

The Olive Oil Industry in Spain in the Nineteenth Century: Cordoba and the Alvear Mill

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This article analyses the situation of the Spanish olive oil industry in the nineteenth century. It examines particularly the development of the techniques used in the process of refining of the oil and it reveals very clearly the tremendous backwardness of Spanish industry compared with that of the Italian or the French. It also refers to the major commitments of agriculture: the cultivated areas, yields, prices, costs and markets. Finally, it provides economic information concerning the Alvear mill, the first Spanish industry which used the hydraulic press for the extraction of oil.

1. Introduction¹

In the last few years, olive growing has seen a period of strong expansion in Spain. Numerous plots used in the past for vineyards and cereals, or even wastelands, have been turned over to olive cultivation. Although Spain has the greatest area of olive groves and is the most important producer of olive oil in the world, Spanish oil has met various problems in expanding its markets, requiring the intervention of Italian

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firms in its commercialisation. Researching why this was so brings us closer to the origins of olive growing, as well as to the productive aspects for commercialising olive oil in the nineteenth century.

History shows how, as in the case of the typical olive groves growing in harsh environments - high hills and deep valleys - Spanish olive oil has been considered, among other things, both a prized golden liquid and a stale substance. This determined, for Spanish olive farmers, "hills" of prosperity and rich, deep "valleys" of depression. There are various causes for such a troubled past, from the unavoidable climatological circumstances to cultural, socio-political, technical and demographical reasons, constituting an interesting, almost neglected², field of research. As we have been able to ascertain, many of the problems and bad habits of the sector in the nineteenth century continue to exist nowadays, in spite of the formal complaints presented by important people of the time. Among them, we wish to mention Pequeño, Manjarrés, Morell and Noriega whose publications should be reprinted to remind us of the past in order to avoid repeating the errors committed then.

2. The cultivation of the olive tree

2.1 The origins. The spread of olive-tree growing in the Iberian Peninsula is generally attributed to the hardworking Phoenician settlement along the Mediterranean coast. Various classical writers, such as Strabo, Pliny, Martial and Columella, refer to the splendour of the olive groves in the Betica region twenty centuries ago. Owing to numerous archaeological remains, we know about the glorious cultivation of the Spanish olive tree during the Roman Empire. Thus, Andalusian olive oil was exported to the Italian peninsula and other places in Europe, and intense trading flourished during the second and the first centuries B.C. Distribution of olive oil from Betica was favoured by the partial navigability of the Guadalquivir River. On its banks, where kilns were built to fire amphoras for the distribution of

² Except for the important studies by J.F. Zambrana (1981) and C. Tió (1982), among others.

oil, there were numerous mills for producing olive oil, as well as ports or small quays³.

The Arab invasion brought a new period of expansion for the olive groves in Al-Andalus. The use of oil as fuel for lamps rendered the olive tree sacred and a symbol of light. Arab literature mentions both olive-tree agriculture and the use of olive oil in its gastronomy. However, the reconquest and the subsequent expulsion of Jews and Muslims caused a recession in olive-oil consumption. Castilian culture was based on the consumption of animal fat and some Christians considered olive-oil consumption a Jewish habit. Furthermore, at the beginning of the seventeenth century plagues depopulated vast regions of Spain, leaving numerous wastelands, thus causing a major recession in all sectors, including olive groves.

In the eighteenth century, the Ensenada land registry shows that Andalusia had recovered its olive groves, vineyards and cereal plantations. It is possible that in this century there was a strong increase in plantations in contrast to the shortage of mills for making olive oil. As a result of the feudal monopoly over processing olives, the building of new mills for making olive oil was halted, while, year after year, the olive-pruning procedure was delayed, which led to the processing of fruit that was over-ripe and, in some cases, had reached the point of advanced putrefaction. Zejalvo (1990, pp. 273-275) mentions some documents from the Royal Chancery in Granada dating from the sixteenth century concerning the dispute between the inhabitants of Cabra (Cordoba) and the feudal monopoly governing the one and only mill in that area, which was inadequate for the processing of the entire local olive harvest, some 69,800 *arrobas* (1,745,000 pounds), according to the Ensenada land registry.

Once the problems regarding olive-oil production by private owners at the beginning of the nineteenth century were eliminated, the exports of olive oil increased noticeably, as it began to be used in the manufacture of canned fish and in the newly-born industrial sector. Thus it was no wonder that one of the main markets for Spanish oil was the British Isles.

³ See A. Diaz and others (1993, pp. 23-34).

TABLE 1. Balance sheet figures for average production of a hectare of olive grove in Cordoba in 1879

Concept	Total
INCOME	
Olive oil 3.32 hectolitres, each one costing 80 ptas/Hl	265.60
COSTS	
Pressing 10% income	-26.56
Farm labour (2 ploughings, felling, ripening, pruning, plots of land, digging the soil round the trunk, harvesting and transport)	-75.00
RESULT PER HECTARE	164.04
<i>Source: authors' own sources from data by Puente (1879, p. 22).</i>	

However, the incipient Spanish olive oil industry began with a handicap – major technological backwardness – which resulted in the production of an oil which left something to be desired, as can be seen below.

2.2. Agronomy

2.2.1. *CULTIVATION.* In the second part of the nineteenth century in Cordoba, the classic olive grove plantation system was practised, i.e. there were three or four stakes per hole at a distance of 10.031 metres, which meant 90-95 olive trees per hectare. De la Puente (1879, p. 11) notes that the minimum planting distance must be established so that the projected shadow of every tree would not touch the next tree towards the north on 22 March at 12 noon. Nevertheless, in other regions with a different climate and different soil, the soil density varied considerably. Thus, according to Carrascosa (1893, p. 14), in the Valencia region the distance between plants fluctuated between 12 and 15 metres per square hectare, with a density of 50 to 60 trees per hectare, the trees having only one trunk. Planting was carried out by setting stakes or clubs in holes one-metre deep; the young olive trees intertwined with vines, cereals and vegetables until they became mature. Nursery plants were not used in Andalusia until the twentieth century (Zambrana, 1987, p. 122). However, the use of nursery plants in Valencian villages, such as Torrente, which were given over to olive groves and other horticultural products, was very common (Carrascosa, 1893, p. 13). Practices

TABLE 2. Varieties of olive groves cultivated in the main areas of olive oil production in Cordoba, Seville and Jaen in about 1891.

Legal Jurisdiction	Varieties
Province of Cordoba	
Aguilar	Tachuno, Manzanillo, Hojiblanco, Gordal, Lechin, Ojudo and others.
Baena	Picudo, Hojiblanco, Manzanillo and Carrasquenho.
Cabra	Hojiblanco, Carrasquenho, Picudo and Manzanillo.
Lucena	Hojiblanco, Nevadillo, Manzanillo, Carrasquenho and Ocal.
Montilla	Hojiblanco, Nevadillo, Picudo, Alameno, Lechin, Ocal and others.
Montoro	Nevadillo, Manzanillo, Picudo, Ocal, Paseto, Imperial and others.
Posadas	Ecijano, Picudo, Gatuno, Manzanillo, Alameno, Ocal and Paseto.
Pozoblanco	Nevadillo, Carrasquenho, Mollar, Paseto, Ecijano and Alameno.
La Rambla	Alameno, Lechin, Picudo, Ocal and Hojiblanco.
Rute	Hojiblanco, Manzanillo, Nevadillo and Carrasquenho.
Province of Jaen	
Andujar	Nevadillo, Correal or Tetudo and Manzanillo.
Baeza	Picual, Manzanillo, Gordal, Sevillano, Lechin and Nevado.
Carolina, La	Cornezuelo, Manzanillo, Gordal, Nevadillo, Sevillano and Tetillo.
Martos	Nevadillo, Manzanillo, Carrasquenho, Jabaluno, Picudo and others.
Jaen	Picual, Lechin, Carrascal, Cornezuelo, Gordal, Manzanillo and others.
Ubeda	Gordal, Manzanillo, Lechin, Nevadillo, Verdial, Cornezuelo and others.
Villacarrillo	Manzanillo, Lechin, Nevadillo, Verdial, Cornezuelo, Sevillano and others.
Province of Seville	
Carmona	Zorzaleno, Gordal, Manzanillo, Verdial, Dulzal Canivano.
Cazalla Sierra	Zorzaleno, Gordal, Manzanillo, Verdial, Picudo, Alameno and others.
Ecija	Zorzaleno, Verdial, Manzanillo and Gordal.
Estepa	Gordal, Lechin, Hojiblanco, Manzanillo, Picudo, Alameno and others.
Lora del Río	Zorzaleno, Gordal, Manzanillo, Lechin de Seville, Picudo and Verdial.
Moron	Gordal, Manzanillo, Verdial, Zorzaleno, Lechin de Seville and Alameno.
Marchena	Zorzaleno, Gordal, Manzanillo, morcal and Figurilla.
Osuna	Lechin, Manzanillo, Sevillano, Gordal and Alameno.
Sanlucar	Zorzaleno, Gordal, Manzanillo, Verdial, Mollarejo, Canivano and others.
Seville	Zorzaleno, Gordal, Manzanillo, Verdial, Alameno and Rompesayos.
Utrera	Zorzaleno, Gordal, Manzanillo, Verdial and Allora.

