.0
1993	138.7	2,008.3	2,147.0
1994	130.0	2,047.3	2,177.3
1995	127.6	2,096.1	2,223.7
1996	133.3	2,122.3	2,255.6
1997	124.1	2,156.0	2,280.1
1998	124.5	2,221.9	2,346.4
1999	169.7	2,194.9	2,364.6
2000	174.3	2,231.6	2,405.9
2001	163.8	2,265.5	2,429.3
2002	164.3	2,266.2	2,430.5

Source: Anuario de Estadística Agraria (MAPA).

For the case study of Andalucía, as can be seen at table 12, irrigation surface increase is over 162,000 ha, what means 52% of national irrigation surface increase.

Table below shows the evolution of irrigation in Spanish olive groves from 1994 to 2003. There has been an outstandingly significant increase of irrigation. Thus in 1994 there was only a 5% of irrigated surface. That percentage increased continuously as shown until the present 19%. Irrigation increase has been higher in Table olive than mill olive. With regard to year 1994 increasing percentages are 435% for table olive and 299% to mill olive.

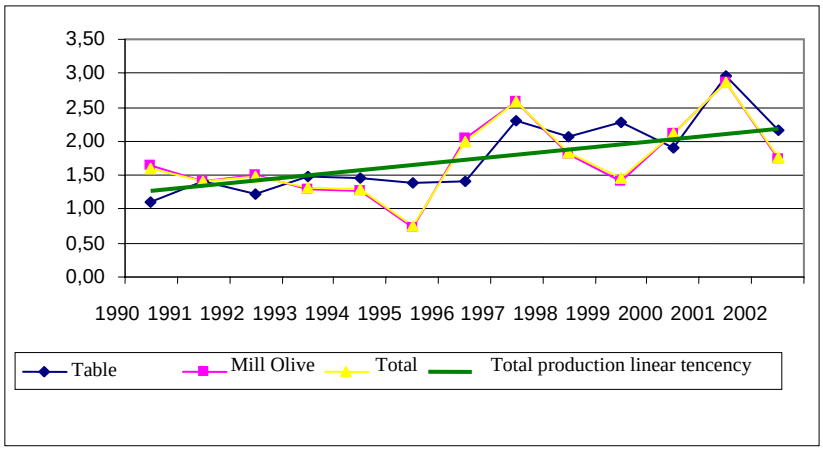
Table 21 : Irrigated olive surface (ha) by final destination

Year	Table olive	Mill olive
1994	8,148	109,631
1995	18,252	102,902
1996	21,398	173,748
1997	17,569	191,710
1998	27,816	222,736
1999	32,650	295,585
2000	35,808	372,258
2001	34,051	398,665
2002	36,898	419,943
2003	35,403	437,277

Source: Encuesta sobre superficies y rendimientos (MAPA).

Regarding yields evolution we can see a considerable increase, so that average yield for the first tree years of the regarded period is 1.49 t/ha, and for the last four reach 2.25 t/ha. This period excludes years 1993 to 1995 that were extremely dry and production suffered the effects of draught. Thus there can be seen that have been an increase of yields.

Chart 13 : Olive grove yield. (t/ha)



Source: Own work from Anuario de Estadística Agraria (MAPA).

Regarding to the fertilizers and phytosanitary products consumption there are not reliable analytical data aggregating all Spanish olive groves farm data. Thus we have to use statistical data from survey studies. Table bellow shows the results of RICA indicators regarding fertilizers and phytosanitary products purchases.

Next table show san increasing tendency interrupted at year 1999, and restored the last tree years. Interviewed public and private managers agree to attribute this interruption to CMO reform because of the following: At year 1999 olive grove farmers reduced incomes expenses expecting an aid level decreasing. After initial reduction farmers tried to intensify production to balance aids decreasing by means, amongst others, incomes increasing.

Research and technical studies enhance a moderate income products use increase. Research is driven to increase products effectiveness, but in many income product increase. There must be seen that production result increase is higher (Pastor, M. 2005a,b; Saavedra, M. 2002; Troncoso, A. 2005; Guerrero, 2003)

Table 22 : Spanish average purchase of fertilizers and crop protection products at olive grove (€ real terms)

Year	Spain		Andalucía	
	Fertilizers	Crop protection products	Fertilizers	Crop protection products
1989	553	569	557	554
1990	605	755	616	711
1991	654	806	651	803
1992	565	443	562	453
1993	636	429	628	432
1994	1116	948	1111	961
1995	1065	1420	1059	1394
1996	987	1197	936	1071
1997	1214	1255	1123	1116
1998	1211	1256	1140	1125
1999	480	906	495	857
2000	642	726	737	692
2001	1007	809	983	773
2002	854	707	815	666

Source:RICA.

Case study interviews to farmers confirm these statements. 70% (14 of 20) of interviewed farmers agree to have intensified their production in the following way:

Table 23 : Type of production intensification carried out by interviewed farmers.

Transformation	%	Nº
Introduction of irrigation	**77**	**11**
Reducing planting distance	**36**	**5**
Increasing growing surface	**43**	**6**
Increasing the use of fertilizers	**57**	**8**
Changing agricultural practices	**77**	**11**
Total	**100**	**14**

Source: Interview to farmers.

When asked about a deeper description of these practices farmers answer as follows:

- Irrigation system was always drip irrigation. This agrees with technical information and also with managers and researchers. Thus Andalucía Government studies centre (IFAPA, 2004) is clear about that and do not take into account other irrigation system than drip irrigation. At the rest of Spain situation is similar.[6]
- Reduction of plant distance was practiced mainly when modernizing an olive grove uprooting and replanting. Inter line planting system was not used. About the last interviewed regional researcher pointed that is a difficult practices at dry land because of the root concurrence between old olive groves and young ones recently planted.
- The increase of fertilizers use was justified because of the increasing tree request linked to irrigation. Although 11 interviewed farmers increased irrigation only 8 of them increased as well the use of fertilizers.
- When asked about the farming procedures modifications all the interviewed farmers answered that they adopted minimum tilling or non tilling systems. Farmers who did not

6 For the case of Exrtremadura CCAA can be seen: Prieto, J.M. (1998). *"Determinación del potencial productivo del olivar extremeño"* Proyecto CAO98-003 del SIA (INIA). And at national level: Comunidad de Madrid, 2004; Guerrero, 2003; Pastor, 2005ab, 2001, 1998, 1997b, 1996b; Vega, 1997.

modified their agricultural practices after 1998 CMO reform argued that they already practiced the cited farming procedures before that date. No one of them practiced vegetal cover systems[7].

Concerned surface

Prior to evaluate environmental effects of intensification we will establish the concerned surface. To do that we will centre at the case study works. The relevance of olive grove at Andalucía and the availability of reliable data offer the possibility of concluding which olive groves are concerned by intensification and their environmental particularities.

Following table present a summery of information contained at annex 4, where there is a more detailed description of Olive grove typologies at Andalucía. Next comments are also based at the referred annex 4.

Table 24 : General typologies of olive groves at Andalucía.

Typology		farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Density (tree/ha)	Production (kg/ha)
Age	**Adult**	214,274	84.48	988,038	77.29	4.61	124.57	2,737
	Renovation	39,389	15.52	290,302	22.70	7.37	149.90	1,961
Use of water	**Dry**	202,333	79.76	959,280	75.03	4.74	119.74	2,473
	Irrigation	51,330	20.24	319,060	24.96	6.22	162.15	2,822
Plantation	**Traditional**	231,338	91.21	1,183,495	92.58	5.12	123.49	2,612
	Intensive	22,325	8.79	94,845	7.41	4.25	215.60	1,913
Slope	**High**	117,695	46.40	497,043	38.87	4.22	125.77	2,157
	Low	135,968	53.60	781,297	61.12	5.75	133.22	2,817

Source: Junta de Andalucía, 2002.

These classification criteria are the following:

- **Adult**: Olive grove with no one tree planted during ht lat decade
- **Renovation**: Presence of trees planted during the last decade or full re planted olive grove.
- **Dry**: Total absence of irrigation.
- **Irrigation**: Presence of irrigation systems at a part or the entire olive grove.
- **Traditional**: Olive grove with several trunks by tree or with a plantation density under 140 trees/ha.
- **Intensive**: Single trunk tree olive grove and plantation density over 140 trees/ha.
- **High slope**: Olive grove with an average slope over 15%
- **Low slope**: Olive grove with an average slope under 15%

About this typology can be done several considerations:

Olive grove age

Age condition the type of possible intensification. As can be seen at table above renovation olive groves presents a higher density. Adult olive groves can only be intensified by means of irrigation or agricultural practice modification, whereas at renovation olive groves can also be modified plantation density.

As shown, renovation has been applied at 39,389 farms, which supposes 15.52% of olive groves at Andalucía. Also can be seen that the relevance of irrigation is higher at renovation olive groves. In addition the relevance or intensive plantation is quite higher at renovation olive groves. Finally

[7] About vegetal cover use, interviewed managers' point that this practice has been applied almost only at agricultural production, thus it is a commitment. Their use at traditional production is really low. There is more common a higher tolerance of adventitious vegetation by means of minimum tilling procedures, but without establishing a full vegetal cover. General sector studies also agree (Pastos, 1996b, Guerrero, 2003).

regarding slope differences are almost zero. This means that slope there is not a decisive condition to renewing olive groves.

Use of water
Irrigation is the main way to intensify production. As said al the interviewed managers and researchers and the regarded bibliography point that olive grove production increase outstandingly when is irrigated.

Previous table shows that the incidence of irrigation is higher at renovation olive groves than at adult ones, whereas 33%of renovation olive groves has been irrigated (total o partially) only 22% of adult ones have suffered the same transformation. Irrigation level is also higher at intensive olive groves (38%) than at traditional ones (23%) Regarding this two concepts assemble we find that the higher level of irrigation is found at renovation and intensive olive groves reaching 44.6%

Plantation
Plantation intensification is the second main way to intensify production. Although can be seen that average production at intensive plantation is lower than at other typologies, this intensification procedure influence at farming procedures. Plantation intensification change olive grove structure in order to grow in a different way. This is a yield intensification which regards not only the final production, but also production costs, trying to reduce them.

Slope degree
There is significant that 38.9% of olive groves at Andalucía are placed at high slope plots. This represents 46.4% of farms, which means that olive grove exploitations at high slope areas are smaller than those at low slope areas. This typology observation confirm one assessment of interviewed regional manager about structural features of Olive groves at Andalucía, which is the atomization of farms at marginal or less favored areas.

According to this typologies table bellow shows the degree of intensification of olive grove at Andalucía. There have been regarded tree types of intensifications:

- **Highly intensified olive groves:** Those where there have been applied both irrigation and plantation intensification.
- **Intensified olive groves:** Those where there has been applied one of the previous cited transformations
- **Not intensified olive groves:** those where no transformation has been applied.

Table 25 : Olive grove intensification degree at Andalucía.

	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Density (tree/ha)	Production (kg/ha)
Highly intensified olive groves							
Irrigated and intensified olive groves	5,516	2.2	36,650	2.9	6.64	238.81	2,225
intensified olive groves							
Traditional irrigated olive groves	45,814	18.1	282,410	22.1	6.16	152.20	2,900
Intensified dry land olive groves	16,809	6.6	58,195	4.5	3.46	200.98	1,716
Not intensified olive groves							
Traditional dry land olive groves	185,524	73.1	901,085	70.5	4.86	114.50	2,522

Source: Own work. Data taken from: Junta de Andalucía, 2002.

We find that only 2.9 % of olive grove surface and 2.2% of olive grove farms have been highly intensified. And other 26.6% of surface has been moderately intensified. The intensification percentage is quite higher in terms of surface those in terms of farm number. Thus intensification has been moderately higher at greater plots.

Table shows the connection of intensification degrees with slope typology

Table 26 : High slope olive grove intensification degree at Andalucía.

	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Density (tree/ha)	Production (kg/ha)
Highly intensified olive groves							
Irrigated and intensified olive groves	2,663	1.1	6,581	0.5	2.47	224.22	2,079
intensified olive groves							
Traditional irrigated olive groves	16,404	6.5	71,265	5.6	4.34	143.54	2,404
Intensified dry land olive groves	9,295	3.7	27,710	2.2	2.98	203.03	1,450
Not intensified olive groves							
Traditional dry land olive groves	89,333	35.2	391,487	30.6	4.38	115.42	2,163

Source: Own work. Data taken from: Junta de Andalucía, 2002.

Table 27 : Low slope olive grove intensification degree at Andalucía.

	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Density (tree/ha)	Production (kg/ha)
Highly intensified olive groves							
Irrigated and intensified olive groves	2,853	1.1	30,069	2.4	10.54	242.00	2,257
intensified olive groves							
Traditional irrigated olive groves	29,410	11.6	211,145	16.5	7.18	155.12	3,068
Intensified dry land olive groves	7,514	3.0	30,485	2.4	4.06	199.12	1,958
Not intensified olive groves							
Traditional dry land olive groves	96,191	37.9	509,598	39.9	5.30	113.79	2,798

Source: Own work. Data taken from: Junta de Andalucía, 2002.

There can be seen that intensification is higher at low slope olive groves (21.3%) than at high slope ones (9.3%). That means that 70% of total olive grove intensification has been applied at low slope olive groves.

Environmental effect

70 % (14 out 20) of interviewed farmers thought that intensification has environmental effects. Amongst those who agreed having practiced any kind of intensification this percentage rose to 93% (13 out 14). Interviews managers and researches general point of view is also that there have been a severe agricultural practices modifications during the last two decades with clearly visible environmental effects.

When asked for a personal appreciation of those environmental effects farmers opinion was never negative. 69% of those who have practiced modifications (9 out 13) detached erosion decreasing, and 62% (8 out 13) pollution decreasing. But managers and researches pointed to son not so positive situation described as follows.

Effects on soil

Soil erosion is widespread in areas with extensive olive farming. Soil loses in olive plantations have been estimated in Andalucía as 80 t/ha-year (soil loses over 50 t/ha-year is considered very severe. The intensification itself suppose a heavy environmental risk, but associated to modern

irrigation system and soil management, as vegetal cover or slope perpendicular working, reduce soils looses considerably (BalcocK, 2002).

Ecological and irrigated olive groves are the only able to fight soil erosion accuracy because are the two production system able to balance water loses due to vegetal cover consumption. Ecological olive groves stop tillage because producers are committed to do that and to implant vegetal covers, but that can not be assured so rightly in the case of irrigated olive groves, because these farmers are not obliged to specific farming practices. The general situation is that at irrigated olive groves tillage incidence decrease outstandingly. We must remember that the main task of tillage is suppressing adventitious vegetation water consumption.

