# Olive Cultivars in Spain

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ADDITIONAL INDEX WORDS. *Olea europaea*, olive germplasm, breeding

SUMMARY. The diversity and antiquity of the cultivars, their restricted distribution and the limited use of rootstocks characterize cultivated olive (*Olea europaea* L.) plant material in Spain. An exploration survey identified 262 different cultivars, which have been introduced in the Olive Germplasm Bank in Córdoba, Spain. Evaluation of this germplasm, field trials and a breeding program are in progress.

Olive growing in Spain began between 2,000 and 1,000 BC. Early olive farmers in each area selected the best trees from wild olive groves on the basis of their productivity, fruit size, oil content and quality and adaptation to the local environment. Vegetative propagation of these plants brought these genotypes into cultivation and spread them to other areas, giving rise to the first cultivars. The importance of olive growing increased, and during the Roman Empire, olive oil export by sea, from southern Spain, expanded. Proof of this is the Testaccio mountain in Rome, formed almost exclusively from amphorae used to transport olive oil from Bética (today Andalucia). Also Columela, a Roman–Spanish agriculturist of the first century A.D., described 10 olive cultivars. In the Middle Ages, olive growing continued to expand, olive oil and table olives became the main Spanish products for export. Reliable references to cultivars date from the 15th century, and those cultivar names are the same as those used today for cultivars in the same areas. By the end of the 19th century, >1 million ha (2.47 million acres) were devoted to olive growing in Spain. During the first half of the 20th century, there was a further increase in acreage aimed at substituting olive oil for animal fat. Today, olive growing continues to expand as a consequence of the greater international demand for olive oil.

## Importance and distribution

Spain is the leading world producing country. Table 1 shows olive distribution and production in Spain and worldwide. Until 1990–96, Spain accounted for 28% of the planted area and 35% of world olive production. In recent years, Spanish acreage, production and yield have increased steadily. Currently, Spain's production may reach 40% of the world total production in the years to come; 92% of Spanish production is used for olive oil extraction and the rest for table olives.

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**Table 1. Area of olive orchards, olive oil, and table olive production[z] in different regions of Spain and in the world (1,000 ha = 2,471 acres, 1,000 t = 1,102 tons).**

| Geographic area | Area (1,000 ha) | Olive oil (1,000 t) | Table olives (1,000 t) |
|---|---|---|---|
| Spain | 2,241 | 650 | 240 |
| Andalusia | 1,300 | 535 | 180 |
| Castille-La Mancha | 275 | 35 | --- |
| Extremadura | 250 | 30 | 50 |
| Catalonia | 120 | 20 | 2 |
| World | 8,200 | 1,800 | 850 |

[z]Average data for 7 years (1990–96). Primary source International Olive Oil Council.

The main processing procedure for table olives, known as the Sevillano style, employs green olives. Another preparation method, the Californian style, where the olives are collected green and blackened by oxidation, is also used. One third of Spanish olive-oil production and half of table-olive production are exported.

Average rainfall in the main olive-producing areas of Spain ranges between 300 and 600 mm (11.8 and 23.6 inches) per year, although substantial annual variations occurs. Rainfall is heaviest in fall and spring, and occasionally very intense, causing serious erosion damages. Summer is dry and hot, reaching temperatures of over 35 °C (95 °F), which are not usually harmful, except in the event of unusually hot weather during flowering in May, thus harming fruitset. In Spain, rainfed farming accounts for 85% of the area devoted to olive growing. Farming irrigated land usually uses more modern techniques and intensive methods of production.

## Cultivars

In an exploration survey of olive cultivars grown in Spain, 262 different cultivars were identified (Barranco, 1995). These have been conserved, together with the principal foreign cultivars , in the Olive Germplasm Bank in Córdoba. Cultivars were identified using morphological features (Barranco and Rallo, 1984) followed by analysis of isoenzymes in pollen samples (Trujillo et al., 1995) and RAPD molecular markers (Belaj et al., 1997).

As in many other olive-producing countries, olive plant material cultivated in Spain is characterized by the abundance of very old cultivars restricted to specific areas where they originally grew. Furthermore, most of these cultivars are self-rooted. Grafted trees are found only in the case of difficult-to-root cultivars (i.e., 'Gordal Sevillana' and 'Empeltre') or as the result of topgrafting onto wild olives or onto other, less-useful, trees. The diversity of cultivars is due to their indigenous origin and reduced pressure of selection by farmers throughout history. The limited spread of cultivars may have been due to difficulties involved in transporting the voluminous plant material required in traditional propagation procedures and the scant knowledge of the behavior of cultivars in areas far from their place of origin.

Olive cultivars in Spain have been classified in four categories—major, secondary, dispersed, and local—based on their degree of importance and diffusion.

Major cultivars are those which account for either a large portion of the acreage or predominate in one or more olive districts. Secondary cultivars are not predominant in any district but are the basic cultivars of some orchards. Dispersed and local cultivars are isolated trees in various or single olive districts, respectively.