Source: authors' own sources from data by Espejo (1898, pp. 37-49).

were similar in Valencia: they used to turn the horse-drawn plough three or four times at a depth of 20 centimetres to turn over the surface soil in order to soften it. They would dig the soil around the trunk, cut the shoots and eventually prune the tree every two years.

Olive growing was very profitable at the end of the 1870s. At that time one hectare in Andalusia had a value of between 700 and 1,200 pesetas; thus, according to the information given in *Table 1*, profitability could be higher than 15%. Pequeño (1879, p. 5) stressed the high price of olive-grove land and noted that in Jaen one *fanega*⁴ of cereals used to cost 900 *reales*, but when planted in an olive grove it would yield triple the price. This author quoted some examples from other provinces, where the profitability of olive-grove land ranged between double and quadruple.

Agricultural work valued in the province of Cordoba in 1879 is shown in *Table 1*.

Just as nowadays, the residue from pruning and felling had to be eliminated quickly, in order to avoid the proliferation of woodworm and moths, so there were strict rules, the breaking of which was prosecuted and punished⁵.

2.2.2. VARIETIES. According to Zambrana (1987, pp. 115-120), the 'picual', 'lechín' and 'hojiblanca' varieties of olive were the most common in Andalusia in the nineteenth century. In Seville, due to changes in table-oil production, these varieties were heavily grafted to 'gordal' or 'manzanilla' varieties. In other regions, climate and soils determined the spread of other varieties: in the centre of Spain the 'cornicabra' variety predominated, whereas in Aragon and in Catalonia the 'empeltre' and 'arbequina' varieties did.

Table 2 summarizes the varieties and locations of olive groves in the provinces of Cordoba, Seville and Jaen according to the information published by the "Junta Consultiva Agronómica" in 1891 quoted by Espejo (1898).

2.2.3. HARVESTING. Olives used to be picked by *ordenño* (by hand) or by *vareo* (hitting the tree with a long stick). This method is no longer in use because of the damage caused to the trees: in fact the trees lose their stems for the next harvest. In Seville, Noriega (1901, p. 294) stated that the majority of green olives was picked by *ordenño* (by hand) by means

⁴ Land measure equivalent to 0.623 hectares.

⁵ J. L. Casas (1982, p. 83) provides details of such regulations for the inhabitants of Montilla.

of teams called *casas*, consisting of one man and two women, or one man, one woman and several children. The tools used for this task were a five-metre ladder (*banco*), a piece of linen measuring 2 metres x1 metre (*oron*), a sieve made of wicker to sift the fruit and baskets for transport. The owner would hire a *rabero* and a *tajador* in order to keep watch over the teams. The *rabero* was responsible for seeing that the team did not leave any olives on the ground and the *tajador* was in charge of entering in the registers the quantity of olives harvested by each team. The counts were carried out by means of marks or *tajas* in olive tree sticks. The *tajador* would split an olive stick in two halves along the shaft, and then he would keep the two halves joined to make one cut for each *fanega*⁹ of harvested olives, always marking the two halves. The *tajador* would keep one of the halves and the head of each team the other, so at the end of the day the *fanegas* of harvested olives could be compared and the *tajador* and the head of each team could balance an account with the owner.

Around 1845, Collantes (1845, p. 19) stated that in San Fernando (Madrid) the cost of harvested olives were, for the normal harvest, four *reales* per *fanega*. At the end of the nineteenth century, according to Noriega (1901, p. 296), the cost of the harvest in Seville ranged between 50 and 87 cents per *fanega* (which is equivalent to approximately 40 kg of olives). Each team used to collect about 10 *fanegas* per day, i.e., about 400 kg. During the poor harvest periods, the daily wages for men were two pesetas and one peseta for women or children. Because harvesting took place at a time of the year when there was frequent heavy rain and a lot of mud, beasts of burden were used to transport olives, in large esparto baskets, at a rate of 100 kg per animal, or in carts, if the country paths allowed it. The cost of the transport obviously depended on the distance; according to Noriega's data (1901, p. 296), the cost could range from 0.18 to 0.30 pesetas per *fanega*, the average being approximately 0.60 'pesetas' per 100 kg.

⁹ The Castilian *fanega* is equivalent to 55.5 litres or 1.58 bushels; the *arroba* was used as a liquid measure equivalent to 12.563 litres of oil (Permanent Commission of Weight and Measures, 1862, pp. 26-30).

Oil production in Cordoba, according to De la Puente (1879, p. 18), amounted to 3.32 Hl/ha. In Seville, Noriega's data (1901, p. 293) gave a much smaller average, 2.07 Hl, whereas Manjarrés (1892, p. 379) estimated an average of 2.19Hl for the whole country, and Pequeño (1879, p. 341) increased the average from 2 to 4 Hl⁷.

3. Technology, quality and capital investment

After the olives were carried to the mill, oil extraction was traditionally carried out in two pressure stages called grinding and pressing, as described below. The shortage of olive mills for making olive oil would force the producers to practise *entrojado* or storage in warehouses and mill-yards for several weeks and even months. Thus, olives would ferment and, consequently, a stale oil with an unpleasant taste was obtained. The agronomist engineer from Cordova, Pequeño (1879, p. 193), mentioned that "in Andalusia olive-grinding lasted from December to July and, in some years until the next harvest time, resulting in a detestable oil". Similarly, Carrascosa (1893, p. 34) also confirmed delays of over four months in such a process. Although almost all the bibliography on agriculture in the nineteenth century mentions the bad consequences of *entrojado*, we know that it was not possible to grind olives without their being accumulated until well into the twentieth century, Cordoba and Seville being the pioneers in this process (Zambrana, 1987, p. 139).

The shortage of mills was clearly related to the detrimental feudal monopolies on the mills for making olive oil and flour, and on bread ovens, inns and soap, which had lasted from the Middle Ages until the eighteenth century. Only the bearers of seignorial titles were able to build and own mills and other such establishments. The Dukes of Medinaceli and the Marquises of Priego, who ruled over a great part of Andalusia, kept this privilege until 1771 (Calvo Poyato, 1987, p. 111). Thus, according

⁷ Spanish olive-grove productivity was very low, compared with other countries. According to R. Manjarrés (1892: 337), an olive farmer in southern France gained, on average, four times more olives and nine times more money.

to Estepa Giménez (1987, p. 259), in the inventory of the Marquis of Priego's possessions for 1752 there were six mills for making olive oil (spread over the territory from Aguilar de la Frontera to Montilla, Monturque, Cañete and Puente de Don Gonzalo) and some mills for making flour, among the most profitable possessions of such a rich estate.

In Montilla, the cost of the olive *makila*⁸ in the feudal mills was one *arroba* of oil for every eight grindings (Aranda, 1982, p. 249). On top of that, there was a long delay in the grinding because there was only one mill with 19 beams in the village. This situation forced the authorities to grant permission to build eight private mills, generally belonging to religious communities. In those mills, people were only allowed to grind their own olives and they had to pay a tax to the Marquis of Priego.

3.1. Grinding Process. The aim of olive-grinding is to break up the olives' vegetable tissue where the oil is to be found, thus forming a paste that can be pressed. The traditional mills were built with a stone base called *empiedro* or *solera* (lower millstone) over which a central shaft with another cylindrical stone called *muela* (millstone), would turn (see *Figure 1*). During the nineteenth century, the cylindrical millstone was gradually replaced by one or more conical millstones to increase the contact and working surface (see *Figure 2*). However, the size of the millstone differed greatly, depending on the region. It could range from two metres in diameter in Andalusian mills to just under one metre in Catalanian and Valencian mills (Manjarrés, 1896, p. 101). The animal power that moved millstones used to be provided by one or two beasts of burden. There was a low performance of only 4 *fanegas* per hour (Pequeño 1879, p. 165). The steam engines used in smelting mills and the spread of electricity, which was not used in olive-oil production until the 1920s, brought remarkable progress (Parejo, 1994, p. 30). According to Pequeño (1879, p. 241), one of the pioneer entrepreneurs to introduce the steam engine in olive-oil production was Mr. Manuel Félix Pérez from Bollulos de la Mitación, a municipality

⁸ An Arabic word, which referred to the amount of olive oil, flour or grain retained by the miller in compensation for grinding.

in Seville. In 1870, he installed an 8 HP machine built in the Grouselle and Co. factory in Madrid⁹. This device obtained 250 *arrobas* of oil per working day.