Research data point that vegetal cover at dry olive groves at regions under 600 mm of yearly rain is difficult to practices, and means production looses. Thus in the case of Spain the general case is that vegetal covers at olive groves need support irrigation, not at vegetal cover but at olive groves trees to balance water looses produced by vegetal covers consumption.

Irrigation drives immediately to minimum tillage. As irrigation system is always drip irrigation the presence of irrigation systems over the soil surrounding olive trees stops traditional tilling procedures. Moreover the control of adventitious vegetation outside of irrigated surface is less relevant. There is an extra supply of about 125 mm surrounding each tree at the critical season, (summer) and there is possible to allow the emergence of vegetation in the lanes during winter.

Surface where drippers are placed is kept clean by means of chemical procedures, and at lanes control system selection is compulsory. Many interviewed farmers choose a mixed control system, with chemical products and tillage.

Irrigation is useful to fight erosion because a little supply of water allows relaxing adventitious vegetation control. There is not need to keep soil clean all along the year. There are seasons where adventitious vegetation can grow up. There need of storing winter rain at soil to summer consumption (doubtful effectiveness) is lower because of summer deficitary irrigation (125 mm.) helps summer olive tree vegetation better than soil storing. Thus there is possible to allow adventitious vegetation or growing a vegetal cover at olive grove lanes during winter. This is the season of highest rain flow and when soil erosion is mainly produced.

Researchers and managers met at Andalucía described the present situation of soil keeping agrigultural practices as follows:

- Vegetal cover is limited to ecological agricultural region and outside them is a minority practice.
- The most common soil keeping is still bare soil.
- Traditional tillage systems are almost abandoned, but mechanical soil cleaning is still important.
- The most spread soil keeping procedures are minimum tillage with a mixture of mechanical and chemical cleaning procedures, or full chemical cleaning systems.

Research point that vegetal covering and adventitious vegetation supposes a serious concurrence to olive grove because of their water consumption P(pastor, 1991) but adequately managed soils cover effects on final olive production are really low (Pastor, 1997a). But reality, according to interviewed PO managers is that vegetal cover outside ecological agriculture and irrigation lands is scare.

As said before, when asked about the farming procedures modifications, all the interviewed farmers answered that they adopted minimum tilling or non tilling systems. Farmers who did not modified their agricultural practices after 1998 CMO reform argued that they already practiced the cited farming procedures before that date. No one of them practiced vegetal cover systems. Interviewed managers agree that this situation is representative of regional one.

Research has focused clearly the environmental effects of soil keeping systems establishing soil erosion as level as follows[8] (Gómez, 1998):

- Traditional farming supposes a heavy soil loses (reaching 80 t/ha yearly)
- Soil looses with vegetal cover are the lowest (2 t/ha yearly)
- Non tillage systems with bare soil looses are also high (8 t/ha yearly)
- Conservation tilling system soil looses are intermediate (5t/ha yearly)

At this point there can be said that the great part of olive grove soils is still under erosion risks. According to interviewed managers, only ecological agriculture and irrigation olive groves are able to fight soil erosion accuracy. This supposes only 360,000 ha at Andalucía and 550,000 ha at the whole span, what means about 25% of total olive groves surfaces.

We have seen that almost the half of olive grove at Andalucía is at high slopes this means that there is about 500,000 olive groves ha in the region under erosion risk. Minimum tillage has contributed to attenuate the problem, but is not a definitive solution.

We have not found by the moment reliable regional data about the fertilizer consumption evolution in olive groves. According to MAPA data we can suppose an average consumption like the following. These do not belong to fertilizer units, but to commercial fertilizer consumption, thus resultant fertilizations are within the nitrates directive.

Table 28 : Olive grove fertilizer consumption (kg/ha)

		N	P	K	Composed	Amendments
Table olive	**Dry**	101	0	0	263	3,130
	Irrigated	180	0	0	360	107
Mill olive	**Dry**	158	10	8	148	406
	Irrigation	193	0	12	320	155

Source: Own work from Encuesta sobre utilización de medios de producción (MAPA).

Farmers and researchers met agree that the use of nitrogenous fertilizers is higher in irrigated olive groves, but in any case doses are moderate[9], thus in general terms there is not risk of nitrogenous pollution of soil and water. In irrigated farms the risk of run-off to water bodies is directly linked to irrigation systems. In this case, as the most common irrigation system is drip irrigation the risk of run-off is low, because of the high efficiency of irrigation system.

The main environmental risk to water in Spain is residual herbicides such as atracinas, strongly used in the nineties. The implantation of ATRIAs promoted by cooperative sector has supposed increasing the environmental integration of plant protection product and pesticide treatments, because of organization drives to increasing treatment efficiency.

Producers organizations operative programs seems to be an effective answer to olive grove environmental integration. The relevance in terms of this program depends on the PO capability to spread into sector. At Andalucía there are more than 218,000 producer[10] associated to PO, and the number of farms[11] is about 253,000, so this programs scope is really wide.. As shown bellow this program has focused on the main environmental risks:

[8] Research results at moderate slope conditions.
[9] All the technical data and research publication about olive tree fertilization at Andalucía have a a variation range from no nitrogenous fertilization to 600 g/tree this means a dose per hectare about 50 N units at traditional olive groves to 130 at intensive ones (Troncoso, 1998; IFAPA, 2004; Martínez Raya, 2005;Pastor, 1991).
[10] Source MAPA.
[11] Source: Junta de Andalucía 2002.

Table 29 : Environmental integration measures in producer organizations operative programs

Measure	Activity	Funding	Responsible
High ecological value olive groves collective keeping	Joint plant protection product treatment and vegetal covering	96,272.46	UPROL
Establishing good agricultural practices in olive groves and application monitoring	Teaching olive growers in soil keeping farming practices	67,827.64	CJAJ
	Teaching olive growers in soil keeping farming practices	226,123.78	UNAPROLIVA
	Self control of pesticides residues in olives and olive oil	541,571.48	UPROL
	Olive growers training	240,522.43	UNAPROLIVA
	Promotion of good agricultural practices	472,230.90	UPROL
	Integrated production and good agricultural practice promotion	546,515.88	UNASUR
	Rational use of soil, water, fertilization and pesticides.	143,942.21	OPRACEX
Olive farming technical demonstrations	Demonstration of environmental respectful techniques	287,425.04	UPROL
Total		**2,396,08.04**	

Source: Dirección General de Agricultura (MAPA).

As we have seen CMO production based subsides have incentive intensification establishing synergies with other market and consumption conditions. This intensification has a positive general environmental influence, because the most detachable environmental impact of olive groves is its presence in territory. Olive groves have by itself several positive environmental effects such as:

- Olive groves taking up wide slope areas in dry and even arid zones which in absence of olive groves should be highly exposed to wind erosion. In this sense the surface increasing has increased soil protection.
- Permanent crops fix atmospheric CO_2
- Olive groves have a great landscape value in several Spanish regions, reaching even the level of a cultural patrimony that must be protected.
- In many areas olive groves are the only arboreous ecosystem, thus them are a fundamental support to the animal biodiversity.

Effects on water

In terms of water consumption intensification has supposed the introduction of irrigation at about 300,000 ha. The irrigation system selected has been drip irrigation. This irrigations are support irrigations, with yearly applications of 1000 m^3/ha at Guadalquivir River area and 1,250 m^3/ha at Ebro River one. Interviewed manager from Conferedación Hidrográfica del Guadalquivir. Assure that sector is under strict control by means of irrigating farmers communities. Actualy the The Confederation is installing caudal measures systems at each plot. So regulation is almost absolute.

These are the administrative concessions of administrative authorities. Interview to farmers has revealed that common irrigation dose uses to be higher, from 1,500 to 2,000 m^3/ha. Some farmers agued that they manage their full water concession concentrating it, and other recognized that there are some unregulated situations that must be attended by Spanish Public Administrations.

About the effect on water resources interviewed Confederation managers point of view is that there is no risk of water supply to olive grove. They also point that olive grove profit excedentary winter water resources by means of storing them at small artificial lakes. The level of winter comsumption y lower that Guadalquivir valley winter surpluses, so authorities do not find ay trouble at this point, moreover interviewed manager are favourable to this profiting system

The main part or olive oil irrigation water comes from superficial resources or wells. In this case Confederación manager point that during the regarded period there have been a resources rearrangement. At the eighties there was common water allowances over 10,000 m^3/ha for extensive herbaceous crops and actually them are of 4,500 m^3/ha. This water resources reallocation has allowed increasing outstandingly irrigation growing surfaces, an not only at olive grove but also at extensive herbaceous crops.

Besides of that legislation establish low flows, from 1l/s·ha to 0.25 l/s·ha. Then irrigation systems are committed to be efficient. Confederació Hidrográfica manager agree that all irrigation olive groves are irrigated by means of drip irrigation.

Scientific studies[12] show that olive is sensible to deficit irrigation. Although olive grove was irrigated under their needs there have been seen positive effects on final production. This really important in Andalucía, where draught is a periodical difficulty. So when water resources are scare, whereas there can not been reach a successful production at other irrigation crops, olive grove improve its results as little as the extra water supply was (source CIFA).

Water regulation is also driven to preventing run off to water bodies.

Effect on landscape

Regarding landscape olive grove is seen as a positive element. All the interviewed experts agree to affirm its positive impact. In many areas olive groves are the only arboreous ecosystem, thus them are a fundamental support to the animal biodiversity. Surface increasing has supposed the recuperation of abandoned olive areas during the seventies, what means an environmental restoring.[13]

Effect on biodiversity

The regarded effect in terms of biodiversity is diverse. The intensification has produced a moderate varietal substitution. Old olive trees are being replaced by high productive varieties, and there us been usual the presence of olive varieties out of their traditional areas (Junta de Andalucía, 2003). As seen at olive grove typology analysis this practice is still low. Renovation olive grove surface at Andalucía is only 290,000 ha (20.7% of regional surface) and the average percentage of new trees[14] is about 38%.

Change at soil keeping system ha been outstandingly positive to soil micro-life (campos, 1999). Vegetal cover and minimum tilling systems are favourable to that.

Connection with CMO

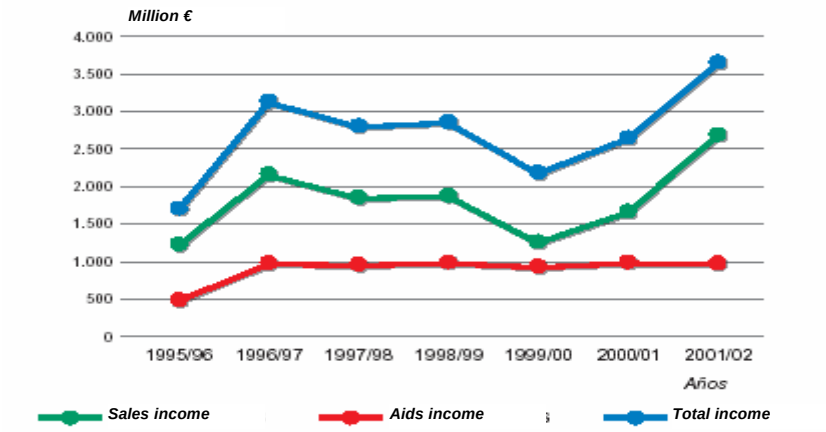
All the data point to a crop intensification, but we ca not only attribute this intensification to CMO subsides. There are other factors such as market conditions which have also conditioned intensification. This can be seen easily comparing table olive and mill olive. We find that intensification has been higher in mill olive because the consumption increasing has been higher in olive oil (MAPA, 2003). But in the market context we can assure that CMO subsides are the main responsible of the supporting of a great part of Spanish olive groves. So that we can establish that intensification has been an answer to market condition, and CMO subsides have offered to producer the financial support to answer easily to that conditions, because in absence of subsidies about the half of farms will not be profitable.

Chart bellow shows the relevance of subsidies at total olive growers income, and also the influence of market conditions, thus after several years of draught and low production prices raised and in 1996 and 1997 sales incomes were high (MAPA, 2003). We can also se in chart 6 the evolution of

[12] Already quoted and presents t bibliography.
[13] About landscape we are waiting for a recent study to arrive in one week (the author promised) This study will complete landscape point with a scientific approach.
[14] Data taken from annex 4

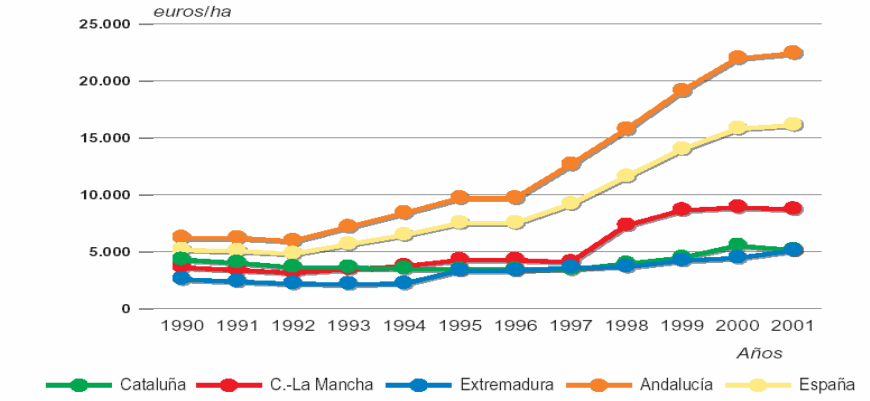
average olive grove price. There can be seen how the average Spanish price per hectare has raised from 5000 € in 1990 to more than 15.000 € in 2001.The rising is higher in Andalucía increasing 260% from 6,210 € to 22,405 € This evolution shows that there is a high demand of olive grove surface, so olive growing is a well considerate activity amongst producers. Of course there are multiple factors influencing this price rising, most of them local and particular, but there is not doubt about the social consideration of olive growing. Olive grove is higher in the region where the crop is more spread, so higher prices are reached in Andalucía. The first conclusion is that private sector has investors in olive oil groves during the last year raising their prices, so olive growing has been a profitable activity to farmers.

Chart 14 : Olive oil sector income levels



Source: Agricultural white book (MAPA).