There are 24 major cultivars. Table 2 provides data on use of the fruit, acreage and provinces in which these cultivars are grown. Two cultivars, 'Manzanilla de Sevilla' and 'Gordal Sevillana', are used mainly for table olives. Three other cultivars, 'Hojiblanca', 'Manzanilla Cacereña', and 'Aloreña', are used for both table olives and oil production. The remaining cultivars are almost exclusively used for olive oil.

**Table 2. Major olive cultivars in Spain, their use (O = oil, T = table), area, and district location (see Fig. 1).**

| Cultivar | Use | Area (1,000 ha) | District |
|---|---|---|---|
| Picual | O | 725 | Jaén, Córdoba, Granada |
| Cornicabra | O | 269 | Ciudad Real, Toledo |
| Hojiblanca | O, T | 237 | Córdoba, Málaga, Sevilla |
| Lechín de Sevilla | O | 185 | Sevilla, Cádiz |
| Arbequina | O | 91 | Lérida, Tarragona, Córdoba |
| Manzanilla de Sevilla | T | 85 | Sevilla, Badajoz |
| Morisca | O | 74 | Badajoz |
| Empeltre | O | 72 | Zaragoza, Teruel, Baleares |
| Manzanilla Cacereña | O, T | 64 | Cáceres, Salamanca |
| Picudo | O | 60 | Córdoba, Granada |
| Farga | O | 45 | Castellón, Tarragona |
| Lechín de Granada | O | 36 | Granada, Almería, Murcia |
| Verdial de Huévar | O | 34 | Huelva, Sevilla |
| Gordal Sevillana | T | 30 | Sevilla |
| Verdial de Badajoz | O | 29 | Badajoz, Cáceres |
| Morrut | O | 28 | Tarragona, Castellón |
| Sevillenca | O | 25 | Tarragona, Castellón |
| Castellana | O | 22 | Guadalajara, Cuenca |
| Verdial de Vélez-Málaga | O | 20 | Málaga |
| Aloreña | O, T | 17 | Málaga |
| Blanqueta | O | 16 | Alicante, Valencia |
| Villalonga | O | 15 | Valencia |
| Chaglot Real | O | 5 | Valencia |
| Alfafara | O | 4 | Valencia, Albacete |
| Other cultivars | --- | 53 | --- |
| Spain | --- | 2,241 | --- |