3.2. Pressing process. Once the olives have been ground, the paste must be pressed to release the oil, a process called the "pressing process". The olive oil presses used in Spain during the nineteenth century were basically of five types: *torre* (tower), *viga* (beam), *rincón* (corner), *columnas* (column) and *hidráulica* (hydraulic). All the presses used wide, flat esparto mats with a hole in the middle, which enabled the mats to be strung on an axle. The layers of ground olive paste were placed in between the mats, and was called *cargo* (charge) or *tarea* (job) and once the olive oil press was full, pressure began to be applied.

Tower presses consisted simply in the use of some solid walls, which were used as an end-point for one moveable tower made of stone. This tower used the force of gravity to exert strong pressure on the *cargo* (charge) of olives. Noriega (1901, p. 302) states that tower-pressing exerted a pressure of under 2 kg/sq. cm., and besides did not have much working power, and therefore was abandoned. Beam or lever presses used the principle of the lever for pressing. This type of pressing consisted of a beam that ranged from 12 to 20 metres in length. The beam rested on two strong masonry pillars and exerted a force on a circular lower millstone placed at one or one-and-a half metres from the support point. The lower millstone had a channel or ditch to gather the liquid obtained from the pressing and propel it to some small wells where the oil was separated from the water by decantation. The principal disadvantages of this kind of press were the high cost of the building and the small volume of olives pressed in a working day. Corner presses are so called because they were located in corners of buildings. They were a cross between a tower and a beam press, using a platform made of wood that performed poorly because of the fragility and the great waste of force due to the wooden components.

⁹ The tardiness in bringing the steam engine into the olive-oil industry is noteworthy, taking into account that almost one hundred years previously they were used in other types of mills. J. Nadal (1992, p. 55) points out that in 1789 a flour mill already worked in Cadiz using this type of energy.

**TABLE 3. Comparison of the techniques used in oil production
in the nineteenth century**

Technique	Pressure Exerted	Olives Processed kg/day	Rough investment in reales (at about 1870)
Mill with 1 or 2 stone rollers (moved by beasts of burden)	n.a.	1,000 to 1,500 kg	-
Mill with 3 stone rollers (moved by steam power)	n.a.	3,000 kg	-
Corner press	-	200 kg	-
Tower press	2 kg/cm ²	250 kg	30,000 reales.
Beam press (building included)	5 kg/cm ²	350 to 600 kg	From 47,000 to 56,000 reales.
Column or spindle press	10-15 kg/cm ²	500 to 1,000 kg	6,000 to 14,000 reales.
Hydraulic press	25-50 kg/cm ²	1,800 to 2,500 kg	12,000 to 22,000 reales.

Source: authors' own sources from scattered data from Pequeño (1879), Manjarrés (1872), Noriega (1901) and others.

The first smelting presses spread very quickly. More specifically, those called column or spindle presses consisted of one iron compressor plate continuously moving over a plate, either by means of levers or flywheels that drove sets of cogwheels (*Figures 3 and 4*). They would usually rest on two or four columns. Numerous models of these kind of presses were commercialised in Madrid, Barcelona and other places, according to Pequeño (1879, pp. 199-203). Referring to such presses, Noriega (1901, p. 304) confirms that two men could exert a force from 80,000 to 120,000 kg, equivalent to 10-15 kg/sq. cm., from the section called *cargo* (charge) or *pie* (base). Lastly, the hydraulic press (see *Figures 5 and 6*) revolutionised the technique of oil extraction, greatly increasing both the pressure exerted and the speed of work. A further important advantage was that, unlike the case of beam presses, a large building was not required. The hydraulic press worked according to Pascal's principle. This type of press consisted of a cylinder within which a piston moved, driven by the injection of a fluid (water, oil, steam), compressed in turn by a plunger or pump. It was invented by the English mechanic Joseph Bramah at the end of the eighteenth century.

The first hydraulic press brought to Spain was imported by Diego de Alvear y Ward¹⁰, who came from Montilla (Cordoba), in 1833 before numerous protectionist measures hindered the utilisation of machinery or technology from Great Britain. This businessman, whose mother was English, belonged to a prominent family of wine exporters. He was aware of the advantages of this press that was used in other countries for pressing bales of cotton, hay and other products; as a consequence, he decided to purchase a hydraulic press for his olive-oil mill. The machine was built in Manchester and, after a hazardous journey, it was transported to London and then to Minorca (which had been a British colony). From there, it arrived via Malaga at his country house "El Carril", in Montilla (Cordoba). Probably, the procedure followed to export the press was not "legal", because Alvear himself (1834, p. 25) stated one year later that he had "forgotten" the name of the builder and the papers regarding the machine had gone "missing". The price of this press rose to 15,000 reales, to which Diego de Alvear y Ward had to add a further 10,000 reales for the transport.

The advantages of the hydraulic press compared to the other presses are shown in *Table 3*. The quantity of processed olives per working day was between 5 and 15 times more with this press than with the others so the saving in time and labour was remarkable. The oil could be of better quality with this new press because it was not necessary to store the olives, and the higher pressure exerted by this new machine noticeably increased the profitability of the olives. Pequeño (1879, p. 220) quotes that an Andalusian oil-producer, Francisco Iribarren, spent ten months grinding and pressing with beam presses the 12,000 *fanegas* from his harvest in 1850, and he obtained the same quantity of oil from only 9,000 *fanegas* of olives in sixty working days with a hydraulic press. Similarly, Collantes (1845, p. 29), from the royal mill in San Fernando, asserted that the use of this new press signified, for the same quantity of production, an annual saving of 257 days in the processing of olives and also a financial saving, at a cost of 6,600 reales instead of 11,067 reales.

¹⁰ To know more about the family records of this innovator/ businessman, our previous study, quoted in the bibliography (F.J. Fuentes, 1995), can be consulted. In addition, in the section 5 of this study, we analyse in detail Alvear's olive oil mill activities.

TABLE 4. Number of olive oil presses in Spain about 1878

Province	Hydraulic presses	Double pressure presses (by steam)	Spindle presses	Beam presses	Corner presses	Total presses
Almería	11	20	11	96	47	185
Badajoz	3	0	56	146	110	315
Barcelona	1	1	2	8	60	72
Caceres	12	3	51	86	214	366
Castellon	1	0	24	156	197	378
Ciudad Real	0	0	40	143	0	183
Cordoba	28	22	329	947	370	1,696
Gerona	0	1	50	10	238	299
Granada	36	4	55	145	77	317
Huelva	3	2	63	92	45	205
Huesca	2	4	19	213	32	270
Jaen	6	0	11	147	0	164
Lerida	2	0	18	488	47	555
Malaga	0	0	42	257	57	356
Murcia	45	18	130	119	33	345
Seville	14	40	214	1130	208	1,606
Tarragona	2	0	6	203	90	301
Toledo	21	0	43	548	69	681
Valencia	2	24	59	53	93	231
Zaragoza	5	0	18	139	67	229
The rest of the provinces	20	3	133	769	193	1,118
TOTAL	214	142	1,374	5,895	2,247	9,872

Source: own sources from data by Pequeño(1879, p. 331).

However, the hydraulic press still took many years to spread (*Chart 4* shows the distribution of the number of presses in the principal olive provinces of Spain about 1878). Although such a list may be incomplete, it provides us with some idea of the distribution of presses: 45 years after the installation of the first hydraulic press, the old presses were the most widely used in the incipient Spanish olive-oil industry. According to this information, the provinces of Granada¹¹, Murcia, Seville, Cordoba, Toledo

¹¹ See L. Morell's publications about the olive-oil industry in Granada during the nineteenth century.

and Valencia were the first to use hydraulic presses – using steam or otherwise – on a large scale in the extraction of olive oil.

Pequeño (1879, p. 232) refers to other statistics from an olive-growing publication. This raised the number to 11,677 presses, of which only 232 were hydraulic presses and 148 double pressure presses. This would confirm the obsolescence of the technology used and the inevitable delays in processing the olives, which resulted in a bad quality product. Lastly, Manjarres (1896, p. 373) mentions that the number of olive-oil mills had risen to 12,961 (Official Catalogue of the Paris Universal Exhibition of 1867).

In the last quarter of the nineteenth century the mills were modernised. Thus, Noriega (1901, pp. 334-348) shows significant growth in the number of hydraulic presses. In Seville the presses increased from 14, as mentioned above, to 73 at the end of the nineteenth century, considering only the industries that figured in the tax census for giving the *makila* to a third party.

3.3. The Cleaning Process. As a consequence of the pressing process, a mixture of oil and water is obtained. This mixture must be separated by means of decantation. Mills had some tanks or cleaning wells where both liquids, oil and water, were separated, utilising the difference between their densities. Through this process, the oil remained on top of the wells and was removed with saucepans or jugs, and the wastewater remained in the lower part of wells. This wastewater used to be poured out of the mill (usually into the nearest river or stream).

3.4. Bottling and Storage Processes. Traditional oil storage used to be done in large non-glazed jars made of clay with a capacity of 80, 100 or more *arrobas*, covered with esparto mats. Likewise, Pequeño (1879, p. 253) mentions other pottery recipients, waterproof pots impregnated with waste water from olive-oil processing and tin-plate deposits which, according to him, were increasingly used. Obviously, all these methods of storage were extremely damaging for olive-oil preservation. The cleaning of warehouses was superficial or non-existent, while olive oil became stale due to oxidation and its scent was contaminated by the wastewater and muck in the containers.