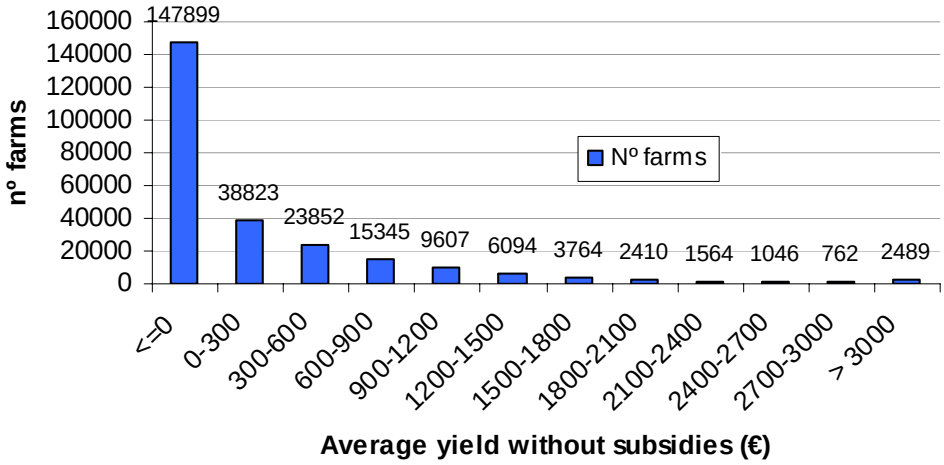
Chart 15 : Olive grove price evolution. (€/ha)



Source: Agricultural white book (MAPA).

The Junta de Andalucía did a deep study about the economic effect of production subsidies over olive oil production in 2003 (Junta de Andalucía, 2003). Its result is representative for the global Spanish situation because represent more than half the production and surface and growing conditions are quite similar. In fact Andalucía results should be more positive because of the average farm size is quite higher than the national one. There can be seen how far production sustainability depends on subsidies. Results are that almost 58 % of the olive groves should not reach benefits without aids (first column in chart bellow).

Chart 16 : Average yield without subsidies at Andalucía olive groves (2003).



Source: Junta de Andalucía, 2003

Results show that olive oil production is directly depending on aids. But also that production is increasing despite of aid penalization, as show the following table, Spanish aid level has been strongly penalized since the NGQ was established. Thus we can see that olive growers prefer to produce despite of a higher level of subsidies, or that penalizes subsides are though enough.

Table 30 : Olive oil subsidies penalization evolution

Year	1999	2000	2001	2002	2003	Average
Production (t)	889,991	747,000	1,074,970	156,2531	972,130	1,051,324
Aid (€/100kg)	112.16	130.4	93.91	63.75	101.95	100.43
%Penalization	13.99	-	27.98	51.11	21.82	22.98

Source: Own work. Data from FEGA

Previous analysis shows a sector image both depending on EC subsidies, but also with a considerable internal dynamism promoting its evolution. This evolution can be seen though the described evolution of surfaces and growing procedures.

We can conclude that CMO is directly linked to the olive grove transformation during the regarded period. Although those transformations started before CMO reform, this situation contributed to accelerate them. Thus CMO is not responsible of the changes nature, but is of their speed, and expansion. All the interviewed managers agree with this point. I absence of CMO reform sector transformation would have been slower.

d) Results

Olive oil CMO is directly responsible of the described production intensification, because as said before olive growers reacted to subsidy level decreasing enhancing production and concurring themselves to get the highest amount of global subsidy.

CMO is a market measure but we can conclude that has had environmental effect by means of the environmental consequences of olive grove transformation dues to the necessary sector fitting to market.

About soil erosion CMO has been quite positive because has accelerated previous transformation process tending to less aggressive farming procedures, but farmers election was not about environment protection bur about reducing costs.

About water resources CMO effect has been negative in terms of quantity, because producers developed irrigation systems raising water demand. But there has also be positive because sector

reacted redistributing water resources and implanting high efficiency irrigation systems, which have complementary positive such as decreasing water run off.

In terms of landscape CMO is outstandingly positive because is the main support of a typical human handmade landscape which spreads over 2.4million of Spanis hectáreas. But there is a negative point when traditional olive groves are replaced by super intensive ones. By now this process is minimal and is out of high landscape value olive grove areas.

Question 2 (O1): Do the production based subsidies of the CMO lead to extra inputs of agro-chemicals as an insurance premium for the related income support and if so: what are the impacts of this on flora and fauna (biodiversity) and pollution, especially of soil and water?

a) Question context in Spain

- **Measure description**

As can be seen in the previous question CMO subsidies enhancing olive groves intensification, and is supposed that this intensification had an environmental effect, by means of using chemical fertilizer and phitosanitay products.

In the case of Spain the use of these products is directly linked to environmental conditions.

- **Measure level implementation**

The level of use of chemical products is directly linked to two factors:

- The olive grove growing typology (super-intensive, intensive or traditional) and,
- The olive grove sanitary condition.

The use of chemical products depends also on the final economic yield. Their application supposes an important expense, and normally they tend to be restricted to the strictly needed. If olive grove final profitability is high there is possible to spend more in treatments and fertilization,

b) Advanced impacts

- **Effects on agricultural practices**

There can be expected some changes of agricultural practices due to the increasing of the use of chemical substances.

The more important effect on agricultural practices is due to the use of herbicide and plant protection products. Herbicide treatments are replacing tillage as adventitious grass control system.

Regarding the use of plant protection products, there has been an important evolution during the regarded period because of the development of ATRIAs.

Regarding the use of fertilizers, there are outstanding changes at those olive groves under irrigation. As the irrigation system is trickle irrigation, there is usual to practice organic irrigation.

- **Possible effects on environment**

There is expected to describe effects on water due to their use increase, on soil due to de decreasing of tillage, and on biodiversity due to the change of plant protection products and herbicide treatments.

c) Question Analysis

In question 1 (O1), we have seen that the structural data point to a crop intensification, but we ca not only attribute this intensification to CMO subsides. But in the market context we can assure that CMO subsides are the main responsible of the supporting of a great part of Spanish olive groves. So that we can establish that intensification has been an answer to market condition, and CMO subsides have offered to producer the financial support to answer easily to that conditions, because in absence of subsidies about the half of farms will not be profitable.

There are two possible general effects of CMO subsidies:

- To promote the subsistence of traditional olive groves.
- To promote the modernization of traditional olive groves by means of intensive plantation or irrigation.

Production intensification in olive groves may need increasing the use of fertilizer ah chemical plant protection products.

We have not real data of the use of fertilizers besides of those consigned at table 1(O3)1. About the use of fertilizer interviewed expert agree to assure that their use in dry crops depends on the environmental conditions. In dough campaigns farmers reduce their use, because of crops lack of the water resources needed to profit fertilizes, and as the expected income are lower production expenses also decrease. On the other hand in favourable campaigns the situation is just the opposite. In irrigation crops the use of fertilizer do not depend on environmental conditions because of the water supply is constant.

Interviewed managers view is that olive grove is not a high fertilizer consumption grow, and the use of fertilizers is always under the nitrate pollution security range.

All Spanish CCAA have developed its own Good agricultural Practice ode between 1997 an 2000. Those codes have different approaches depending on each region needs but all of them are focused at least on water and soil nitric pollution. For the case study of Andalucía the regional decree 261/1998 establish a typology of vulnerable zones town by town. For those zones there have been published operative programs which are compulsory for the referred crops according to the table below:

Table 2(O1)1: Vulnerable zones and regarded crops in Andalucía

Vulnerable zones	Regarded crops
Valle del Guadalquivir (Sevilla)	Wheat, sunflower, sugar beet, cotton, potatoes, horticultural, **olive grove**, citrus and irrigated fruits.
Valle del Guadalquivir (Córdoba)	Wheat, sunflower, sugar beet, cotton, potatoes, **olive grove**, citrus.
Detrítico de Antequera	Wheat, barley, sunflower, potatoes, horticultural, **olive grove**.
Vega de Granada	Wheat, barley, sunflower, corn, tobacco, horticultural, **olive grove**.
Litoral Atlántico	Wheat, sunflower, sugar beet, cotton, potatoes, horticultural, cut flower, vineyard.
Litoral Mediteráneo	Horticultural, **olive grove**, citric and subtropical fruits

Source: Junta de Andalucía (order 27/6/2001).

This show that olive vulnerable zones in terms of soil and water pollution are those where olive groves are placed in irrigated valley or littoral areas. Thus at mountain areas, where olive groves are majority, (such as Jaen province where this crop is placed at almost 90% of UAA) there is not risk of water and soil pollution because of applications are within security rates.

At vulnerable areas produces are required to carry out the rules of Olive Grove Acting Program about:

- The way of application nitrogenous fertilizer to table and mill olive and,
- The maximum nitric dose according to the table bellow:

Table 31 : Olive groves fertilization limits at vulnerable zones in Andalucía

Crop	N extraction (kg/t production)	Efficiency rate	N. externe application (kg/t production)	N. application (kg/t production)
Table olive				
Dry land	10	0.8	3	10
Irrigation land	20	0.7	15	14
Mill olive				
Dry land	20	0.8	3	14
Irrigation land	25	0.7	15	20

Source: Junta de Andalucía.

This rates assure that olive production in vulnerable areas is nor aggressive to environment in terms of soil or water pollution.

The intensification of plantation normally means the substitution of old olive groves by new ones, with a higher plantation density (normally over 140 trees/ha). The increase of the number of trees do not meant the increasing of vegetal mass, because they are smaller. What really increases is the olive grove agronomical performance, because the new plantation is more suitable for the modern farm works. So the efficiency of inputs applications is higher, and the pollution risks decrease. The promotion of traditional olive groves structures combines with modern farming equipment means inefficiency. Then the risks of pollution are higher. The increase of water supply because of irrigation must be campaigned by a increase of fertilizer doses.

70% of interviewed farmers (14 out 20) agree to having intensified their production during the last 15 years, and 89% of them (13 out 14) think that CMO subsidies helped to that, because of the extra funding. Table bellow shows the most important transformations carried out by them.

Table 32 : Type of production intensification carried out by interviewed farmers.

Transformation	%
Introduction of irrigation	**77**
Reducing planting distance	**36**
Increasing growingsurface	**43**
Increasing the use of fertilizers	**57**
Changing agricultural practices	**77**

Source: Interview to farmers.

55% of interviewed farmers (11 out 20) converted into irrigation their olive groves during the regarded period. All of them selected trickled irrigation systems. In those cases fertilizers are being applied by means of organic irrigation. This system allows a high fertilization efficiency if water dose is not higher than soils absorption capability.

In the case of Andalucía Olive groves are mainly at clay soils (in many cases swelling clay soils), so irrigation dose can not be high because of the slow infiltration. In ay cases the risk of deep infiltration is low.

Traditional farming has helped to avoid deep infiltration risks. As olive is a traditional dry land crop roots develop deeply, so the risk of deep, moreover surface tillage prevents the development of surface roots. So that roots develop in depth avoiding the risk of deep infiltration.

In the case of irrigated olive groves this effect keeps at a great pat of olive groves. As can be seen at the table bellow, Irrigation surface in Andalucía is higher than surface increase, and managers interviewed agree to consider uprooting and replanting as a marginal procedure, so many of the irrigated olive groves are former dry land olive groves. In that cases root structure keeps, and tr risk of deep infiltration is also low.

Table 33 : Olive grove surface at Andalucía at 1994, 2002 and surface increase.

Province	1994	1994-2002	2002	
	Total surface	Surface increase	Total surface	Irrigation surface
Almería	11,690	4,210	15,900	9,885
Cádiz	13,683	6,217	19,900	1,300
Córdoba	307,034	38,928	345,962	21,942
Granada	152,000	22,197	174,197	40,029
Huelva	29,602	-914	28,688	2,674
Jaén	515,198	75,722	590,920	150,277
Málaga	109,561	11,904	121,465	6,814
Sevilla	179,960	26,284	206,244	53,097
Andalucía	**1,318,728**	**184,548**	**1,503,276**	**286,018**

Source: Junta de Andalucía.

Finally the risk is quite higher at newly planted irrigation olive groves, but regarding that there is always used drip irrigation, and that average irrigation yearly dose is about 1,500 m^3/ha[15] the risk of deep infiltration is really low. There must be taken into account that water is used as support irrigation only in dry seasons. In this situation farmers are carefully because there are conscious to be handling a really scare resource.

A direct consequence of CMO measure is the development of Producer Organizations (PO) and ATRIAs, especially at Andalucía but also in other olive oil production areas. These organizations promote the cooperation at plant protection product treatment works. The cooperation has supposed increasing the environmental integration of plant protection product and pesticide treatments, because of organization drives to increasing treatment efficiency. The efficiency of this treatment system is high, because of the farming land structure (huge and continuous surfaces of olive groves) allows common treatments application systems. There is also a marking system to ecological olive groves, which is commonly respected. Nine of the interviewed farmers (45%) agree that there have been infractions at treatments but only one of them thinks that is a common infraction. The other 8 think that infractions are scare.

Structurally thinking CMO has had a negative influence because the level of implantation of modern growing structures is low, but we must think that is a slow process. Moreover, the subsidies contribute to preserve inefficient farming systems in which inputs profitability is lower. But there are also some organizations directly linked to CMO such as PO, and ATRIAs that promote the efficiency of inputs application with the subsequent reduction of environmental impacts.

d) Results

CMO subsides have had a direct influence on environmental protection by means of the support of Producers organizations, Operative Programs. All of them are driven to improve plant protection products treatments and to promote associated treatments organizations. Public administrations, especially at Andalucía, and also in other Spanish olive oil production areas, have enhanced the development of ATRIAs.

Indirectly CMO subsidies have promoted the production systems modernization in all ways, mechanization, irrigation, fertilization and plant protection products use optimization. Production based subsidies have helped production increase, pressing market price down, so producers have had to be more efficient to increase their olive groves global profitability. Thus the use of chemical products has been rationalized, in order to increase their efficiency decreasing costs. This has had an indirect positive environmental effect, because of their use has tends to be reduced to the strictly needed.

[15] Data taken from interview to farmers.

3.1.2 Olive – Theme 2: farming practices

Question 1 (O2): Does the CMO support sustainable farming practices that are beneficial to the environment such as organic and integrated production systems?

a) Question context in Spain

- **Measure description**

Organic production at Spain is generally linked to market opportunities. Generally farmers are favourable to this production but are extremely cautious because of the market insecurity. AEM subsidies support organic and integrated production

Spanish olive groves are grows really favourable to integrated production implementation because of traditional farming procedures (excluding burning pruning rests) are really close to integrated production ones.