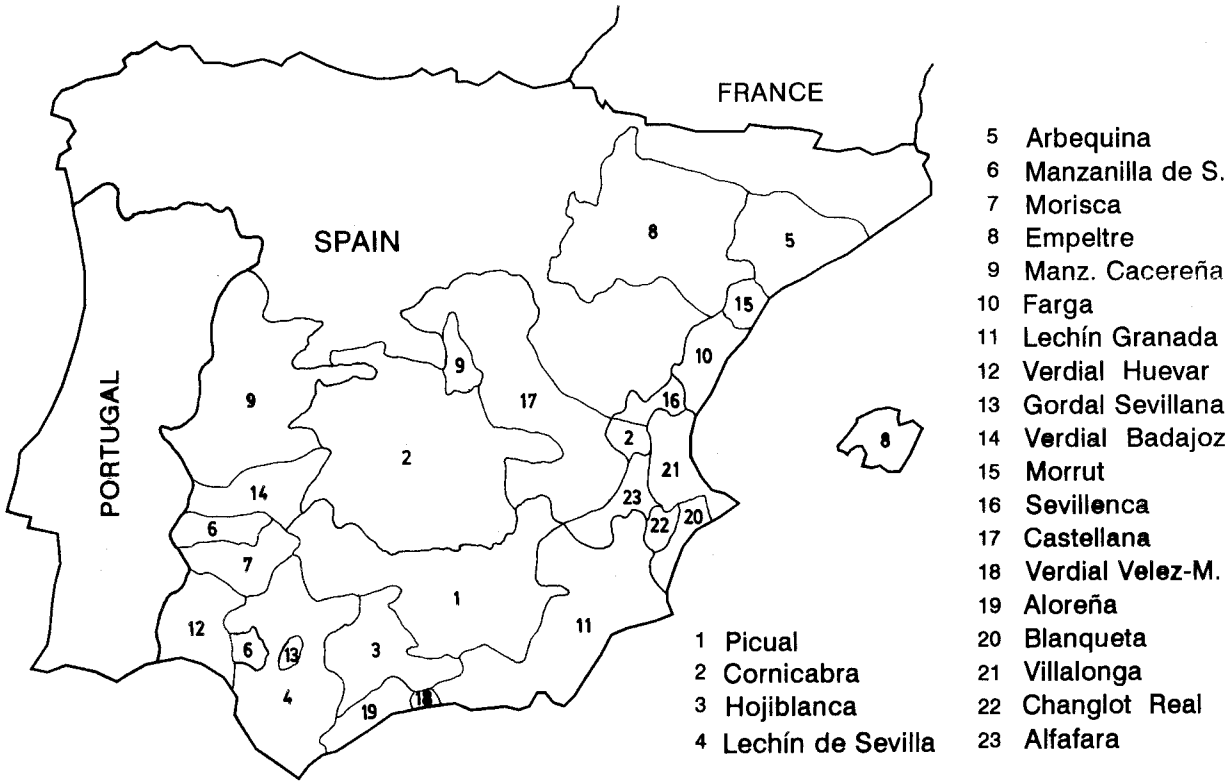


**Fig. 1. Dominant olive cultivars in Spain.**

Among these cultivars, 'Picual' shows many favorable agronomic characteristics, such as early bearing, high yield and low fruit removal force facilitating mechanical harvesting. It is also adapted to different environmental conditions. As a consequence, 'Picual' is the main cultivar in new orchards. 'Arbequina' is also increasing in acreage in intensive plantings, due to its low vigor, very early bearing, high productivity and high oil content besides its appreciated oil. Other outstanding productive cultivars are 'Blanqueta', 'Villalonga' and 'Hojiblanca'.

Figure 1 shows geographical distribution of the dominant olive cultivars in Spain. All major cultivars are included, with the exception of 'Picudo', which is not the dominant

**Table 3. Fruit characteristics of the main olive cultivars in Spain (28.35 g = 1.0 oz).[z]**

| Cultivar | Fruit wt (g) | Flesh/ pit ratio | Oil content (%) | Oleic acid (%) | Oil stability[y] |
|---|---|---|---|---|---|
| Arbequina | 1.9 | 4.6 | 20.5 | 66.2 | 40.5 |
| Blanqueta | 2.1 | 6.7 | 18.1 | 56.9 | 27.1 |
| Cornicabra | 3.0 | 5.0 | 18.9 | 77.1 | 106.8 |
| Changlot Real | 3.4 | 7.2 | 19.1 | 71.5 | 61.1 |
| Empeltre | 2.7 | 5.3 | 18.3 | 69.6 | 58.3 |
| Farga | 2.4 | 4.4 | 19.8 | 70.5 | 38.7 |
| Gordal Sevillana | 12.5 | 7.3 | 14.5 | 71.5 | 51.2 |
| Hojiblanca | 4.8 | 7.9 | 17.1 | 76.1 | 53.2 |
| Lechín de Granada | 2.1 | 5.6 | 18.8 | 70.9 | 58.3 |
| Lechín de Sevilla | 3.0 | 7.2 | 18.1 | 69.2 | 60.8 |
| Manzan Cacereña | 4.4 | 8.9 | 16.7 | 77.1 | 80.7 |
| Manzan Sevilla | 4.6 | 8.2 | 20.1 | 69.5 | 91.8 |
| Morisca | 5.7 | 7.2 | 22.1 | 65.3 | 41.6 |
| Morrut | 3.4 | 4.5 | 19.2 | 72.6 | 45.6 |
| Picual | 3.2 | 5.6 | 22.1 | 78.4 | 119.4 |
| Picudo | 4.8 | 6.3 | 19.1 | 63.4 | 37.6 |
| Sevillenca | 3.1 | 5.1 | 22.2 | 67.4 | 46.3 |
| Verdial de Huévar | 4.5 | 5.5 | 20.4 | 72.7 | 59.9 |
| Villalonga | 4.3 | 6.5 | 21.7 | 68.8 | 55.4 |

[z]Average data from different authors.
[y]Hours at 98.8 °C (209.8 °F) determined by Rancimat method (Frank et al., 1982).

cultivar in any of the regions where it is grown. However, its acreage overpasses that of other major cultivars (Table 2).

Until present times most varieties were spread over a continuous area in which they were dominant . Outside this area, their importance declined rapidly with distance until they disappeared. Until recently, only two cultivars extended to areas far from their origins: 'Manzanilla de Sevilla' and 'Empeltre'. 'Manzanilla' is a famous worldwide variety since it is the most used for processing as table olives. In Spain, it is the dominant cultivar in its region of origin, in the province of Seville, and in part of the province of Badajoz, where it has been topgrafted onto 'Morisca', the traditional oil producing cultivar of this area. Also, predominance of 'Empeltre' on the Balearic Islands is due to massive grafting to wild olive trees when the conquest of these islands by the Christian Kingdom of Aragon in the 13th century occurred.

Table 3 presents average data from various studies in different years on fruit weight, flesh / pit ratio, oil content, percentage of oleic acid in oil and the stability of the oil for several Spanish olive cultivars collected from the Olive Germplasm Bank in Córdoba. Advantages of some cultivars in comparison to others have prompted establishment of variety trials in recent years in some olive producing areas of the country. Also some clonal selections are being tested (Tous et al., 1998).

Many cultivars display a number of undesirable traits for a sustainable modern olive industry. Need for more suitable cultivars has lead our department to initiate an intraspecific breeding program in 1992. This program aims to obtain cultivars that include at least some of the following traits: early bearing, high oil content, resistance to *Spilocaea oleagina*, adaptation to mechanical harvesting and high oleic acid percentage (Rallo, 1995). Recently we have been successful in shortening the juvenile period (Santos-Antunes et al., 1999). Marker-assisted selection (MAS) has also been incorporated to this program since 1996. Our first evaluations of the progenies suggest that new cultivars may be available in the first years of the next century.

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