The spread of large metallic pots and containers made of iron and zinc brought an important advance in olive-oil preservation. The

containers could now be cleaned easily. Noriega (1901, p. 318) states that the prices of these containers in Seville at the end of the nineteenth century ranged from 70 pesetas in the case of the smallest container (50 *arrobas*) to 955 pesetas in the case of the largest (1,500 *arrobas*).

The containers used for the transport of olive oil varied, from skins or hides, which had the advantage of being the cheapest and of fitting well to the backs of beasts of burden, to wooden casks, clay pots, and recipients made of tin plate or glass. Pequeño (1879, p. 336) commented that hides were the worst recipients because of the impossibility of cleaning them, which resulted in the usual contamination of the product. Tin and glass recipients were used exclusively for the most refined oil. In contrast, wood and clay containers were generally used for the transport of mass-exported products.

3.5. The Quality of the Product and the New Techniques of Extraction.

At the end of nineteenth century, new techniques of extraction were experimented with varying degrees of success. These included scalding olive paste, using stoning machines and centrifugation. The scalding process consisted of adding some hot water to the olive paste to be pressed, in order to increase the quantity of oil to the detriment of its quality. On the other hand, the aim of the stoning process was to eliminate the bad flavour of olive oil caused by the stone or pit and it was used in the Acapulco Method (1909). This method, invented by the engineers Quintanilla and Del Prado and the chemist Arredonda, was patented at the beginning of the twentieth century, using the stoning process and the extraction of olive oil by means of centrifugation and vacuum.

Despite different attempts at quality improvement, Spanish olive oil was of poor quality, which resulted in very low prices in comparison with French and Italian¹² olive-oil prices. Apart from the technical

¹² V. Collantes' (1845) paper shows in detail how laziness in olive-grove cultivation and in olive-oil elaboration even affected a mill near Madrid belonging to the Crown. On the other hand, a paper by an anonymous author (1842) denounces a very similar situation of backwardness in the Portuguese olive-oil industry, giving information about activities and maps regarding the modern Italian industry in Bari.

TABLE 5. Capital equipment of the entire olive oil factory in the Pfeiffer industry for a grinding capacity of 250 fanegas of olives/24 hours

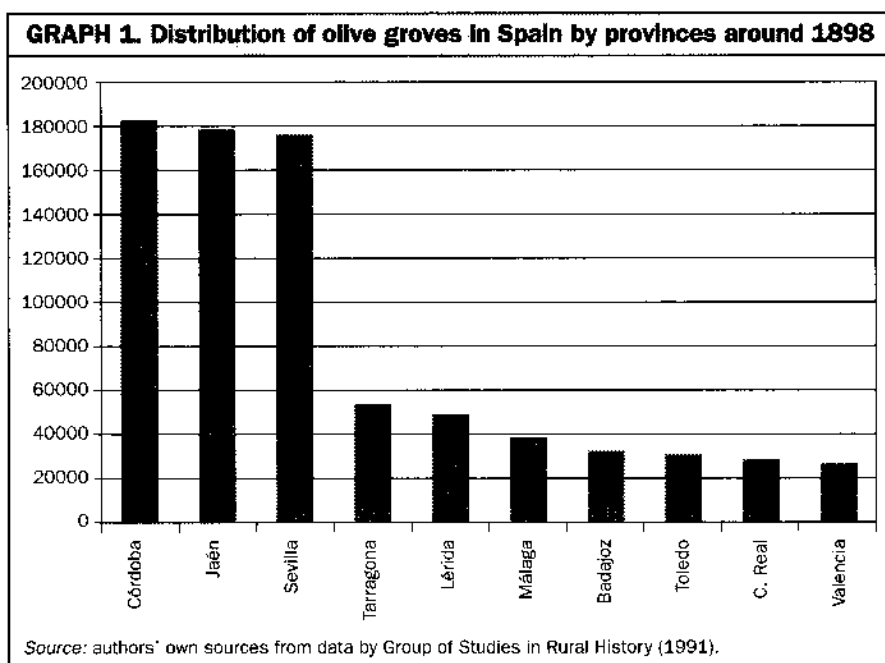
Concept	Total (reales)
Vertical high-pressure steam machine, with six HP, and a boiler of ten, chimney and the rest of the accessories (with olive <i>orujo</i> as fuel)	265.60
Two transmission shafts with their wall-supports and pulleys to drive the grinders and the presses.	8,000
Two complete machines to grind olives; one with a distributor to grind and the other to re-grind the <i>orujo</i> ; with its accessories to activate the transmission shafts, 8,900 reales per unit.	17,800
Three hydraulic presses with pistons of 24 centimetres and double pumps, driven by machinery working over the transmission, 18,500 reales per unit.	55,500
Nine kegs of smelting iron to press the oil.	3,600
Three iron containers with pipes and taps heated by means of water and steam used in presses.	3,000
One iron container to collect the oil from by the presses and one force pump mounted over the container to move the oil to the jars.	2,500
BUDGET TOTAL	114,900

Source: authors' own sources from data by Majarres (1872, pp. 466-467).

backwardness, there was no separation of the oil according to its quality. In Italy, apart from separating olive oil according to its freshness and the quality of the olives, at least four qualities of oil were produced (Manjarres 1896, p. 359):

- a) olive oil obtained with no pressure or very low pressure.
- b) olive oil obtained with low pressure.
- c) olive oil extracted from the re-grinding and with high pressure without heating.
- d) olive oil resulting from scalding.

Obviously, in Italy, separating oil according to how it was produced and the facilities for the extraction, processing and storage of oil became increasingly complicated. However, the products were of a higher quality, which made it easier to blend oils, carrying out *coupages* in order to fulfill customers' and market demands. In fact, Spanish olive oil was used in other countries for blending. An anonymous work (1842, p. 25) pointed out one of the causes of the good flavour and the high price of French



and Italian olive oil: good olive oil was blended with other oils made from turnips and other sources.

The Spanish were remiss in their oil production, but numerous authors at that time mentioned the lack of money as a reason for the backwardness of the olive-oil industry. In our opinion, it was not very expensive to set up an olive-oil factory; in Manjares' study (1872, pp. 466-467) we find a budget drawn up by the builder Pfeiffer from Barcelona; this budget has been summed up in *Table 5*. If we take into account that we are dealing with a rather important factory (built for processing 250 *fanega* per day), we can see that its cost is equivalent to the market price of that time, i.e. from 20 to 30 hectares of olive groves. In our opinion, this capital could be easily found by any landowner and also by associations of farmers' co-operatives.

Nevertheless, the individualism of Spanish farmers hampered the opening of co-operative mills. Acapulco (1909, p. 117) points out the many disagreements among Spanish olive farmers, whereas in Italy and France there were large associations of agricultural owners that would join together and defend olive farmers' interests.

TABLE 6. Areas and production of olive groves in the province of Cordoba, approx. 1879 and approx. 1891

Legal Jurisdiction	Surface of Olive Groves (hectares)		Production (Hectolitres) according to Puentes (1879)	
	approx. 1879	approx. 1891	olives/ha.	oil/ha.
Aguilar	14,179	24,313	26.86	4.42
Baena	4,349	12,130	19.55	3.32
Bujalance	15,455	8,101	19.55	3.32
Cabra	8,585	14,478	26.86	4.42
Castro del Rio	3,507	4,858	19.55	3.32
Cordoba	4,547	7,852	13.43	1.50
Fuenteovejuna	642	523	13.43	2.26
Hinojosa del Duque	372	928	13.43	2.26
Lucena	12,397	23,583	26.86	4.42
Montoro	18,555	33,128	26.86	4.42
Montilla	3,200	9,100	13.43	3.01
Posadas	9,113	12,698	19.55	3.32
Pozoblanco	4,051	10,151	13.43	2.26
Priego	3,268	3,410	19.55	3.32
La Rambla	8,209	11,903	19.55	3.32
Rute	6,651	13,889	19.55	3.32
TOTAL	117,082	191,045	19.55	3.32

Source: information collected from Puente (1879, p. 18) and Espejo (1898, pp. 41-42).

4. Markets and figures of the sector

4.1. Cultivated area. According to Tió (1982, p. 27), the area cultivated with olives increased to half a million hectares between 1860 and 1900, as a result of the development of the railway, free trade and increasing dynamism in foreign markets. Zambrana (1987, p. 53), however, points out that this development did not last all the nineteenth century, because the last two decades saw blockage and even recession in Spanish olive growing, due to the low prices of olives. The most important Spanish province for the production of olive oil in relation to the area given over to the cultivation of olives in the nineteenth century was Cordoba, followed by Jaen and Seville (*Graph 1*). Spanish olive trees have always have grown on arid land. However, in 1888, there were 71,642 hectares of Spanish olives cultivated on irrigated land, equivalent to 6.2% of the total (Espejo, 1898, p. 52).