- **Measure level implementation**

There is a direct influence of CMO subsidies on the development of integrated and organic production systems by means of producer organizations operative programs, when these are driven to help that. But this programs influence is restricted to the end of the regarded period.

b) Advanced impacts

- **Effects on agricultural practices**

There are not expected important changes of agricultural practices due to the implementation of integrated production. The common agricultural practices at Spanish olive groves are compatible with this production.

In the case of organic production, legislation establishes several specific agricultural practices such as bringing cattle into olive groves.

- **Possible effects on environment**

The environmental effect of integrated and organic production is relevant. And its effect is higher in Spanish olive groves, because of them are high risk of soil erosion areas.

c) Question Analysis

Producer's organizations operative programs include several measures to support environmentally integrated farming. As shown at table 1(O1)10 almost 2.4 euro million from a global amount of 7 euro million are contributed to environmental measures. Programs are driven to teaching olive growers into environmental respectful agricultural practices, and not to support that practices. Their main activity lines are:

- Joint plant protection product treatment and vegetal covering.
- Teaching olive growers in soil keeping farming practices.
- Self control of pesticides residues in olives and olive oil.
- Promotion of good agricultural practices.
- Integrated production and good agricultural practice promotion.
- Teaching rational use of soil, water, fertilization and pesticides.
- Demonstration of environmental respectful techniques.

For the following period (years 2004 and 2005) the relevance of environmental measures at national level increased from 24% at 2003 to 59 % at 2004. In this period there has been created regional operative programs, complementary to national scope PO, but organic and integrated farming kept into national program, which shows that is a priority matter.The funding of PO Operative Programs shows the CMO commitment with environmental preservation, but referring to direct acting into the sector their effect is too recent to be evaluated only by this measure.

As we know the institutional support to organic and integrated production relays on the rural development program since the EC regalement 2078/1992, and continued with the 1257/1999, which established horizontal AEM measures.

Spanish CCAA were allowed to select the AEM to implement into their territories depending on their farmers needs or funding possibilities. Tables bellow shows the beginning of the implementation of Spanish AEM related to line 3: "Environmental Techniques to rationalize the use of chemical products" and line 4: "Erosion fighting at fragile environments". The next one presents the distribution of environmental integrated surface by CCAA at year 2002. We can see that the development of ecological agriculture is higher at Andalucía and Castilla la Mancha, and that integrated one is higher in Cataluña, Andalucía and Extremadura. In these regions, as shows the case study the olives grow is an important factor to develop these types of productions.

Table 34 : Agro-environmental Measures 3 and 4 national implementation.

Measure 3	**Beneficiary**		**Surface (ha)**	
	2001	**2002**	**2001**	**2002**
3.2. Integrated control	1.587	2.506	18.101	33.279
3.3. integrated production	5.549	7.903	43.617	84.178
3.4. Ecological agriculture	3.932	4.559	52.616	87.293
Measure 4	**Beneficiary**		**Surface (ha)**	
	2001	**2002**	**2001**	**2002**
Ligneous crops in slopes or terrace	4.753	3.906	48.019	50.522

Source: TRAGSATEC.

Table 35 : Agro-environmental measure 3 surface at 2002 in olive production CCAA (ha).

CCAA	**Integrated Control**	**Integrated production**	**Ecological agriculture**
Andalucía	Not opened	14,458.00	39,293.00
Extremadura	Not opened	19,162.17	Not opened
Castilla la Mancha	Not opened	Not opened	28,805.00
Valencia	Beginning	5,975.00	2,498.16
Murcia	23.405,9	2,919.33	7,239.81
Madrid	9773,56	Not opened	1,215.09
Cataluña	Not opened	35.065.74	3,517.84
Aragon	Not opened	6,455.65	5,684.25
Baleares	100	Not opened	1,770.00

Source: TRAGSATEC.

For the whole Spain table 1(O2)3 shows the evolution of organic olive surface with regard to global organic growing surface.

Table 36 : Organic olive oil surface evolution from 1991 to 2003 (ha)

Year	Organic olive surface	% organic surface	Total Organic surface
1991	1,068	25.22	4,235
1992	1,430	18.2	7,857
1993	1,450	12.42	11,675
1994	3,241	18.83	17,212
1995	3,912	16.25	24,074
1996	11,596	11.18	103,721
1997	23,553	15.48	152,151
1998	59,011	21.9	269,457
1999	65,018	18.46	352,210
2000	71,351	17.73	402,431
2001	82,246	16.96	484,941
2002	85,967	12.93	664,865
2003	91,292	12.58	725,692

Source: SJAR, 2005.

There is interesting to point that the relevance of organic olive growing was higher during the first years, the percentage variability is due to herbaceous organic grows which surface change easily from one year to the next. But Organic olive increase continuously. Other relevant aspect is that at year 1999, just after implementing 1257/99 regalement subsidies, organic olive surface was 71% of present surface, whereas total organic surface was only 48%. This shows that development of organic olive oil was early motivated by market opportunities, and when 1257/99 subsidies were implemented, this aids contributes to support the production bus its increasing rate decreased because of the market difficulties.

For the case study of Andalucía we find that ecological olive grove reached the surface or 29,961 ha at dry lands and 1,556 at irrigated ones. This show that 73% of all Ecological grows at Andalucía are olive groves. 63% of them are located at Córdoba province of, where is found the district of Los Pedroches in which olive groves began to be practised ecological agriculture in the middle of the eighties[16].

Regarding data from table below, we can see that ecological olive groves in Andalucía are placed mainly in mountain areas. Table 1(O2)4 shows the main ecological olive production areas and 86% of surface belongs to mountain zones. Growing conditions at those zones are less favourable because of higher slopes and lower size of plots. This two factors difficult mechanization and irrigation. This areas yield is low and ecological production offers an added value not only by means of AEM subsidies but mainly through market opportunities.

[16] Bara, F. and Ruiz, P. (2003). *Olivar ecológico en zonas de montaña Andaluzas.* Centro de Investigación y Formación Agraria "Alameda del Obispo" Córdoba, España.

Table 37 : Surface of organic olive production zones in Andalucía (ha).

CCAA	Surface (ha)
Los Pedroches	10,763
Campiña Alta	1,518
Campiña Baja	484
Penibética	382
La Sierra	1,448
Sierra de Segura	1,174
Siera Magina	421
Sierra Norte de Sevilla	660
Antequera	582
Vega de Sevilla	375
Sierra de Cádiz	334

Source: CIFA Córdoba.

Interviewed managers an experts point that olive traditional farming system is really compatible with integrated farming procedures in terms of fertilization and phytosanitary treatments. Other traditional practices such as burning pruning rest or down slope tillage are against integrated farming procedures, but these two practices are falling into disuse.

90% of interviewed farmers (18 out 29) agree to think that CMO helps environmental compatible production the same percentage also that their PO assistance is adequate. Only 11 of them (61%) knows the RDR measures about agricultural production, and 9 of them think that that are positive to olive grove production but only 12% of them (2 out 11) apply them. Reasons given are diverse but the general sense is that in productive areas is more interesting to reach the higher production, and ecological production is only applied in marginal zones were production intensification is not possible.

CMO measures are opposite to ecological olive growing because subsidies are linked to production. As said producers tried to increase their production to get an amount of subside as high as possible. Thus there appeared a concurrence between Spanish producers despite of penalizations. Whereas overrunning NGQ and lower selling prices are detrimental to all producers equally, high production benefits only to those produces who reach the higher productions, and those are who get the higher amount of subsidies.

d) Results

Result is that CMO double. In one hand subsidies has implemented really efficient tool to help the development of integrated production systems, and farmers are more conscious about the risks of erosion and the need of a right use of chemical products. But in the other hand subsidies have contributed to increase the differences between high and less productive olive groves. Whereas overrunning NGQ and lower selling prices are detrimental to all producers equally, high production benefits only to those produces who reach the higher productions, and those are who get the higher amount of subsidies.

Then CMO is comparatively detrimental to mountain and traditional olive farmers, but as an own answer to that damage producers have developed ecological agriculture to get other subsidies, but mainly to reach other market with a higher selling price. But although ecological production market is expanding, it is only able to assume a little part of the possible production.

3.1.3 Olivo – Theme 3 : specific measure

Question 1 (O3): What is the environmental impact of restriction on imports from outside the EU?

a) Question context in Spain

- **Measure description**

Spain is the greater olive oil producer and exporter all over the world and represent by itself about the XX% of total production. As EU proDuce about the 80% of world olive oil is supposed that internal EU market

- **Measure level implementation**

Measure is implemented by means of custom duties. Measure affects only to third countries produced olive oil imported to be consumed into the UE, but not to that re-exported. There is also a contingent of 54,000 t from Mediterranean countries out of restriction.

b) Advanced impacts

- **Effects on agricultural practices**

This measure has an indirect influence over production and by consequence over agricultural practices.

Depending on its influence on global market the can be supposed effects of enhancing or deteriorating EU internal production.

There can be supposed to think that Spanish production is the most sensible to olive oil world trade modifications, because almost the half or our production is exported.

- **Possible effects on environment**

Through this measure effects o internal EU production there can be established environmental effects, but this should be mainly the common production ones.

The environmental effect of production condition is amplified by the Spanish olive grove sector conditions. The most market sensible olive groves are those little and placed in marginal areas such as mountain areas, and these olive groves are also those of a higher environmental value. Because of that there can be supposed that little market condition changes will be amplified environmentally.

c) Question Analysis

Tables below show the evolution of Spanish olive oil and table olive production, exportations and importations. There can be seen the relevance of exportations to Spanish olive production. These exportations reached 58 % of olive oil at campaign 1999/00 and 65.8% of table olive at 2001/02 one.

All these data drive to think that Spanish global olive oil sector is used to international trade conditions. Interviewed managers and experts think that international prices are fixed by Spanish production which is the most important producer. Besides that the regarded productive tendency during the last five years, despite of subsidies penalization shows that sector prefers production to subsidies.

Table 38 : Spanish olive oil external market evolution (t).

Olive oil				
Campaign	**Production**	**Importation**	**Exportation**	**% Exportation**
1991/92		61,144	144,893	-
1992/93	623,081	28,230	221,636	35.57
1993/94	549,064	54,014	233,900	42.60
1994/95	526,877	95,600	158,398	30.06
1995/96	336,076	64,300	194,420	57.85
1996/97	954,149	41,900	409,151	42.88
1997/98	1,120,952	36,300	428,965	38.27
1998/99	846,851	109,069	257,295	30.38
1999/00	669,100	18,635	388,255	58.03
2000/01	971,000	23,578	483,916	49.84
2001/02	1,413,500	10,059	600,493	42.48

Source: MAPA.

Table 39 : Spanish table olive external market evolution (t).

Table olive				
Campaign	**Production**	**Importation**	**Exportation**	**% Exportation**
1991/92	232,100	-	-	-
1992/93	204,200	793	127,260	62.32
1993/94	190,800	712	121,970	63.93
1994/95	177,500	9,022	118,160	66.57
1995/96	189,000	9,855	118,000	62.43
1996/97	286,800	6,505	113,200	39.47
1997/98	258,500	3,117	161,150	62.34
1998/99	387,800	6,656	137,210	35.38
1999/00	331,200	8,618	177,280	53.53
2000/01	485,900	5,868	218,590	44.99
2001/02	354,200	4,141	233,090	65.81

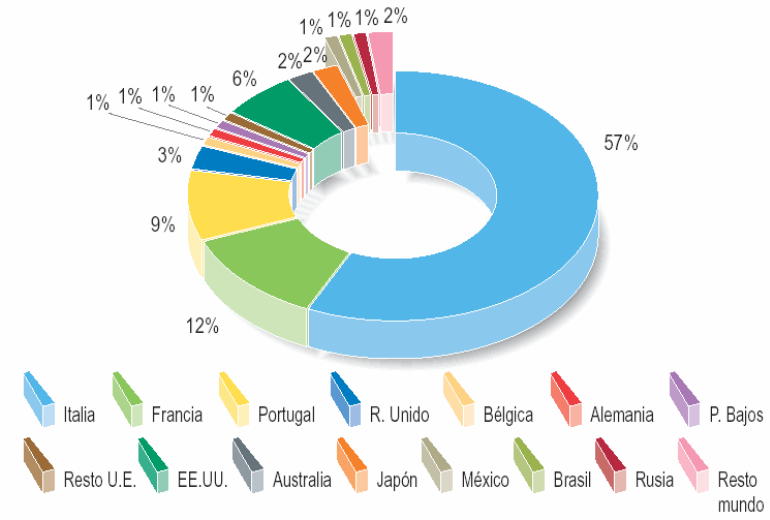
Source: MAPA.

But managers also agree that Spanish produces are under concurrence into EC market is under inequality conditions, and because of those importations from third countries must be restricted in order, at least, to match third countries situation with Spanish inequality from other EU countries.

Because of the setting up of the NGQ at 1998, Spanish subsidy level has been penalized almost every year. Thus the assigned quantity was outstandingly under Spanish production capability. Result is that, as shown at table 2(03)1 (in the next question) other EU members subsidy level is higher than Spanish one.

Thus Spanish production is under less favoured condition with regard to other EU producers, and as a consequence in inequality about trading with third states. Because of that Spanish producers have chosen effectiveness as a market policy, and difficulties come from this referred internal inequality, because as seen in chart bellow, main Spanish exportation market is UE with 87% of final exportations.

Chart 17 : Spanish olive oil exportation by destination country at 2002.



Source: MAPA

In any case, as olive oil supposes only 3% of world vegetal fats production the main threat is not other olive oil production countries than other vegetal fat producer crops. Thus whereas this measure protection is effective helping marginal olive groves to keep at production, is useless preventing the main threaten to any type of olive groves, which is, as said, other vegetal fats.

d) Results

All this information point to a low impact of restriction on imports, but there is also a moderate protective effect on less competitive olive groves, because in absence of these measures the relevance of free market concurrence will be higher. These are precisely those of a higher environmental value, because are usually located at mountain or erosion risk areas.

But in the case of Spain the damage to marginal olive groves is higher in the case of inequality subsidy level. This situation push international trade maters into the background, when regarding the global effect of CMO regulation over Spanish production, because the main Spanish market, after own country, is internal UE one.

Because of that the influence of restriction on imports is really moderate.

Question 2 (O3): What are the environmental impacts of increased maximum guaranteed quantities per member state?

a) Question context in Spain

- **Measure description**

This measure has been seen at Spain as an aggressive measure because Spanish olive grove development tendency during the nineties was increasing surface intensification. Thus Spanish olive growers have suffered a comparative damage with regard to other member states where olive production has kept within the traditional production rates.

