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Peach Industry in Spain

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Abstract

Peach (*Prunus persica* L. Batsch) is the main stone fruit grown in Spain. The area devoted to this crop has increased slightly (4%) over the past 15 years; however, its production has doubled in this period. Spain ranks fourth in world production after China, Italy and the USA, producing 25% of the total peach crop in the European Union. Six regions of Spain produce 95% of the peaches (1,261,000 MT): Cataluña, Aragón, Murcia, Andalucía, Extremadura and Valencia. Fruit type distribution is: non-melting peaches 41%, nectarines 33%, melting cultivars 24% and platycarpa (flat) types 2%. The Spanish climate is diverse among peach producing regions. There are areas with 200-400 chilling hours, like Andalucía, and other regions like Aragón or Cataluña with 700-1100 chilling hours, allowing one of the longest harvest seasons in the world, from April to November. Currently, there is a notable renewal of the cultivars grown, i.e. the range of cultivars is changing, there is a large increase in nectarines and platycarpa types, a slight increase in melting peaches and a decrease in non-melting cultivars. Regarding rootstocks, the hybrids from almond x peach (GF-677 and G x N series) are the most widely used (64%). Although peach production is increasing, consumption in Spain is decreasing, as it is in other western countries (Europe and USA). The lack of internal fruit quality is the main reason claimed by consumers for declining to buy fresh fruit. In addition to fruit quality, the main limitations of this crop are poor adaptability of many cultivars from foreign countries to the Spanish environment, dependency on cultivars bred in other countries, the incidence of pests, diseases and abiotic stresses and the high cost of crop management. These problems can be overcome, in part, by developing scion breeding programs based on controlled crosses.

Peach (*Prunus persica* L. Batsch) is the most important stone fruit crop in Spain. The area devoted to this crop has increased slightly (4%) over the past 15 years, reaching 79,000 ha in 2005; however, production has doubled in this period, from 629,000 MT to 1,261,000 MT (Fig. 1), as a consequence of the use of drip irrigation and the introduction of new improved cultivars and more efficient rootstocks. Spain ranks fourth in world production after China, Italy and the USA, producing 25% of the peach crop in the European Union (7). In 2006, 44% of the total Spanish production (545,200 MT) was exported, mainly to countries in the European Union: France, Germany, Italy, United Kingdom, Portugal, Poland, The Netherlands and Belgium (14).

Table 1 shows the average peach production (2005-06) in the six regions that produce 95% of total Spanish production (14). The Spanish climate is very diverse among production areas. There are regions with 200-400 chilling hours (e.g. Andalucía), and other regions (e.g.Aragón or Cataluña) with 700-1100 chilling hours (Fig. 2), which allows for one of the longest harvest season in the world for this species, from April to November (Table 1). Distribution according to fruit type is: non-melting peaches 41%, nectarines 33%, melting cultivars 24% and platycarpa (flat) types

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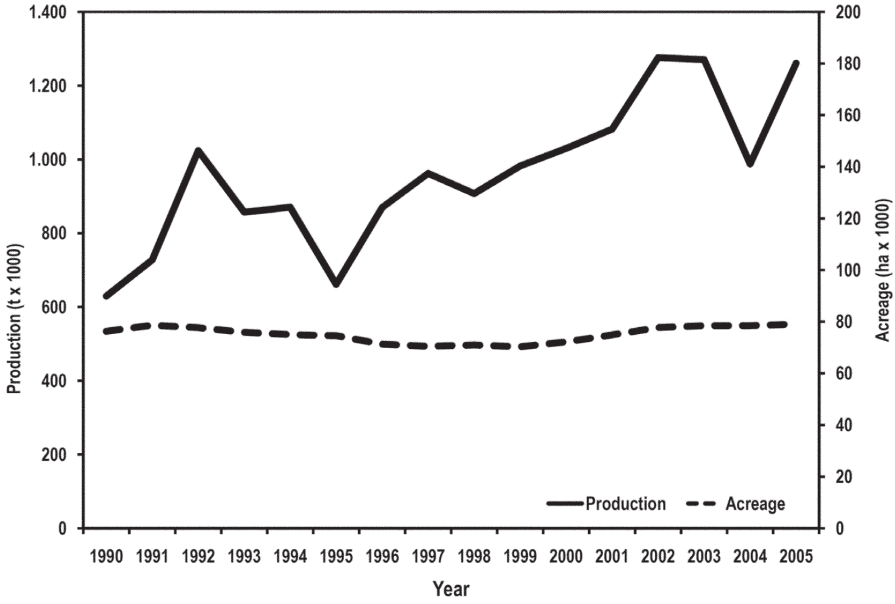

Figure 1. Changes in the acreage and production of peach in Spain (1990-2005).

Table 1. Spanish peach production (14) and harvesting calendar in the main production regions.