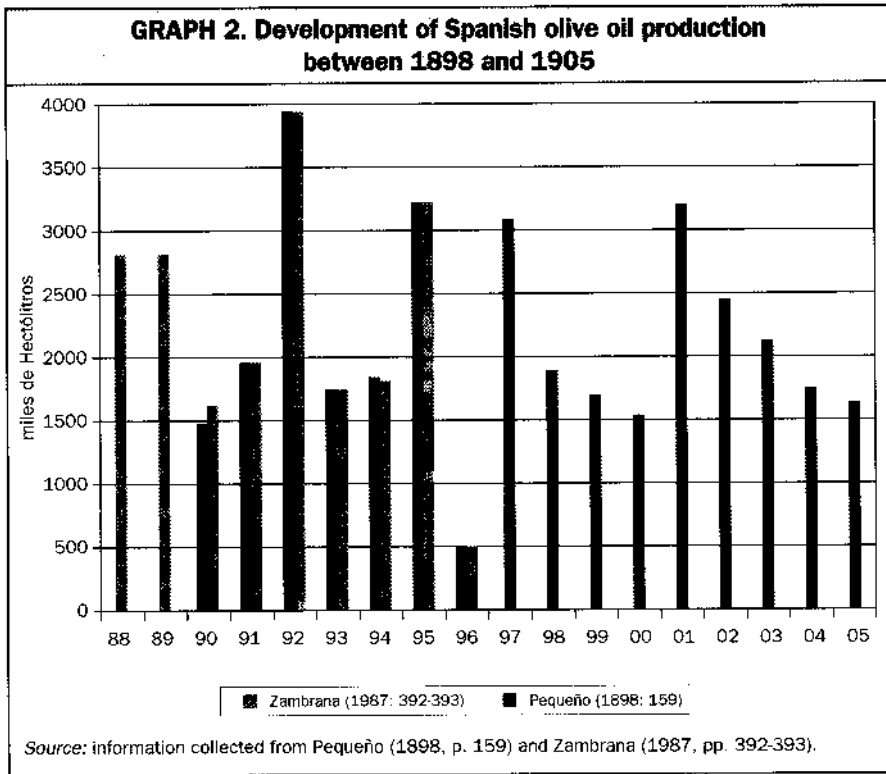
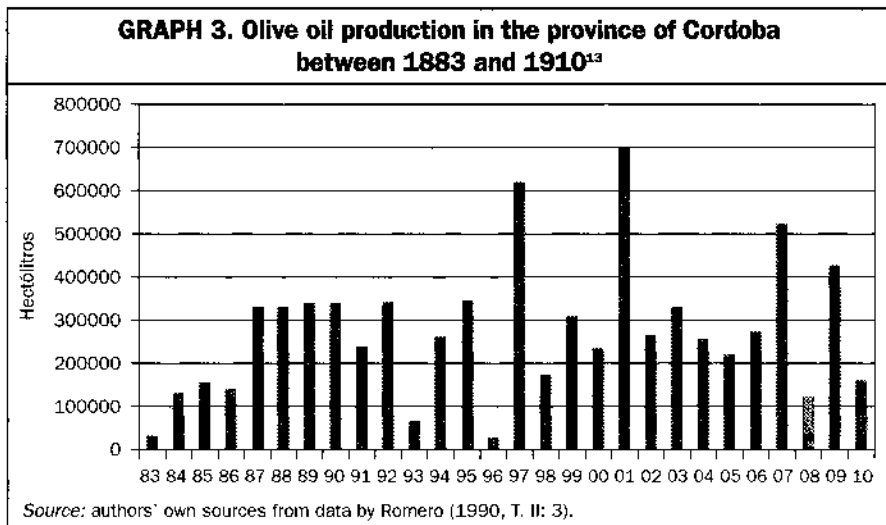


Table 6 shows in detail the extent of olive growing and the oil production of the different legal jurisdictions in the principal olive-oil production province. An important increase in this cultivation during the 1880s can be identified.

4.2. Production of Olive Oil. According to Pequeño (1898, p. 160), at the end of the nineteenth century Spain was the second producer of olive oil in the world, far behind Italy (with an average of 3.35 million Hl.), whose olive oil reached a very high price. Spain was followed at a distance by France (230,000 Hl.), Turkey (160,000 Hl.) and Greece (137,000 Hl.).

There is no doubt that the inherent instability of this cultivation and the detrimental habit of harvesting olives by means of the *vareo* process determined important fluctuations in the production of olive oil. Zambrana (1987, p. 53) remarks that, although olive cultivation became much more



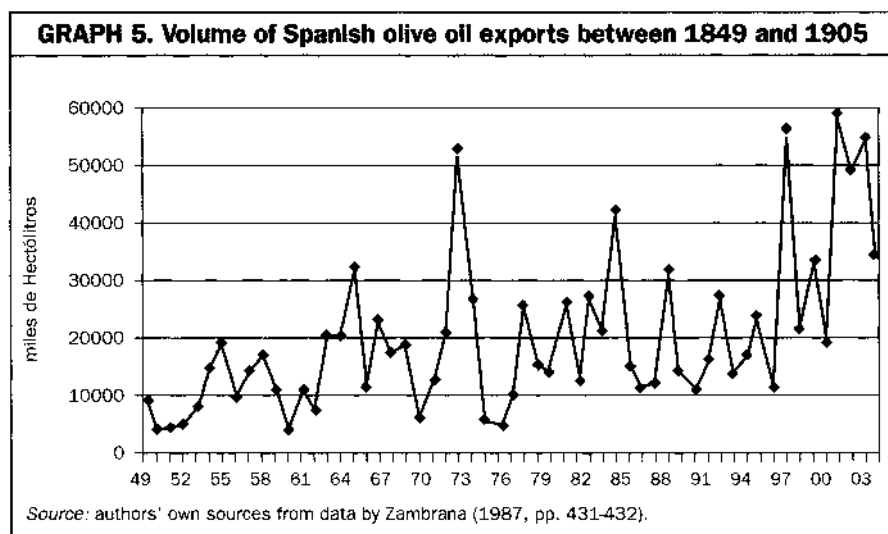
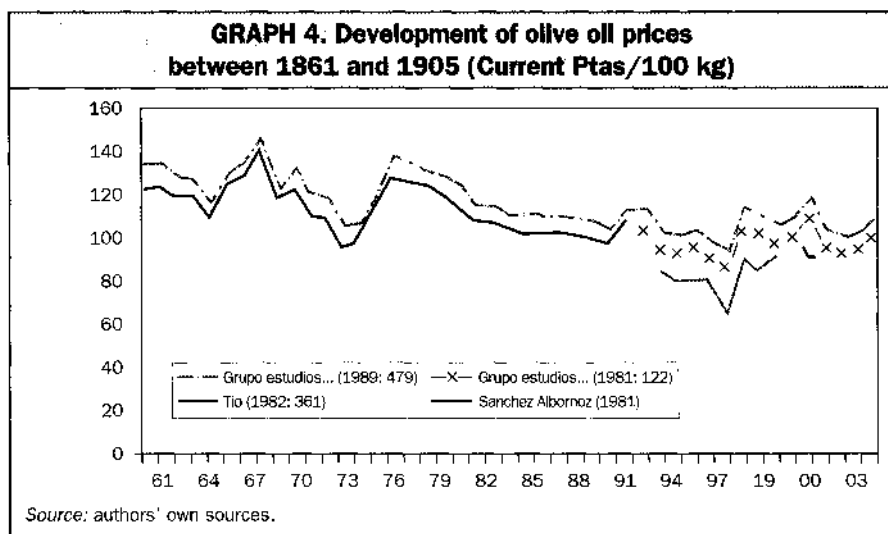
widespread in the mid-nineteenth century, it had to compete with lower-priced seed oils during the last two decades of the century. *Graph 3* illustrates olive oil production in the province of Cordoba: the average annual production exceeded 200,000 hectolitres, which meant that the production level in this province was higher than in France.

4.3. Prices There is an interesting range of specific publications on olive-oil prices, such as that by Sanchez-Albornoz and Carnero (1981) -which refers to the 1856-91 period- and the monograph by the Group of Studies of Rural History (1981), which makes a detailed analysis of prices from 1891 to 1916.