- **Measure level implementation**

There was not a distribution of NGQ amongst Spanish CCAA. The distribution of subsidy penalization has been suffered fairly by any type of producer.

b) Advanced impacts

- **Effects on agricultural practices**

The effect on agricultural practices is derived of the reduction of global income due to the subsidy penalization. As we will see farmers reacted intensifying production in order to get the maximum amount of subside despite of its unitary diminution.

- **Possible effects on environment**

Effects on environment are those described derived of intensification. These effects are diverse depending on the typology of olive grove regarded.

c) Question Analysis

The MGQ increasing of 1998 supposed the raised 21,5% the Spanish NGQ reaching 760,000 t, and the global subsidy amount also raised. But there was not a direct production linked subsidy, because there was a fixed amount of money to be distributed amongst producers. Payment was 130.4 €/100 kg when production was under NGQ and payment reduces gradually when global national production was over NGQ.

The NGQ calculation system was for the Spanish case was wrong because to of the reference years was of extremely draught in the southern Spain, and there was no reference to the starting structural changes, done at that years because transformed olive groves was not yet at full production.

The result is that NGQ shows to be really short to the Spanish productive potential. The production development was due to market situation, because olive oil consumption has kept rising during past years and there is not olive oil excess at global world trade. So all olive oil produced is consumed.

The result is that, as shown at table bellow, during the last years Spanish subsidy level has always been penalized. Thus the assigned quantity was outstandingly under Spanish production capability. Result is that, as shown at table bellow other EU members subsidy level is higher than Spanish one. Because of that Spanish production is under less favoured condition with regard to other EU producers, and as a consequence in inequality about trading with third states. Because of that Spanish producers have chosen to increase effectiveness reducing costs and opening market enhancing consumption, to compensate that difference.

Table 40 : Olive oil subsidies evolution (€/100kg)

Year	1999	2000	2001	2002	2003	Average
Sapin	**112.16**	**130.4**	**93.91**	**63.75**	**101.95**	100.43
Italy	130.40	**101.78**	130.40	**100.45**	**103,20**	113,25
Grece	**99,05**	**118,56**	**114,76**	130.40	**127.79**	117.11
Portugal	130.40	130.40	130.40	130.40	130.40	130.40
France	130.40	130.40	130.40	130.40	130.40	130.40

Source: Own work. Data from FEGA

In a global approach every interviewed manager agree that Spanish productive sector can afford penalizations, because of its aim is to sell the maximum olive oil and table oil into the market. The intensification and agricultural practices modernization has increased the crop profitability reducing production cost. 1998 CMO modification in terms of changing MGQ was unable to prevent accurately the development of Spanish olive sector due to market expansion.

Moreover olive grove surface has increased about a 14% during last ten years both in Spain (Table 11) and in the particular case of Andalucía (Table 15). This increase has continued after May 1st 1998 and in this case olive groves are not allowed to receive subsidies. This newly plantation surface reach 144,251 ha which supposes almost 6% of national surfaces. As seen in table below this plantations are mainly located in Andalucía an Extremadura. Thus there is 6% of olive producers which are able o produce without any subsidy.

Table 41 : Olive oil plantation surface after May 1st 1998

CCAA	ha
Andalucía	48,227
Extremadura	31,358
Castilla la Mancha	19,980
Cataluña	7,679
España	**144,251**

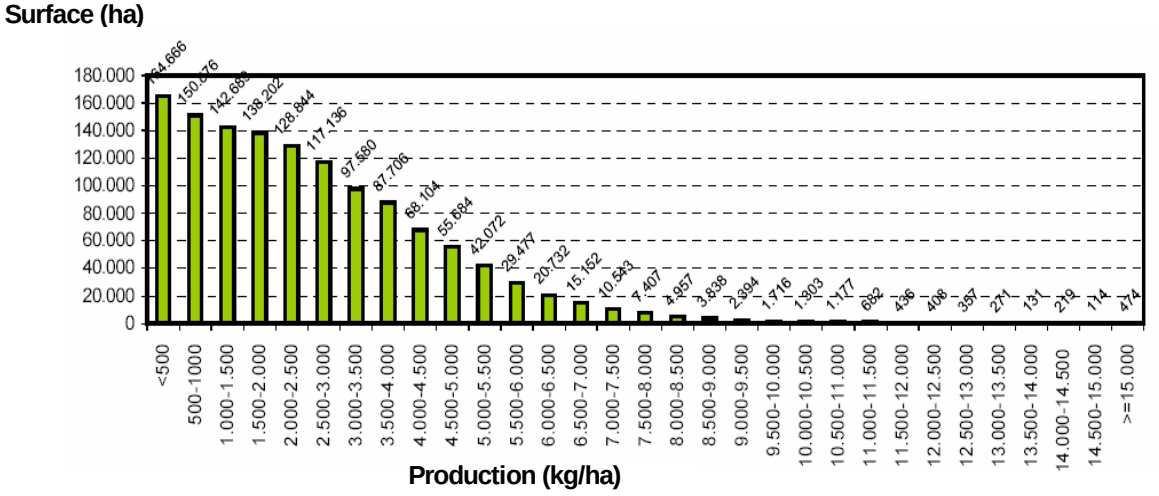
Source: Own work. Data from FEGA

The environmental effect of CMO modification is related to de size and production system of different olive groves.

As showed at table 5 the number of small olive groves increased outstandingly from 1989 to 1999. The reason is double: Firstly the surface restoring during that decade helper the recovering of abandoned little olive groves. Secondly farmers divided their application into several little surface ones in order to profit former CMO small producers subsidy benefits. Despite of this trick, every interviewed manager agrees that former CMO kept at production and restored a great surface of little and traditional managed olive groves. All of then consider this process as environmentally positive, because of the environmental value of olive grove by itself.

Chart below shows the distribution of olive grove surface at Andalucía according to production rates.[17] We see that there us an important surface of 164,666 ha which production is below 500 kg/ha, that means more than 10% of regional surface, and there is other 10% between 500 and 1000 kg/ha. Thus there is a great surface with a low production which is sensible to prices and subsidies decreasing. These plots are damaged by the general context of production competition in order to get the highest amount of subsidies.

Chart 18 : Olive grove surface distribution by production rate at Andalucía



Source: Own work. Data from FEGA

19 of 20 interviewed producers (95%) have increased their olive grove yield, mainly by mechanization (10 out 20), improving plot management though agricultural practices (11 out 20). 19 of them agree that MGQ modification has driven them to that, and when are asked by the direct relations between CMO changes and agricultural practices intensifications all of them point to farming procedure modifications, in addition to the referred modifications 6 producers introduced irrigation and only 3 recognize fertilization use intensification.

They reoriented their production system both to reduce costs and to intensify production. When farmers have irrigation olive groves they intensify, but at soil keeping all of them changed to

[17] Data from: Consejería de Agricultura y Pesca. Junta de Andalucía.

minimum tillage or soil preservation farming systems. The pointed to reduce tillage costs, but they also recognize the environmental value of their agricultural changes.

d) Results

MGQ modification supposed a comparative damage to Spanish sector with regard to other EU produces countries in terms of unitary subsidy for producers. The subsidy decreasing linked to production enhanced producers to intensify productions to reach the highest amount of subsidy. Therefore appeared an internal concurrence amongst Spanish producers in which the most damager was those with less productive olive groves. It means olive groves with low plantation density, traditional farming systems and mountain areas.

These types of olive groves are the most exposed to environmental risks, especially soil erosion and fire risk when are abandoned. Moreover that olive groves are also those with a higher ecological value, as represent a traditional landscape element when are under grow, but once abandoned increase the related damages degrade them.

At the moment this risky olive groves keep at production because present prices and subsidies level are still over the profitability level, but it has reduced dangerously.

The subsidy decoupling will avoid the referred internal concurrence lightening the pressure over the low productive olive groves.

On the other hand subside reduction accelerated the implanting of good agricultural practices such as combined soil keeping (with minimum tillage and herbicide), because of farmers need to reduce costs to keep their profit level.

Question 3 (O3): What is the environmental effect of the removal of the production aid in terms of payment per tree meant for smaller producers?

a) Question Context in Spain

- **Measure description**

The main consequence of this measure is that after 1998 small producers were under the general regulation and began t be affected by subsidies penalizations.

- **Measure level implementation**

At Spain the presence of small producers is higher in marginal regions. In Andalucía this presence is more significant than in other regions because of the surface concentration. In those regions where olive grove regression has been significant little olive groves have disappeared, but in Andalucía, concentration and cultural matters have kept almost all the olive surface under production.

b) Advanced impacts

- **Effects on agricultural practices**

Agricultural practices should be affected if small farmers assume transformations to adapting themselves to the new situation. The most radical change is giving up production, and others can be: Intensification, ecological production o reducing costs.

- **Possible effects on environment**

Once again associated environmental effects are due to transformations assumed by small farmers to adapting themselves to the new situation. Related advanced transformations are in close relation with soil state, water consumption and biodiversity.

c) Question Analysis

Previous question analysis about the effect of Spanish subside penalization due to production over NGQ is valid in general terms to this one. When small producers entered the present CMO they suffered the same damage as the rest of Spanish producers. But in this case they had shorter headroom.

As can be seen at table 5 over 66% of Spanish olive groves surface is under 2 ha, what means 12.99% of olive grove surface at 1999. This surface has decreased because of plantations after 1998 are mainly over this surface. As small producer typology is liked to olive oil global production, the classifying of these olive groves under two hectares has changed along the time. Regarding the production data from 1992 to 1998 there can be supposed that the great part of these olive groves fulfilled the requirements of small producer category.

Thus CMO reform at 1998 arrived whether great part of those small surface olive groves owners were not used new system. Thus the CMO modification affected about 60 % of olive plots and the 13% of olive surface. This modification supposes decease of subsidy level and because of that of olive grove final profitability, reaching in some cases levels below cero. In these cases there is usual to find olive groves integrated into a greater plot with other crops and farmer are not conscience of the separate crop production costs. Farmers realize that their global farm profitability has decreased but their continue producing olive oil mainly by cultural reasons.

In some other cases small olive groves belong to retreated people or to not professional farmers. In this cases production is arranged with some professional farmers at the area, who manage several little olive groves as an integrated farm profiting scale economy benefits. This is the common case at Andalucía where the surface concentration offers many possibilities to those arrangements. Thus at Jaen Province, 90% of useful farming surface is occupied by olive groves.

In the most dynamic areas organic production has been developed to increase profitability, but transformation is usually due to farmers organization that provides technical and empirical support, where there is not relevant the plot size. Result is that in these areas many small producers have changer to organic production, but also many bigger ones. Transformation to organic production is a solution to improve small olive groves profitability, but do not depend o plots size, the main reason are market and technical possibilities.

Finally we have not found sings of small olive groves abandonment during the last six years. Managers and farmers interviewed agree to assure that the great part of small olive plots keep at production.

Concluding, the CMO modification of small farmers regulation points to the risk of a progressive abandonment of plots, because of the individual profitability decreasing This supposes a high risk of negative environmental impact because Spanish small olive groves are about 13% of national surface. But there have not been seen these effects because cultural and structural features have helped small olive oil producers to keep at production.

d) Results

Concluding, the CMO modification of small farmers regulation points to the risk of a progressive abandonment of plots, because of the individual profitability decreasing This supposes a high risk of negative environmental impact because Spanish small olive groves are about 13% of national surface. But there have not been seen these effects because cultural and structural features have helped small olive oil producers to keep at production.

3.1.4 Olivo – Theme 4: structural and accompanying measures

Question 1 (O4): What are the environmental impacts of the grants for grubbing up old groves, replanting and irrigation [Rural development regulation 1638/1998]?

a) Question context in Spain

- **Measure description**

CMO regulation does not provide measures to help structural changes, but Rural Development Regulation do. Its measures have been widely applied at Spain.

- **Measure level implementation**

Irrigation replanting and transformation have been important measures at Spanish olive groves. Thus rural development regulation has played an important role during these processes. Olive grove irrigation development has affected to almost 300,000 ha at Spain during the period.

Besides of uprooting and replanting other structural transformation is olive groves transformation without uprooting by means of cutting off one or two logs at multiple logs olive groves. This transformation is associated to pruning modifications in order to re-structure olive tree aerial parts.

b) Advanced impacts

- **Effects on agricultural practices**

Structural changes are linked to new agricultural practices derived from the new production system requirements. Thus as first term has been important at Spain there is supposed to find effects on agricultural practices such as soil keeping, pruning, irrigation, fertilization, treatment or collecting.

- **Possible effects on environment**

Every agricultural practice has an environmental influence, and practices quoted above are specially related to erosion, water pollution, water supply and biodiversity.

c) Question Analysis

Amongst the rural development subsidies established by Reglament 1257/99 applied at Spain the measure of "Improving Agricultural Structures and Farming Systems" helped the structural modernization of holdings.

Helping agricultural infrastructures Spanish MAPA established three acting lines:

- Water resources management by means of National Irrigation Systems Plan
- Agricultural holdings competitiveness improvement
- Agricultural production protection and improvement.

Amongst helping farms structure transformation measures there is a specific aid line to planting woody crops only since year 2000.

Other aid line with structural effect was the olive oil quality improvement programs settled up at year 1998. This program established training courses to olive oil farmers and managers. Although the number of people concerned by courses is low (about 1000 per year) the representatively of them and them into the sector increased the demonstrative effect of courses teachings.

Table below shows the incidence of farms structure transformation measures during the period. There can be seen that olive oil sector aids are only 5.4 euro millions 0.7% of national amount. Comparing this data to olive contribution to national aggregated agricultural production which is 8.8% at national level seems to be a really insignificant measure. Also the number of beneficiary what supposes only 0.05% shows the measure low relevance.

Table 42 : Structure transformation measures 2000-2003 (€ million)

	Nº beneficiary	Total investment	Public aids
Great crops	5,366	226.7	108.6
Horticultur e	4,646	307.1	151.6
Vineyard	1,112	38.1	17.4
Fruits	1,990	61.2	28.6
Olive grove	334	13.7	5.4
Other crops	9,095	373.2	178.4
Dairy cattle	6,225	292.9	126.4
Meat Cattle	2,429	75.8	33.7
Pig	362	21.0	9.7
Poultry	253	16.2	7.7
Other cattle	3,760	156.3	74.5
Other	666	28.8	14.1
Total	**36,238**	**1,611**	**756**

Source: MAPA.

Irrigation was widely developer since the second half of the nineties because was a useful way to reduce draught damages. 65% of transformed surface is located at Andalucía. But as olive grove has some tolerance to draught it has never been a priority crop when helping irrigation transformation, specially after CMO reform, when was seen that production increasing due to irrigation (and others) was counterproductive in terms of production subsidies.

Table 43 : Irrigation surface increasing at Spain (ha)

Y ear	Irrigated surface	Irrigation surface increase
1995	121,154	3,375
1996	195,146	73,992
1997	209,279	14,133
1998	250,552	41,273
1999	328,235	77,683
2000	408,066	79,831
2001	432,716	24,650
2002	456,841	24,125
2003	472,680	15,839

Source: MAPA.

Farmer tied to develop as much as possible irrigation at olive groves but national and regional authorities kept cautious because of the negative impacts of a high irrigation development on sector balance. Thus many of the irrigation transformation were developed without public support.

There was developed some significant olive irrigation transformation such as Úbeda area (Jaén province) were olive groves are irrigated with recycled urban residual water flows.

In terms of water resources public administrations regulated strictly when and how farmers were allowed to use water. But many olive growers managed to use legislation gaps to profit unused water resources. This is the referred case of winter water pumping to small lakes (question 1(O1)). There are not illegal irrigations but actually are out of legislation. The result is that present Irrigation National Plan, plans to use some of those resources by building a huge artificial lake (Abreñador Artificial Lake)[18].

[18] Information from managers and farmers interviews.

About olive groves structural transformations, interviewed farmer majority think is that uprooting and replanting has been and frequent practice but the most common practice has been cutting one or two logs and modifying pruning procedures.

There is remarkable that in the case of Andalucía farmers have organized themselves to provide common irrigation systems by building small lakes with a PET covering or similar, where they pump water from rivers in during winter to be used in spring and summer. This practice has a

d) Results

Olive groves have developed outstandingly by means of structural changes and irrigation systems implanting. In the case of structural changer Public Administrations support has helped transformations, but the transformed surface has been much bigger that that under Farms Structure Transformation Measures.

In the case of irrigation aids the transformation olive groves transformation has developed separately from subsidies.

Environmentally these programs have a really positive influence, because their result is a farming system less aggressive to environment. In the case of irrigation the subsidy restriction helped to stop a possible production boom which could have had a really negative environmental production increasing market pressure over less efficient olive groves.

Question 2 (O4): What are the environmental impacts of the LFA aid for olive farmers?

a) Question context in Spain

- **Measure description**

Rural Development Regulation 1257/99 establishes special accompaniment measure to sustain produces at les favoured areas, which are those under depopulation risk and mountain areas. This is not a CMO measure, but as works in terms of direct transaction to producer, can be thought as a complement to that. Farmers according to requirements which plots are placed at LFA, receive this aids if they agree with several commitments at their agricultural practices.

- **Measure level implementation**

This measure is very significant because, according to data from chart below, the main part of Spanish agricultural useful surface is regarded as LFA. For the period 2000-2006 are affected 12 ha million (47% mountain, 52% depopulation risk and 1% special difficulties areas) Global funding are 87,5 € million what supposes 20% of global accompaniment measures program.

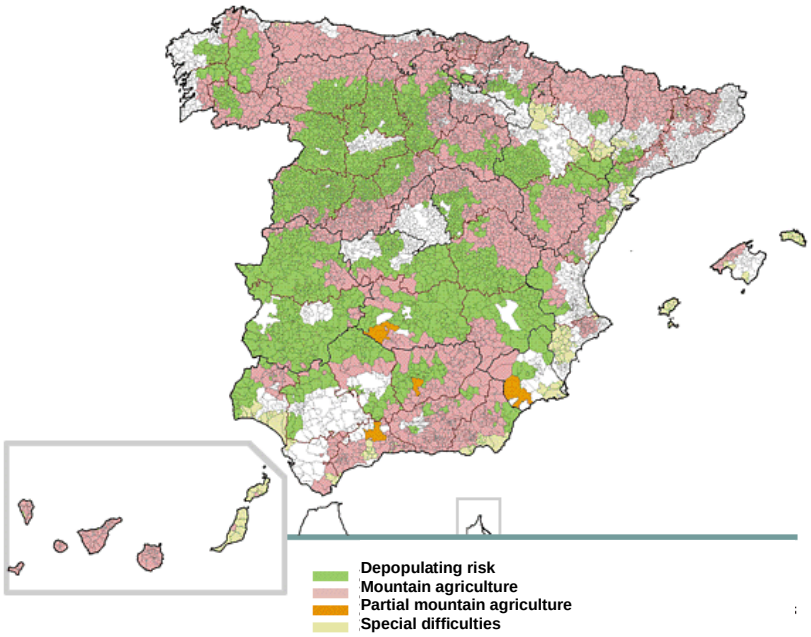
Crossing chart 2(O4)1 with chart 1 information can be seen that the main Spanish olive grove surface is at less favoured areas.

b) Advanced impacts

- **Effects on agricultural practices**

There is a direct effect of this measure on agricultural practices, because farmers compromise to follow regional good agricultural practices code at their plots.

Chart 19 : Spanish less favoured areas



Source: MAPA

- **Possible effects on environment**

Because of the previous commitment measure has also an important environmental effect, because Good Agricultural Practice Codes have been established to protection environment. This measure has a potential environmental effect almost all over Spain.

c) Question analysis

This measure initial aim is to help production at les favored areas by means of extra aids. But there is an outstandingly environmental effect because of the commitment about good agricultural practices. At this point farmers balance potential additional cost due to good agricultural practices commitments and les favored areas aids. At those crops where those commitments were easy to implant farmers will apply for the extra aid, and if doubted, the common collected opinion is that farmers choose the aid.

Spanish national RDR establish the following main good agricultural practices as a basic level to be fulfilled by every regional good agricultural practices code.

- Soil keeping and erosion fighting: Baning of slope direction tillage.
- Crop rotation: There must been followed local crop rotation habits.
- Fossil energy optimization:
- Efficient water use: According to regulations from Confederaciones Hidrográficas.
- Biodiversity preservation: Banning of burning stubble and pruning rests.
- Fertilizer use rationalization: At Nitric pollution risk areas must be followed specific regional programs.
- Rationalization of herbicide and plant protection products use: These products must be used according to safety regulation and application schedules.
- Agricultural origin pollution reduction.
- Other regulations about set aside and livestock density.

Aids for les favored areas are applied as a direct payment to professional farmers when applied as Basic Compensatory Compensation (BCC). This compensation is though according to the supposed added difficulties of producing at les favored areas with regard to other production areas. Basic aids are:

- 75 €/ha. for mountain areas
- 45 €/ha. for depopulation risk mountains
- 120 €/ha. for specific difficulties areas

For the tree zones the maximum aid perceivable quantity are 2,000 € and the minimum 300 € per farm. Table below show the evolution of these aids:

Table 44 : BCC aids evolution at Spain

Y ear	Nº beneficiary	Total aid € million
1993	188,031	67.53
1994	177,703	66.61
1995	-	-
1996	172,830	68.72
1997	169,367	67.78
1998	143,641	58.62
1999	160,215	65.38
2000	150,444	56,65
2001	88,185	65.64
2002	135,290	78.92

Source: MAPA.

Interviewed farmers and regional manager agree that this aid is really lower than CMO subsidies and that its contribution to global exploitation income is moderate. The maximum aid limitation makes this measure almost worthless to big olive plots. This measure consideration improves as much as farms size decreases.

Interviewed farmers also agree that BCC commitments are easy to fulfill all the olive groves because many of them are into their traditional production procedures. In other cases such as erosion fighting farmers realize that is not only a social need but the first damaged by erosion is their own plot soil and their future production. Because of that the participation of olive groves farmers at BCC aids is higher than other crops.

d) Results

LFA aids relevance in terms of direct money transfer has a low relevance with regard to CMO subsidies. But the environmental effect is high because of the aids commitments. Farmers must follow good agricultural practices codes to be able to receive the aid. Thus a little amount of money has high environmental consequences. This measure development has been wither at those crops where the assumption of good agricultural commitments supposed easy changes of farming procedure, or where there was positive linkages between commitments and farming systems modification needs because of market requirements. This is the case of olive grove.

3.2. Horizontal questions

3.2.1 Horizontal – Theme 1: land use over time

Question 1(H1): Does the CMO lead to substantial changes in land use over time (abandonment, expansion and set-aside) and if so: what are the positive and negative environmental impacts? [This question should preferably consider typical patterns of alternative status/use after or before use of the land for the permanent crop to which the CMO relates.]

a) Question context in Spain

- **Measure description**

Abandonment has been a very important measure at Spanish olive groves during the seventies when the development of other vegetal oil crops affected outstandingly olive oil market. This measure implies the change of the land use, which can have both positive and negative effects on the environment. This question tries to determine if there are any statistical data reflecting these changes in Spain and which type of cultures have substituted the olive groves.

- **Measure level implementation**

There has not been specific olive grove planting or uprooting support measures, but studied information reveal a high increase of olive grove surface and the development of mew live grove agricultural management techniques.

b) Advanced impacts

- **Effects on agricultural practices**

The main effects are those linked to the specificity of the new implanted culture, which can vary from one to another and from among different regions.

- **Possible effects on environment**

The permanent abandonment an olive groves recovering can have different effects on the environment, above all on the productive capacity of soils and on a potential erosion process. Besides, there are some implications related to the irrigation requirements of the new substitutive cultures.

c) Question analysis

After de development of oil seeds herbaceous crops during the sixties and seventies olive oil market was invades by cheaper seed oils, and sell decrease. Besides farming production modernization increased yields. Thus growing surface decreased outstandingly. Sector reacted slowly by means of marketing but recovering results came linked to the entering to CEE, when new subsidy system helped surface recovering pointing to the profit increase by means of subsidy payments.

Table 3 shows the increase of olive grove surface at Spain during the last two decades. This increase supposes a modification of last use. This modification has been done to two different ways:

- Restoring abandoned olive groves at traditional olive grove areas.
- Planting new olive groves at traditional olive grove growing areas.
- Planting olive grove at not traditional olive grove growing areas.

Following table present the statistics of crop succession of permanent crops ant Andalucía during the regarded period.

Table 45 : Statistics of the cultural successions of permanent crops in Andalicía from 1990 to 2004

	CULTURE year+1 (%) new use																				
	Winter grains																				
Year	Wheat	Barley	Oats	Rye	Total	Corn	Other grain crops	Pulses	Tuber	Sugar beet	Sunflower	Cotton	Other industrial crops	Fodder crops	Vegetables and flowers		Fallow	Permanent cultures	Other associations	Other surfaces	TOTAL
1990	No available data																				
1991																					
1992																					
1993	0.10	0.08	0.01	0.00	0.19	0.01	0.01	0.02	0.00	0.00	0.05		0.01	0.04	0.20	0.52	0.26	97.64		0,86	100.00
1994	0.04	0.04	0.01	0.00	0.09	0.00	0.01	0.01	0.00	0.00	0.04		0.00	0.01	0.01	0.08	0.17	98.92		0,57	100.00
1995	No available data																				
1996																					
1997	0.14	0.13	0.05		0.33	0.00	0.00	0.04	0.01		0.01	0.00	0.01	0.01	0.08	0.87	0.37	96.68	0.40	1.35	100.00
1998	No available data																				
1999																					
2000	0.06	0.03	0.02		0.11	0.03	0.03	0.01	0.00		0.02	0.01		0.01	0.02	0.13	0.17	98.38	0.02	1.19	100.00
2001	0.04	0.03	0.00		0.08	0.00	0.00	0.02	0.01		0.02	0.09		0.01	0.05	0.20	0.15	99.12		0.45	100.00
2002	0.08	0.06	0.00		0.14	0.02	0.01	0.01	0.01		0.00	0.01	0.04	0.01	0.01	0.13	0.26	98.78	0.07	0.62	100.00
2003	0.1	0.0	0.0		0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0		0.0	0.1	0.3	0.3	98.8	0.0	0.6	100.00

Source: INE, Boletín Estadístico, 1998-2003

Previous table shows no specific data of olive groves nor national data are available, so particular conclusions of the evolution of these crops can not be extracted. We can induce that as olive grove is the most important permanent crop at Andalucía, and as there can be seen that the changing rate is low (average yearly change is about 2%) olive groves changes are low. This is according to the surface restoring data coming from general surface study and managers interviews.

Plantation of new olive groves out of traditional olive groves areas is linked to irrigation development. The great part of the 350,000 ha new irrigation olive groves are placed at these areas. Thus there is an outstandingly land use change. And this change is directly linked to CMO subsidies.

Interviewed producers and manager agree that farmers tied to intensify production in order to get the highest subsidy global transaction. New plantations are placed at valley or not slope plots, where former crops were extensive herbaceous ones. In this case water, fertilizers and plant treatment products rate decrease. Thus environmental global effect is regarded as positive. Moreover regarding landscape features, because olive groves are more a grown traditional Spanish forest than a fruit crop. Only super-intensive olive groves (over 400 trees/ha) do not fulfill this feature.

Describes case is the most common Andalucía. There have also been common planting olive trees at uprooted vineyard plots, but the concerned surface is lower than the herbaceous crop one. This last situation has been more common at vineyard decreasing regions such as Castilla la Mancha. In this second case the maintenance of a permanent crop is regarded as environmentally positive.

Recovering abandoned olive groves is quite out of this question matter, but has also a positive environmental effect mainly at fire prevention.

Planting olive groves at traditional olive grove areas has local relevance because has been a way to restructuring former olive groves plots within the general structural changes to adapt farms to new agricultural techniques.

d) Results

CMO has driven to structural changes in terms of land use in at least 300,000 ha at Spain during the last two decades. Olive grove has entered traditional herbaceous extensive areas.

The environmental valuation of this change is positive because:

- Olive grove is a permanent crop really close to a forest area and in many cases is the only arboreous area. Thus is essential to landscape diversity and to wildlife, and also to carbon fixing.
- Olive grove is less environmental aggressive than replaced crops which are mainly extensive herbaceous crop.
- When replacing vineyard olive grove at least keeps the former environmental benefits, despite of dry land extensive herbaceous crops which are the other replacement alternative.
- Growing olive grove at irrigation land supposes saving water because olive requirements are lower than extensive herbaceous crops ones (at least the half). Irrigation system (drip irrigation) increase outstandingly irrigation effectiveness.