Graphs 4 and *7* show clearly the steady downward trend of Spanish olive oil prices during the second half of the nineteenth century. There was an increase in production, as a consequence of the new plantations, but competition from seed oil¹⁴ coming from outlying areas led to the

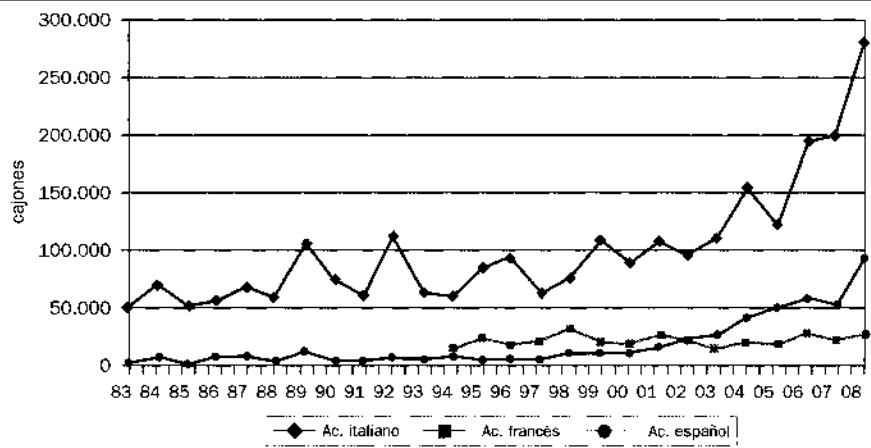
¹³ The data of 1887, 1888, 1889, 1890, 1902 and 1905 were estimated by means of an adjustment of minimal squares and an introduction of an exogenous variable.

¹⁴ The Cordoba Chamber of Commerce *Gazette* (nº 204, August 1905) printed the opinion of the Tortosa Chamber of Agriculture, shared by the Cordoba Chamber of Commerce, which viewed the low price of olive oil as a consequence of the decline in domestic trade in that "it has been beaten in an unfair fight with seed oils" because of the customs duty legislation of 1892.



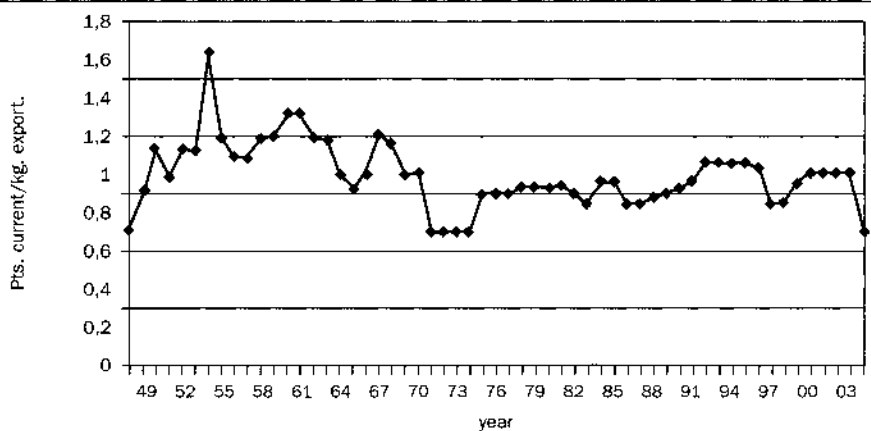
replacement of olive oil in industrial process. This latter aspect is shown by Zambrana (1987, pp. 300 *et seq.*), with noteworthy statistical results. Carrascosa (1893, p. 50) reports the low price of Spanish oil compared to French oil from Aix or Italian oil from Nice, the prices of which were almost double those of Spanish oil. Spanish oil was mixed with Italian and French oil and later re-sold at a high price.

**GRAPH 6. Annual imports of oil shipped to Buenos Aires (1883-1908)
(Imported crates)**



Source: authors' own sources from data by Romero (1990) Volume II p. 253.

**GRAPH 7. Average price of exported Spanish olive oil
between 1849 and 1905**



Source: authors' own sources from data by Zambrana (1987, pp. 431-432).

4.4. Foreign markets. Traditionally, Spanish oil was exported by sea from Malaga, Seville and Barcelona. Madoz (1848, p. 93) shows the olive oil shipment from Malaga to America in 1844 and 1845, estimated respectively, at 126,496 and 115,856 *arrobas*. Unlike production statistics, data regarding olive-oil exports were available from 1849. Obviously, the export possibilities

were limited by the size of each harvest, olive production being always by nature unstable. Nevertheless, the trend was clearly rising. Foreign markets were basically the American ones (Cuba and Argentina), England, France and Italy. Each country imported oil with different aims: American countries used the oil for food consumption, England imported it for industrial purposes and France purchased Spanish oil specially to improve its own by mixing with Spanish oil. In the last years of the nineteenth century Italy started to import Spanish oil to mix with the Italian production, as they did in France.

The quantity of Spanish olive oil exported in the nineteenth century was less than Italy's olive oil exports. In Italy, the international trade in oil predominated, so the quantity of exported Italian olive oil was three or four times that of Spanish oil¹⁵. *Graph 6* shows trends in oil imports shipped to Buenos Aires from 1833 to 1908¹⁶; in it we can see that the importation of Spanish olive oil increased from the end of the nineteenth century, so that in 1902 it beat the level of French exports. This was possible because Spain began to produce very fine oil, using clean olives that were in good condition.

On the other hand, Manjarres (1892, p. 373) states that, according to the reports presented by the Spanish Chambers of Commerce in South America, Spanish oil there cost one third of the price of Italian oil and half the price of French oil, in spite of the technical improvements at the end of the nineteenth century. Spanish oils did not lose their bad reputation as inferior oils until well into the twentieth century. *Graph 7* shows that, from the 1870s, the price of exported oil hardly rose at all.

5. Alvear's mill

5.1. Production levels and costs. There is hardly any micro-economic information about agro-industrial cultivation in the nineteenth century. Zambrana's study (1987, pp. 163-188) makes a detailed analysis of Carbonell House's olive grove *Vista Alegre* from 1887 to 1905, and merits

¹⁵ In 1904, Italy exported 48 million kilograms of olive oil, in a year with a bad harvest; and Spain exported only 40 million kilograms with a good harvest.

¹⁶ According to Carlos Carbonell, the Buenos Aires market was the most important in the world as far as the concept of "consumer market" was concerned. T. Romero (1990) Volume II p. 252.

consultation¹⁷. There are also some account books¹⁸ concerning a mill called "El Carril" set up by Diego de Alvear y Ward¹⁹, together with other documents which summarise the development of this family's business; these enable us to reconstruct the development of an olive-oil mill.

The El Carril estate had 1,917 olive trees. It was one of the Alvear-Ward family's²⁰ olive-grove estates. *Table 7* summarises the amount of olives ground in each harvest and the number of days of work involved. Starting with production, we can see that between 2 and 4 casks of 7 or 8 *fanegas* each were processed every working day, depending on the amount of olives available. According to this, between 9 and 18 hectolitres of fruit were ground per working day. This is a considerable amount, although far from the maximum processed by the press, according to Alvear (1834, p. 26), which was 192 *fanegas*, equivalent to 106.5 hectolitres.

On the one hand, such a low work-rate could be due to a shortage of raw material, as Alvear's olive estates were not very large and olive-harvesting and transportation, carried out during the winter with a lot of work-days lost because of rain, provided a modest amount of olives per day for at least 3 or 4 months. This would delay unnecessarily the working period of the mill. On the other hand, the *makilas* involved a very small increase in olives for grinding, in general less than 10%. Breakdowns also stopped activity temporarily: the mill account-books make frequent references to breakdowns. The breakdown that occurred during the peak harvest time (1845-46) must have been especially serious because Alvear had to grind most of the olive harvest in the Duke of Medinaceli's mill. It is estimated that between 0.75 and 0.90 *arrobas* of olive oil were obtained per *fanega* of olives, i.e. between 17% and 20% in volume²¹.

¹⁷ Likewise, the thesis by R. Castejon (1977) summarises the rise and fortunes of Carbonell House's business.

¹⁸ These books, although somewhat incomplete, have data relating to mill activity from the harvest period of 1836-37 to 1861-62, as well as the information about sales from 1837-1862.

¹⁹ We refer to the studies by D. Alvear (1834) and F.J. Fuentes (1995).

²⁰ In 1833, the hydraulic press mentioned above was set up. This press was bought in England and cost 25,000 reales, transport included.

²¹ The books measure olives and oil in *fanegas* and *arrobas*.

TABLE 7. "El Carril" mill activity from Diego de Alvear's records

Harvest	Volume Processed Olives ²² Oil ²³ (fanegas) (arrobas)		Work Days	Number Of Millers	Wage ²⁴ (reales)	Totalcost of Labour Force (reales)
1836-37	-	790.7	83	-	-	-
1841-42	2,006	1,676.5	85	5	5.5	2,266.0
1842-43	896	-	-	-	-	-
1843-44	1,420	-	146	5	5.75	4,187.3
1844-45	364	-	-	-	-	-
1845-46 ²⁵	4,878	-	81	4	5.75	2,164.5
1846-47	-	-	-	-	-	-
1847-48	2,752	-	118	5	5.5	3,126.0
1848-49	1,658	1,233.7	92	2.5	5	1,701.0
1849-50	2,250	1,608.0	105	5	4.75	2,280.8
1850-51	883	805.5	-	2	4.5	864.5
1851-52	1,045	956.7	85	2	4	779.5
1852-53	-	969.0	85	2.5	4	1,380.5
1853-54	2,659	1,833.0	110	5	4.5	2,465.5
1854-55	2,698	2,140.0	102	5	4.75	2,530.0
1855-56	1,403	870.0	64	5	5	1,689.0
1856-57	1,008	1,111.0	67	5	5	1,765.5
1857-58	2,128	1,872.0	93	5	5.5	2,661.0
1858-59	2,409	2,008.5	98	5	5.5	2,820.0
1859-60	1,168	797.5	57	5	5.5	1,653.0
1860-61	2,750	2,083.7	119	5	5.5	3,230.0
1861-62	1,408	1,163.5	64	-	-	-

Source: authors' own sources.