Question 1 (H2): Are there indications that a change in total spending on the CMO <u>in its present form</u> would have a substantial positive or negative environmental impact? [This question should preferably address the claim of the literature that CMOs for permanent crops differ with respect to their overall environmental impact.]

a) Question context in Spain

- **Measure description**

In this question, we need to find out whether some changes in the distribution of expenditures within the total budget for this CMO would help to reduce the negative environmental effects or to improve the positive ones.
In this question are three different scenarios:

- Increasing subsidies level
- Decreasing subsidies level
- Redistributing CMO measures subsidies percentage.

- **Measure level implementation**

The total budget distribution among the different measures from 2001 to 2003 is distributed as follows:

- 92 % to olive oil production subsidies and producers organizations operative programs.
- 4.5% to table oil production subsidies.
- 1.1% to consumption helps.
- 1.4% to the aid of private storage.
- 0.9% to quality improvement.

b) Advanced impacts

- **Effects on agricultural practices**

CMO do not provide direct programs to promote agricultural practices modifications. Thus regarded effect is indirect. We focus on those transformations implemented by farmers in order to adapting these exploitation systems to changing market conditions. As far as can be established CMO relation with these market conditions, CMO could be supposed to have had effects on agricultural practices.

- **Possible effects on environment**

The application of some measures of the current CMO could have some effects on the environment as much as CMO derived agricultural practices influence on environment.

c) Question analysis

All the interviewed farmers and managers agree that as a CMO subsidy increase will enhance production and a CMO decrease will be negative to farmers because of the final income decreasing.

As seen Spanish olive oil production has kept rising despite of subsidy penalization. The reason is that in the scenario of lower subsidies producers reacted trying to increase production, to balance subsidy decrease increasing selling, thinking to get adequate selling prices.

The main FEGA payments are to production helping. We have already seen that in a subsidy decreasing scenario, such as what happen at Spain since 1999, when NGQ overrunning produced penalizations, farmers reacting stressing production, and as a consequence pressing down subsidy level.

There is logical to find the same reaction in the case of a direct subsidy decreasing. Environmentally there exists a abandonment risk at the marginal olive groves. If producers press production up this will then to be aggregated at the most productive areas. Overproduction will press prices low and marginal producers yield will reduce dangerously. Small and low productive

farmers will receive a lower subsidy amount, so they will lack of means to adapt their plots to the new productive situations.

Production intensification does not necessary means environmental damages, because olive grove is an environment respectful crop. Moreover, when producers global yield increases they are disposed to spend resources at environment protection. This is the case of vegetal covering, which is only practised at those plots where olive trees water supply is guarantied.

Subsidies increases do not means higher environment protection guaranties. The supposed increase should be linked to specific good agricultural practices commitments. In many cases may mean just the opposite. Modern olive grove growing techniques about soil keeping and chemical products use has been developed because of the needs of cost reducing. Result is that the implemented agricultural practices also fight many environmental risks. If a sensible subsidies increasing is implemented there is supposed to think that farmers will be less accurate at following those techniques, and if being careless with production they will also be careless with environment.

CMO measures rebalancing seems to be an effective environmental production system, because offers the possibility of implementing new subsidy lines linked to environmental protection commitments.

d) Results

A significant modification of total CMO subsidies seems to be environmentally negative in any cases. Producers are into an internal concurrence productive process in order to get the highest amount of subsidy by means pro increasing olive groves yields. In this process the less favored are small and marginal producers, which plots are under risk of suffering environmental damages because of the lack of production means or funding. The CMO modifications should be driven to stop internal concurrence and to promote sector solidarity.

3.2.2 Horizontal – Theme 2: adequate spending level and method

Question 2 (H2): Are there indications that decoupling of spending <u>at its present level</u> would have a substantial positive or negative environmental impact?

a) Question context in Spain

- **Measure description**

CMO subsidies are linked to production, thus as much as a farmer was able to produce more subsidy will receive. Production linked measures enhance internal sector concurrence not only by selling their productions, but also in order to receive subsidies.

- **Measure level implementation**

In the case of Spain production has raised over the NGQ. There have not been surpluses, because market has assumed all the production consuming it. But the result has been that producers subsidy decreased because of penalizations. Producers have continued the production rising despite of them, but not every one has had the same opportunities.

b) Advanced impacts

- **Effects on agricultural practices**

Decoupling should not have many direct effects on agricultural practices whereas there was kept the global subsidy amount received per farmer. But as in the case of de coupled aids there is not necessary intensify production to maximize subsidies. When subsides are coupled production costs are higher than at decoupled aids. Farmers usually rise production to germ or subsidies overrunning their efficiency limits.

- **Possible effects on environment**

Once again associated environmental effects are due to transformations assumed by small farmers to adapting themselves to the new situation. Related advanced transformations are in close relation with soil state, water consumption and biodiversity.

Tables bellow present the description of tne main environmental risks targeted at the study.

Table 46 : Significant environmental impacts of CMO integrated production measures

Evaluation Parameters	Notation Type
Impact nature	Inputs Reduction
Target	Water and soil
Spatial range	National
Level	Primary
Duration	Long term
Intensity	High
Reversibility	Reversible
Sensibility	High
Width and gravity of the impact with all factors combined	Negative

Source: Own work

Table 47 : Significant environmental impacts of CMO waste management measures

Evaluation Parameters	Notation Type			
Impact nature	Water pollution	Soil erosion	Soil pollution	Landscape degradation
Target	Water	Soil	Soil	Landscape
Spatial range	Local	National	National	National
Level	Secondary	Primary	Secondary	Terciary
Duration	Long term	Long term	Long term	Long term
Intensity	Low	Medium/High	Low	Low
Reversibility	Irreversible	Ireversible	Quite reversible	Reversible
Sensibility	High	High	High	Medium
Width and gravity of the impact with all factors combined	Very negative	Very negative	Very negative	Negative

Source: Own work

c) Question analysis

The Spanish olive grove sector situation after CMO reform t 1998 is an outstandingly example of the production intensification due to coupled aids. During the last years, despite of penalizations farmers continued producing over NGQ. There have not been surpluses, because market has consumed all the production. But the result has been that producers subsidy decreased because of penalizations. Producers have continued the production rising despite of them, because they have tried to maximize the global subsidy amount.

Production coupled subsidies became at a scare resource, because the national amount was fixed, and when production raised unitary payment decrease. As happen with irreplaceable resources, concurrence has stressed. At this process the less favoured are those producers which olive groves production can not be intensified.

The result is that there has been a transaction of subsidies from small, low density and traditional olive groves (The marginal ones) to those irrigated, intensified and easier to mechanize.

This process may have an environmental effect because those marginal began to lack of the necessary resources to sustain production. Production is the most important feature to keep the environmental value of olive groves.

With decoupled subsidies the "subsidy catching" concurrence disappears, resting only market concurrence, thus decoupling benefits comparatively to marginal olive groves. As said before, in the Spanish case, protecting marginal olive groves is protecting environment, and the more intensified olive groves do not lose their support.

Decoupling also stops the production raising spiral, because subsidy is fixed and there is not necessary to press productions up. In this new scenario production level will be determinate by consumption requirements.

Decoupling has also a positive effect about water resources management. Although, as said before, water use at olive grove has a high environmental effect because of the efficiency and the possibility of implanting vegetal covers to prevent soil erosion, continues being a scare resource. Thus decoupling will reduce the pressure over this resource, because reduces the productivity raising tendency. Because of that there will be easier to distribute water according to agronomical and environmental requirements needs without external preasures.

d) Results

Unless soil erosion Spanish olive groves environmental risks are far from the danger limits. In the case of soil erosion there is a national level risk, but higher risks are not directly linked to intensification but to traditional farming procedures Second targeted environmental risks is water pollution. In this case the scope is local and is not due to intensification but to wrong farming procedures.

Decoupling means a positive environmental effect because reduces the environmental risks derived from production intensification. Although there are not dangers direct linked to this intensification, because olive oil production is far with security limits regarding to de use of inputs with a potential environmental risk, there are possible environmental risks due to their wrong use. In this case decoupling helps to reduce intensification and as a consequence this related risks.

In the case of Spain also reduce the environmental risks of marginal olive groves abandonment, which are mainly soil erosion, and fire risk. The reason is that with decoupled aids there is not production concurrence between farmers trying to get the higher aid amount. Thus marginal olive groves which was les favoured with the production linked subsidies are in equalitarian condition with the decoupled system.

Decoupling has also a positive effect about water resources management.

3.2.3 Horizontal – Theme 3: subsidiarity of agri-environmental schemes and horizontal measures

Question 1(H3): Have the agri-environmental schemes and any environmental requirement ["cross-compliance" ex CE 1259/1999] related to these CMOs been sufficiently targeted by Member States and regions at hotspots of environmental degradation or possibilities for environmentally friendly production?

a) Question context in Spain

- **Measure description**

Regulation (EC) No 1259/1999 establishing common rules for direct support schemes under the Common Agricultural Policy, says in Article 3 that "Member States shall take the environmental measures they consider to be appropriate in view of the situation of the agricultural land used or the production concerned and which reflect the potential environmental effects" and that "Member States shall decide on the penalties that are appropriate and proportionate to the seriousness of the ecological consequences of not observing the environmental requirements referred to".

- **Measure level implementation**

Cross compliance effect over olive groves is diverse. There are environmental risk regions where there are specific environmental commitments, and a great surface without specific protection. The main objectives targeted in Spain and Andalucía are based on organic farming, integrated production systems and Good Agricultural Practices Codes.

b) Advanced impacts

- **Effects on agricultural practices**

The environmental requirements can influence the agricultural practices. The Good Agricultural Practices Codes have special requirements for the fertilizing process and for erosion levels control.

- **Possible effects on environment**

The establishment of environmental requirements is supposed to be good for the environment, since producers have to adapt their ways to the regulations if they want to receive any aids. Some positive effects can be observed when organic farming and integrated production are promoted by Member States and regional regulations.

c) Question analysis

Cross compliance has not been sufficiently developed. Interviewed managers agree that there is necessary to include any general environmental commitments at direct subsidies systems, focusing more specifically olive groves environmental risks. General farming system can be very environmental respectful. Scientific and University experts think that the better economical results are reached through environmental integrated farming systems, such as minimum tillage, soil keeping, drip irrigation, mulching pruning rests, and vegetal cover.

At environmental risk areas threaten have been targeted really accurately by national and regional Public Administrations. But at general olive grove surface there is still possible to produce in a environmental aggressive way. If that has not happened is only due to other production needs derived from mechanization and costs optimization.

Farmers are not usually disposed to acquire any type of commitment without a specific economical compensation subsidy. In the case of olive grove farmers think that growing is by itself a really environmental contribution to society, because of this olive groves are generally thought like one of the most typical Spanish landscape element. Moreover farmers think that their agricultural practices are, in general terms, very environmental respectful.

Ecological agriculture began to be developed before direct subsidies were implanted. The reason is that some farmers saw that as a market opportunity. The fast development was slowed down because of market situation. Farmers are disposed to produce under ecological patterns, but in many cases they lack of the transformation and commercialization channels, and they also lack of selling market.

d) Results

Olive grove farmers are generally environmental respectful. But in many cases there is not a direct commitment. Generally is the consequence of some agricultural practices environmental respectful, that has been chosen regarding only the economical profitability. Minimum tillage, mixed soil keeping systems and chemical products control supposes a economical profit.
At environmental risk areas control has been efficient and commitments have been accuracy driven to main risk, but also to farmers needs. In this case there has been able to joint farmers' interest with environment needs.

Table 48 : Matrix of possible environmental impacts of the wine CMO and the RDR measures

Measures Effects	Measures												
	Q1(O1) Production Based Subsidies	Q2(O1) Sustainable practices	Q1(O2) Organic and integrated production	Q1(O3) Import restriction	Q2(O3) Increasing NGQ	Q3(O3)Effect to small producers	Q1(O4) Grubbing up and replanting	Q2(O4) LFA aids	1(H1) Land use change on time	1(H2) CMO spending increase	1(H2) CMO spending decrease	2(H2) Decoupling of spending	1(H3) agri-environmental schemes included
Change in the technical production: intensification increase	+					+		=	=	=	=	=	=
Change in the technical production: reduction/increase of specialization			+			-		+	=	=	=	=	+
Use of water increase			=	-	-	=	+	=	=	+	-	-	=
Use of fertilizers increase	-	+	=	-	-	=	+	=	=	+	-	-	-
Use of pesticides increase	-	+	+	-	-	=	+	=	=	+	-	-	-
Changes in soil use (biodiversity)	+		+		=	-	-	+	+	=	=	+	+
Changes in soil use (landscape)	+		+		+	-	+	+	+	=	=	+	+
Changes in land use (marginal lands)	=	=	=	-	+	-	-	+	=	-	-	+	+
Changes in land use (new plantations)			=	+	=	+	+	-	+	-	+	-	=
Change of the type of land maintenance	+		+		=		+		+			=	+
Production sustainment						-		+		-	+	+	
Change in the specific agricultural practices	+	+			+	+	+	=	+	+	-	=	+
Effects of culture substitution	+			=						+	-		-
Trend to monoculture				+						-	+		-
Competition, synergy or interference with AE measures of the RDR	-	+			+		=	+	+			=	+
Competition, synergy or interference with other RDR measures like investment and irrigation ones	-	+			+		+	+	+			=	+
Influence on the first transformations at local level, little transformation units and transports					+	=		=					

+: positive for the environment
-: negative for the environment
=: It does not affect

APPENDICES

Annex 1 : List of people met or contacted

Annex 2 : Main bibliography identified (used or not) in relation with the study

Annex 3: Main research projects identified related to the study

Annex 4: Olive groves typology at Andalucía

Annex 1: List of people met or contacted

List of people met

National level:

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- **D. Jacinto Ayuso González**. Subdirector General de Zonas Desfavorecidas. Ministerio de Agricultura Pesca y Alimentación.
- **D. Pedro Castaño**. Jefe de Servicio de Medidas Agroambientales. Consejería de Medio Ambiente y Ordenación del Territorio de la Comunidad de Madrid.
- **D. Ciriaco Vázquez Hombrados**. Subdirector General de Materias Grasas. (MAPA).