The lack of information about work expenses (except the labour costs) hinders our obtaining a balance sheet. Every year, the Alvear family used to hire a master-miller, who was always the same person for the period analysed and was called Juan de Dios de Luque. He was helped

²² It includes the olives themselves and the *makilas*, which were negligible.

²³ It includes only the oil obtained from the harvest.

²⁴ These wages corresponded to the number of millers. The master also earned between 0.25 and 0.50 *reales* more per day and received a bonus at the end of the harvest, which increased his wages by 10-15%.

²⁵ By breakdown 2,950 olives were ground in the Duke's mill.

TABLE 8. Oil output from the "El Carril" mill according to Diego de Alvear

Year of Sale	Output (<i>arrobas</i>)		Total Sale (<i>reales</i>)	Average Price (<i>arroba/arroba</i>)(<i>reales</i>)
	Sale	Consumption		
1837	359.5	-	13,958.5	38.8
1838	-	-	-	-
1839	1,066.0	-	32,659.2	30.6
1840	1,586.0	-	55,302.0	34.9
1841	585.0	-	26,022.2	44.5
1842	733.0	-	26,972.0	36.8
1843	1,269.0	80	43,733.0	34.5
1844	1,523.0	-	44,180.0	29.0
1845	1,026.0	134	29,085.2	28.3
1846	1,453.0	94	39,870.0	27.4
1847	1,416.0	9	41,967.8	29.6
1848	1,746.0	149	48,629.2	27.8
1849	997.0	285	29,933.0	30.0
1850	1,270.5	242	54,400.0	42.8
1851	718.5	179	30,837.0	42.9
1852	968.2	149	33,899.0	35.0
1853	830.0	132	39,399.0	47.5
1854	-	-	-	-
1855	2,046.0	95	-	-
1856	817.0	35	-	-
1857	1,111.0	-	-	-
1858	1,786.0	86	-	-
1859	1,915.0	94	-	-
1860	896.0	-	41,712.0	46.5
1861	1,070.0	39	45,616.0	42.6
1862	1,802.0	-	76,663.0	42.5

Source: authors' own sources.

by two or four millers, depending on the amount of olives harvested. Wage trends are interesting: they dropped between 1848 and 1853, and later began to rise.

5.2. Oil output. Table 8 summarises the amount of oil sold by the Alvear family, the income from the sales, and also trends in average selling prices. Prices oscillated between 27 and 47 reales per *arroba*, with rises when harvests were bad and a considerable fall in prices when harvests were

**TABLE 9. Cost of labour force for grinding
at Diego de Alvear's "El Carril" mill**

Harvest period	Oil produced (arrobas)	Price/Unit (reales/arroba)	Amount harvested	Labour force grinding	% Labour force amount harvested
1841-42	1,676.5	36.8	61,658.4	2,266.0	3.7
1848-49	1,233.7	30.0	37,011.0	1,701.0	4.6
1849-50	1,608.0	42.8	68,822.4	2,280.8	3.3
1850-51	805.5	42.9	34,555.9	864.5	2.5
1851-52	956.7	35.0	33,484.5	779.5	2.3
1852-53	969.0	47.5	46,027.5	1,380.5	3.0
1859-60	797.5	46.5	37,083.7	1,653.0	4.5
1860-61	2,083.7	42.6	88,765.6	3,230.0	3.6
		average			3.4

Source: authors' own sources.

abundant. Although the account books do not refer to market sales, the oil was apparently sold loose to consumers or local wholesalers in small batches of less than 200 arrobas, seldom more. Despite Alvear's experience as a wine-exporter, analysed by Fuentes (1995), there are no references to oil-exports in any document, or even to any samples sent to their English customers. This suggests that the oil produced by this family's modern machinery must have been sold easily on the domestic market because of its high quality. However, it was very difficult to develop new foreign markets with a product which had a poor reputation because of its Spanish origin (in fact, in England Spanish oil was largely used for industrial purposes). Furthermore, there was not a sufficient quantity of oil of a sufficiently good quality in Montilla and its region to justify commercial efforts to open new markets.

Finally, *Table 9* gives estimates of the costs for grinding wages compared to production in harvest periods, for which there is complete information. According to Pequeño (1879, p. 281), the *makila* cost in Montilla was one *fanega* for every eight millings, equivalent to 12.5% of the product price. Therefore, we can calculate that it was possible to obtain a good quantity of oil from a well-placed olive-oil mill. Thus, the principal cost item, the wages of the millers who worked for Alvear, was only 3.4% of the oil price, even with the mill's low performance, which we have already mentioned.

Account books summarised in *Table 7, 8* and *9* ended the same year that Luisa Ward²⁶ died. In 1861 the estate was legally distributed among her five surviving children, Tomás, Francisco Solano, Sabina, Candelaria and Catalina Alvear y Ward. As Diego, the brother that set up the first hydraulic press in Spain, was not among the heirs, he must be considered dead by then. With his death the enthusiasm that brought about technical innovations and improvement in extraction techniques died too. The El Carril mill and the “device to manufacture olive oil” were valued in the affidavit of the division of the estate in 1861 at 74,824 reales. This mill continued to belong to the Alvear family well into the twentieth century when the olive groves were uprooted and replaced by vineyards, the mill being shifted into a wine-cellar. Thus, an interesting page of recent Spanish olive-oil history came to an end.

6. Conclusions

Technological backwardness in the Spanish olive-oil industry enabled Italian producers to gain a comfortable supremacy in global markets for olive oil in the nineteenth century. This Italian prominence continues nowadays, not because of the amount of oil produced in Italy – which is clearly lower than in Spain – but because of the size of some multinational firms that have inherited the experience and advantages of surpassing the Spanish oil industry, thus forming an oligopoly of supply that imposes conditions in global markets.

We have found four principal causes for the Spanish olive oil industry’s chronic problems:

1. *The existence of initial feudal monopolies* (until the beginning of the nineteenth century) that hindered development of the extraction industry, making exploitation profitable in the few remaining old olive-oil mills. The creation and consolidation of specialised industrial groups for the production of good-quality olive oil was delayed.

²⁶ Document from Municipal File from Notarial Registry of Montilla, secretary Francisco Solano de Arjona, volume 387, year 1861, pp. 850 *et seq.*

2. *Industrialists' scant interest in modernising their facilities.* As long as there was an easy outlet for the poor-quality oil produced – for industrial purposes or as fuel for lighting – few people were worried about incorporating technical innovations in their mills. These technological innovations were used on a large scale in the production of olive oil in Italy and France, and even in other branches of Spanish industry.
3. *Lack of skill in production processes.* Apart from technological backwardness, Spanish olive oil was almost always produced without identifying oil according to its quality, with a relaxed attitude which, depending on harvests, resulted in very bad, mediocre or good products. Probably, various factors, such as the lack of culture, ignorance about the markets, improvisation connected to the instability of harvests, the lack of professionalism among millers (always incidental due to the fact that their work was seasonal) all influenced the quality of Spanish oil.
4. *Lack of money for modernisation, aggravated by the lack of unity and cooperation among farmers,* which prevented the creation of industries large enough to aggregate investments and gain sufficient profit from them.

At the end of the nineteenth century, when the competition from other olive oils caused the prices of Spanish olive oil to drop, the industrialists undertook an urgent modernisation of this sector. However, the damage was already done: the poor reputation of our olive oil continued and our exporters developed a complex for many years when faced with the Italian oil producers.

If we limit ourselves to recent Spanish history in the twentieth century, the cultivation of olives has seen moments of boom – such as during the First World War – and serious recessions – such as in the 1960s and the 1970s when more than 200,000 hectares of olive groves were abandoned. By contrast, Spain's entry into the EEC in 1986 brought with it generous subsidies for oil production, which drove Spain into a frenzy to increase olive cultivation without a need to modernize exploitation and with the shortcoming of limited control over the distribution of the

product. At present, the new Common Market Organisation is being discussed in Brussels. This organisation will decide the future of this sector at the beginning of the twenty-first century, but that, of course, will be another story.