Regional level:

- **Dr Ignacio Fernandez de Mesa**: Presidente regional de ASAJ Córdoba
- **D. Enrique Garrido Jiménez**: Director Gerente de OPRACOL: Organización de productores de aceite de oliva de Córdoba.
- **Dr. Francisco Villalobos**: Grupo de estudio de usos de recursos hídricos. Instituto de Agricultura Sostenible. CIFA Córdoba.
- **Dr. José Alfonso Gómez Calero**: Grupo de estudio de erosión hídrica del suelo: Instituto de Agricultura Sostenible. CIFA-Córdoba.
- **Dr**. **Diego Barranco Navero:** Profesor de olivicultura del Departamento de Agroomía de la Universidad de Córdoba. Escuela Técnica Superior de Ingenieros Agrónomos y de Montes.
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- **D. Miguel Pastor:** Junta de Andalucía y Universidad de Jaén.
- **D**. **Emilio González Sánchez**: Técnico de la Asociación de Agricultura de Conservación

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- **D. Julio Gil Robles**: Presidente de la Asociación de Agricultura de Conservación.

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Annex 4: Olive groves typology at Andalucía

General table

Age	Irrigation	Mamagement	Slope	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Average density (tree/ha)	Average production (kg/ha)	Average percentage of new trees by farm	irrigation index (%)	Density index (%)	Tree feet index (%)
Adult	Irrigation	traditional	Low	23,834	9.40	149,921	11.73	6.29	139.38	3,412	0.00	68.97	26.42	3.07
Adult	Dry	traditional	Low	85,405	33.67	412,422	32.26	4.83	110.82	2,964	0.00	0.00	11.26	8.46
Adult	Irrigation	traditional	High	12,687	5.00	48,493	3.79	3.82	138.19	2,661	0.00	59.43	19.31	15.49
Adult	Irrigation	Intensive	Low	1,962	0.77	20,778	1.63	10.59	239.86	2,545	0.00	85.33	0.00	0.00
Adult	Irrigation	Intensive	High	1,721	0.68	4,224	0.33	2.45	219.95	2,276	0.00	72.43	0.00	0.00
Adult	Dry	traditional	High	75,529	29.78	308,547	24.14	4.09	113.75	2,259	0.00	0.00	11.98	19.66
Renovation	Irrigation	traditional	Low	5,576	2.20	61,224	4.79	10.98	193.67	2,224	35.04	63.91	46.80	3.91
Adult	Dry	Intensive	Low	5,829	2.30	21,993	1.72	3.77	199.42	2,201	0.00	0.00	0.00	0.00
Renovation	Dry	traditional	Low	10,786	4.25	97,176	7.60	9.01	126.40	2,094	31.17	0.00	22.38	8.86
Renovation	Irrigation	traditional	High	3,717	1.47	22,772	1.78	6.13	154.92	1,856	28.25	56.97	38.91	11.30
Renovation	Dry	traditional	High	13,804	5.44	82,940	6.49	6.01	121.61	1,807	25.35	0.00	16.59	17.21
Renovation	Irrigation	Intensive	High	942	0.37	2,357	0.18	2.50	231.88	1,726	32.49	66.08	0.00	0.00
Renovation	Irrigation	Intensive	Low	891	0.35	9,291	0.73	10.43	246.79	1,613	42.65	84.04	0.00	0.00
Adult	Dry	Intensive	High	7,307	2.88	21,660	1.69	2.96	202.53	1,530	0.00	0.00	0.00	0.00
Renovation	Dry	Intensive	Low	1,685	0.66	8,492	0.66	5.04	198.36	1,330	46.23	0.00	0.00	0.00
Renovation	Dry	Intensive	High	1,988	0.78	6,050	0.47	3.04	204.80	1,164	33.33	0.00	0.00	0.00
Total				253,663	100.00	1,278,340	99.99	5.04	128.12	2,982	15.49	16.78	8.35	24.73

This data are taken from the Study: *El olivar andaluz.* Ed Unidad de Prospectiva, done by Consejería de Agricultura y Pesca of Junta de Andalucía at year 2002.

Following tables group this information by typology:

Adult olive groves

Age	Irrigation	Mamagement	Slope	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Average density (tree/ha)	Average production (kg/ha)	Average percentage of new trees by farm	irrigation index (%)	Density index (%)	Tree feet index (%)
Adult	Dry	traditional	High	75,529	29.78	308,547	24.14	4.09	113.75	2,259			11.98	19.66
Adult	Dry	traditional	Low	85,405	33.67	412,422	32.26	4.83	110.82	2,964			11.26	8.46
Adult	Dry	Intensive	High	7,307	2.88	21,660	1.69	2.96	202.53	1,530				
Adult	Dry	Intensive	Low	5,829	2.30	21,993	1.72	3.77	199.42	2,201				
Adult	Irrigation	traditional	High	12,687	5.00	48,493	3.79	3.82	138.19	2,661		59.43	19.31	15.49
Adult	Irrigation	traditional	Low	23,834	9.40	149,921	11.73	6.29	139.38	3,412		68.97	26.42	3.07
Adult	Irrigation	Intensive	High	1,721	0.68	4,224	0.33	2.45	219.95	2,276		72.43		
Adult	Irrigation	Intensive	Low	1,962	0.77	20,778	1.63	10.59	239.86	2,545		85.33		
Total				214,274	84.48	988,038	77.29	4.61	124.57	2,737				

Renovation olive groves

Age	Irrigation	Mamagement	Slope	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Average density (tree/ha)	Average production (kg/ha)	Average percentage of new trees by farm	irrigation index (%)	Density index (%)	Tree feet index (%)
Renovation	Dry	traditional	High	13,804	5.44	82,940	6.49	6.01	121.61	1,807	25.35		16.59	17.21
Renovation	Dry	traditional	Low	10,786	4.25	97,176	7.60	9.01	126.40	2,094	31.17		22.38	8.86
Renovation	Irrigation	traditional	High	3,717	1.47	22,772	1.78	6.13	154.92	1,856	28.25	56.97	38.91	11.30
Renovation	Irrigation	traditional	Low	5,576	2.20	61,224	4.79	10.98	193.67	2,224	35.04	63.91	46.80	3.91
Renovation	Dry	Intensive	High	1,988	0.78	6,050	0.47	3.04	204.80	1,164	33.33			
Renovation	Dry	Intensive	Low	1,685	0.66	8,492	0.66	5.04	198.36	1,330	46.23			
Renovation	Irrigation	Intensive	High	942	0.37	2,357	0.18	2.50	231.88	1,726	32.49	66.08		
Renovation	Irrigation	Intensive	Low	891	0.35	9,291	0.73	10.43	246.79	1,613	42.65	84.04		
Total				39,389	15.52	290,302	22.70	7.37	149.90	1,961				

Dry land olive groves

Age	Irrigation	Mamagement	Slope	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Average density (tree/ha)	Average production (kg/ha)	Average percentage of new trees by farm	irrigation index (%)	Density index (%)	Tree feet index (%)
Adult	Dry	traditional	High	75,529	29.78	308,547	24.14	4.09	113.75	2,259			11.98	19.66
Adult	Dry	traditional	Low	85,405	33.67	412,422	32.26	4.83	110.82	2,964			11.26	8.46
Adult	Dry	Intensive	High	7,307	2.88	21,660	1.69	2.96	202.53	1,530				
Adult	Dry	Intensive	Low	5,829	2.30	21,993	1.72	3.77	199.42	2,201				
Renovation	Dry	traditional	High	13,804	5.44	82,940	6.49	6.01	121.61	1,807	25.35		16.59	17.21
Renovation	Dry	traditional	Low	10,786	4.25	97,176	7.60	9.01	126.40	2,094	31.17		22.38	8.86
Renovation	Dry	Intensive	High	1,988	0.78	6,050	0.47	3.04	204.80	1,164	33.33			
Renovation	Dry	Intensive	Low	1,685	0.66	8,492	0.66	5.04	198.36	1,330	46.23			
Total				202,333	79.76	959,280	75.03	4.74	119.74	2,473				

Irrigation olive groves

Age	Irrigation	Mamagement	Slope	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Average density (tree/ha)	Average production (kg/ha)	Average percentage of new trees by farm	irrigation index (%)	Density index (%)	Tree feet index (%)
Adult	Irrigation	traditional	High	12,687	5.00	48,493	3.79	3.82	138.19	2,661		59.43	19.31	15.49
Adult	Irrigation	traditional	Low	23,834	9.40	149,921	11.73	6.29	139.38	3,412		68.97	26.42	3.07
Adult	Irrigation	Intensive	High	1,721	0.68	4,224	0.33	2.45	219.95	2,276		72.43		
Adult	Irrigation	Intensive	Low	1,962	0.77	20,778	1.63	10.59	239.86	2,545		85.33		
Renovation	Irrigation	traditional	High	3,717	1.47	22,772	1.78	6.13	154.92	1,856	28.25	56.97	38.91	11.30
Renovation	Irrigation	traditional	Low	5,576	2.20	61,224	4.79	10.98	193.67	2,224	35.04	63.91	46.80	3.91
Renovation	Irrigation	Intensive	High	942	0.37	2,357	0.18	2.50	231.88	1,726	32.49	66.08		
Renovation	Irrigation	Intensive	Low	891	0.35	9,291	0.73	10.43	246.79	1,613	42.65	84.04		
Total				51,330	20.24	319,060	24.96	6.22	162.15	2,822				

Traditionalt olive groves

Age	Irrigation	Mamagement	Slope	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Average density (tree/ha)	Average production (kg/ha)	Average percentage of new trees by farm	irrigation index (%)	Density index (%)	Tree feet index (%)
Adult	Dry	traditional	High	75,529	29.78	308,547	24.14	4.09	113.75	2,259			11.98	19.66
Adult	Dry	traditional	Low	85,405	33.67	412,422	32.26	4.83	110.82	2,964			11.26	8.46
Renovation	Dry	traditional	High	13,804	5.44	82,940	6.49	6.01	121.61	1,807	25.35		16.59	17.21
Renovation	Dry	traditional	Low	10,786	4.25	97,176	7.60	9.01	126.40	2,094	31.17		22.38	8.86
Adult	Irrigation	traditional	High	12,687	5.00	48,493	3.79	3.82	138.19	2,661		59.43	19.31	15.49
Adult	Irrigation	traditional	Low	23,834	9.40	149,921	11.73	6.29	139.38	3,412		68.97	26.42	3.07
Renovation	Irrigation	traditional	High	3,717	1.47	22,772	1.78	6.13	154.92	1,856	28.25	56.97	38.91	11.30
Renovation	Irrigation	traditional	Low	5,576	2.20	61,224	4.79	10.98	193.67	2,224	35.04	63.91	46.80	3.91
Total				231,338	91.21	1,183,495	92.58	5.12	123.49	2,612				

Intensive olive groves

Age	Irrigation	Mamagement	Slope	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Average density (tree/ha)	Average production (kg/ha)	Average percentage of new trees by farm	irrigation index (%)	Density index (%)	Tree feet index (%)
Adult	Dry	Intensive	High	7,307	2.88	21,660	1.69	2.96	202.53	1,530				
Adult	Dry	Intensive	Low	5,829	2.30	21,993	1.72	3.77	199.42	2,201				
Renovation	Dry	Intensive	High	1,988	0.78	6,050	0.47	3.04	204.80	1,164	33.33			
Renovation	Dry	Intensive	Low	1,685	0.66	8,492	0.66	5.04	198.36	1,330	46.23			
Adult	Irrigation	Intensive	High	1,721	0.68	4,224	0.33	2.45	219.95	2,276		72.43		
Adult	Irrigation	Intensive	Low	1,962	0.77	20,778	1.63	10.59	239.86	2,545		85.33		
Renovation	Irrigation	Intensive	High	942	0.37	2,357	0.18	2.50	231.88	1,726	32.49	66.08		
Renovation	Irrigation	Intensive	Low	891	0.35	9,291	0.73	10.43	246.79	1,613	42.65	84.04		
Total				22,325	8.79	94,845	7.41	4.25	215.60	1,913				

High slope olive groves

Age	Irrigation	Mamagement	Slope	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Average density (tree/ha)	Average production (kg/ha)	Average percentage of new trees by farm	irrigation index (%)	Density index (%)	Tree feet index (%)
Adult	Dry	traditional	High	75,529	29.78	308,547	24.14	4.09	113.75	2,259			11.98	19.66
Adult	Dry	Intensive	High	7,307	2.88	21,660	1.69	2.96	202.53	1,530				
Adult	Irrigation	traditional	High	12,687	5.00	48,493	3.79	3.82	138.19	2,661		59.43	19.31	15.49
Adult	Irrigation	Intensive	High	1,721	0.68	4,224	0.33	2.45	219.95	2,276		72.43		
Renovation	Dry	traditional	High	13,804	5.44	82,940	6.49	6.01	121.61	1,807	25.35		16.59	17.21
Renovation	Dry	Intensive	High	1,988	0.78	6,050	0.47	3.04	204.80	1,164	33.33			
Renovation	Irrigation	traditional	High	3,717	1.47	22,772	1.78	6.13	154.92	1,856	28.25	56.97	38.91	11.30
Renovation	Irrigation	Intensive	High	942	0.37	2,357	0.18	2.50	231.88	1,726	32.49	66.08		
Total				117,695	46.40	497,043	38.87	4.22	125.77	2,157				

Low slope olive groves

Age	Irrigation	Mamagement	Slope	farms (nº)	%	Surface (ha)	%	Average farm size (ha)	Average density (tree/ha)	Average production (kg/ha)	Average percentage of new trees by farm	irrigation index (%)	Density index (%)	Tree feet index (%)
Adult	Dry	traditional	Low	85,405	33.67	412,422	32.26	4.83	110.82	2,964			11.26	8.46
Adult	Dry	Intensive	Low	5,829	2.30	21,993	1.72	3.77	199.42	2,201				
Adult	Irrigation	traditional	Low	23,834	9.40	149,921	11.73	6.29	139.38	3,412		68.97	26.42	3.07
Adult	Irrigation	Intensive	Low	1,962	0.77	20,778	1.63	10.59	239.86	2,545		85.33		
Renovation	Dry	traditional	Low	10,786	4.25	97,176	7.60	9.01	126.40	2,094	31.17		22.38	8.86
Renovation	Dry	Intensive	Low	1,685	0.66	8,492	0.66	5.04	198.36	1,330	46.23			
Renovation	Irrigation	traditional	Low	5,576	2.20	61,224	4.79	10.98	193.67	2,224	35.04	63.91	46.80	3.91
Renovation	Irrigation	Intensive	Low	891	0.35	9,291	0.73	10.43	246.79	1,613	42.65	84.04		
Total				135,968	53.60	781,297	61.12	5.75	133.22	2,817				