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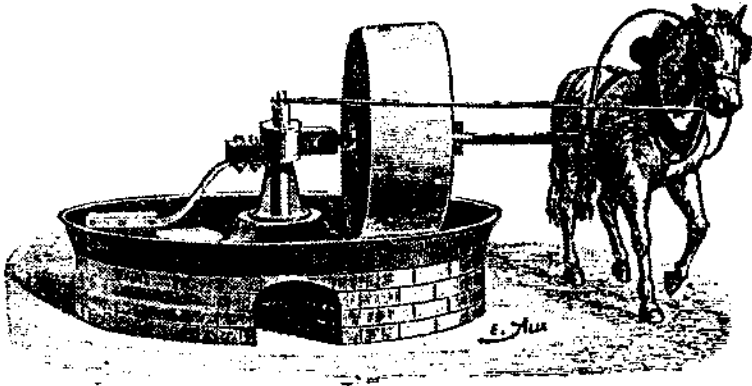
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Appendix

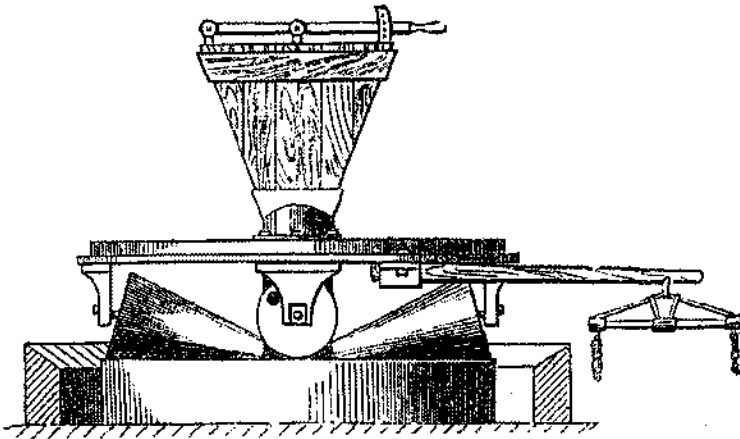
The Olive Oil Industry in Spain in the Nineteenth Century:
Cordoba and the Alvear Mill

FIGURE 1. One cylindrical millstone mill



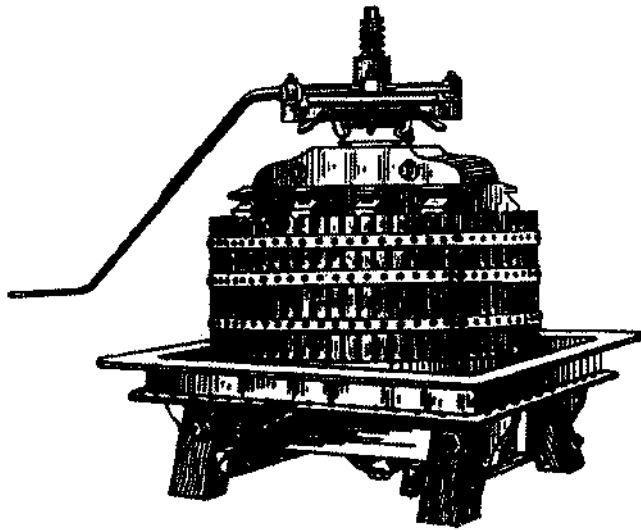
Sources: Manjarrés (1896, p. 101).

FIGURE 2. Two conical millstones mill



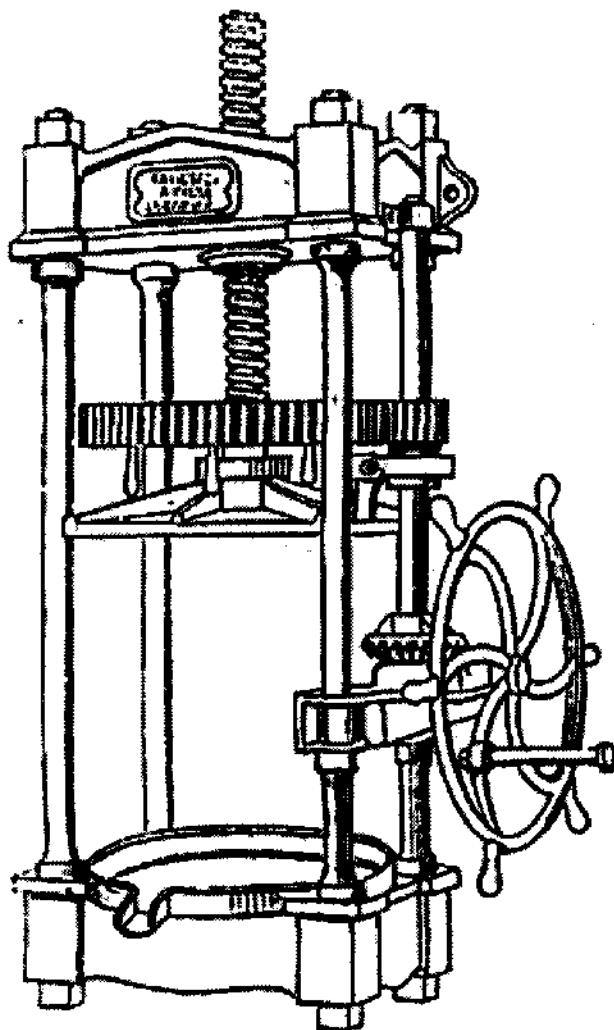
Sources: Manjarrés (1872, p. 197).

FIGURE 3. Spindle or level press



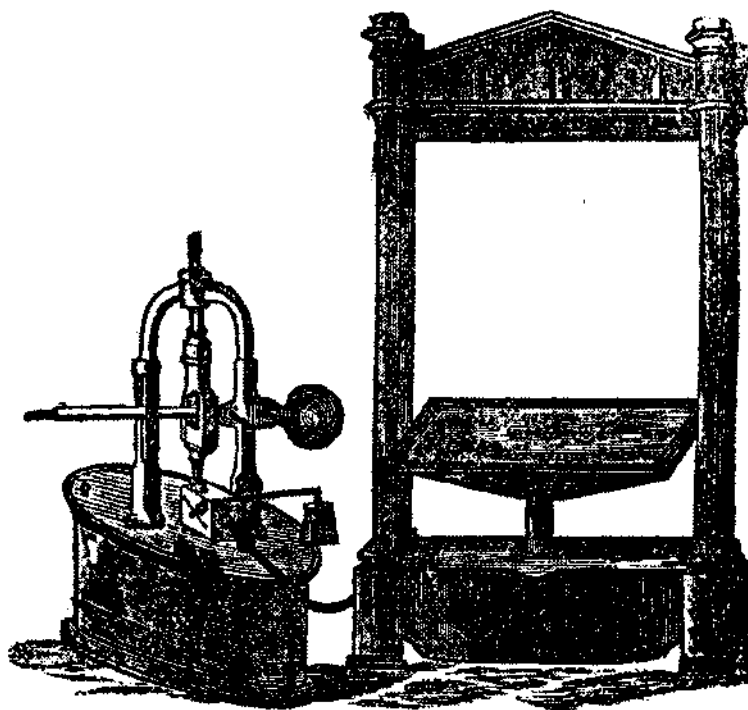
Sources: Soroa (1967, p. 191).

FIGURE 4. Column or flywheel press



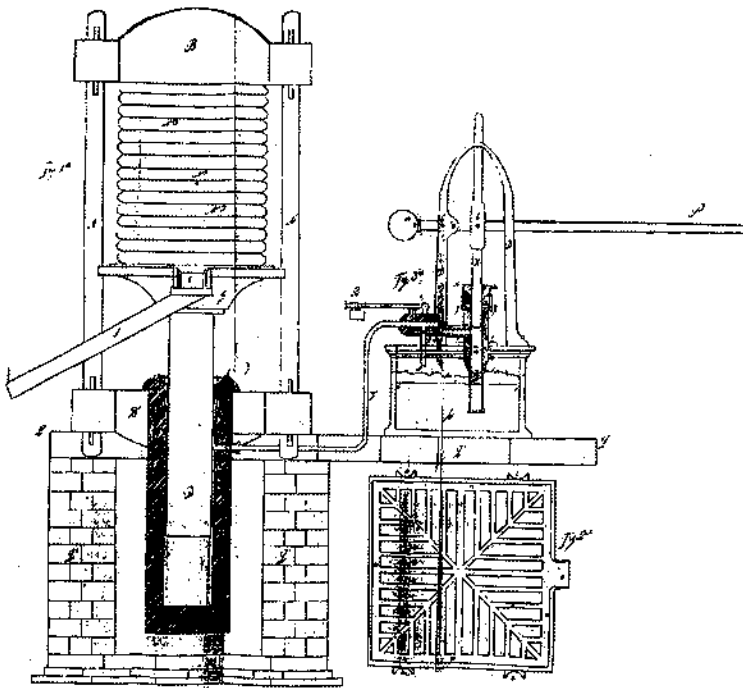
Sources: Manjarrés (1872, p. 199).

FIGURE 5. Hydraulic press



Sources: (Pequeño, p. 213).

FIGURE 6. Diego Alvear's Hydraulic press



Sources: Alvear (1834).

problems

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