Region	Average production 2005-06 (MT)	Harvesting calendar
Cataluña	330,277	May 20-October 30
Aragón	279,338	June 10-November 10
Murcia	261,170	April 20-September 20
Andalucía	153,362	April 15-July 20
Extremadura	104,411	May 15-September 25
Valencia	55,040	May 1-July 15
Others	68,615	-
Spain	1,253,213	April 15-November 10

2% (Table 2). This distribution varies among producing areas, depending on the climatic characteristics (mainly chilling requirements) and management of the crop. In Andalucía, Valencia and Extremadura the most commonly produced types are nectarines and low chilling melting peaches. In Murcia with similar chilling requirements as in Valencia, the most frequent types are non-melting peaches, due to a long tradition of canning peach production. In Aragón, where the chilling units in winter are in the range of 700-1100 and spring frosts are common, it is not feasible to grow early cultivars and production is based on non-melting late-season peaches, well-adapted to climatic conditions, with high fruit quality. In Cataluña, a region with similar chilling units as Aragón, non-melting peaches are decreasing while nectarines and mid-season melting peaches are increasing (Table 2).

Table 2. Spanish peach distribution (%) according to fruit type in the main production regions (14).

Region	Melting	Non-melting	Nectarine	Platycarpa
Cataluña	43	17	39	1
Aragón	5	66	27	2
Murcia	12	62	16	10
Andalucía	21	12	67	--
Extremadura	38	11	50	1
Valencia	38	11	51	--
Spain	24	41	33	2

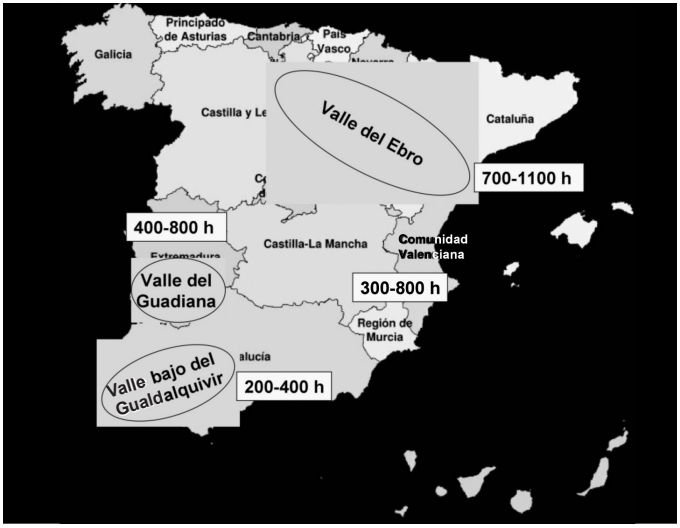

Figure 2. Chilling hours in the main peach producing regions of Spain.

Cultivars

Among the non-melting peaches, the main cultivars are yellow-fleshed, traditionally grown in Spain or introduced from North America, such as 'Sudanell' (4600 ha), 'Catherina' (4500 ha), 'Babygold' group (2800 ha), 'Miraflores' (2200 ha), 'Andross' (2150 ha), 'Carson' (1200 ha), 'Tardíos de Calanda' (1050 ha), 'Jerónimo' (800 ha), 'San Lorenzo' (730 ha) and 'Campiel' (600 ha). Among the melting-flesh types, the most important cultivars are: 'Springcrest' (2700 ha), 'Maycrest' (1400 ha), 'Florida' group (1200 ha), 'Royal Glory' (1100 ha), 'Sunred' (1075 ha) and 'Spring Lady' (880 ha), all of them yellow-fleshed and originating in North America. Only one white-fleshed cultivar, 'Alexandra' (240 ha) has enough acreage to be included in the statistics available. Among the yellow-fleshed nectarines, there are 'Big Top' (1500 ha), 'Fantasia' (730 ha) and 'Fairlane' (650 ha) and among the white-fleshed nectarines there are 'Snow Queen' (820 ha), 'Caldesi 2000' (840 ha), 'Flavor Giant' (384 ha) and 'Caldesi' (180 ha), all introduced from North America except 'Caldesi', which is from Italy (14). The acreage of platycarpa (flat) types is increasing yearly; in 2007 there were about 1800 ha grown, mostly in Murcia, Aragón and Cataluña. The main cultivars are 'Sweet Cap', 'UFO 3' and 'UFO 4'. The estimated percentage of white vs. yellow fleshed cultivars is 16

vs. 84% in nectarines, 7 vs. 93% in melting peaches and 95 vs. 5% in platycarpa types. All non-melting cultivars are yellow fleshed.

Rootstocks

Some soil characteristics in Spain are limiting for peaches. There are calcareous and heavy soils that induce chlorosis and waterlogging. Besides there are replant disorders in many areas. Currently, the hybrid peach x almond GF-677 is the most widely used rootstock, because of its resistance to chlorosis and high graft compatibility, followed in use by peach seedlings and some other interspecific hybrids. The French GF-677 rootstock accounts for 47%, while the American peach seedling rootstocks such as Nemared (17) and the French Montclar have been used in soil with nematode problems and non-calcareous soils respectively. They account for 18%. Recently GF-677 is being replaced by other hybrids such as Adafuel (5), and Spanish selections of plums such as Adesoto-101 (15) and Monpol and Montizo (8), due to their better adaptability to calcareous and heavy soils. Together, these account for 10% of the total. More recently, there has been a significant increase in the use of rootstocks with almond x peach parentage released by the CITA from Spain, for instance Monegro, Garnem and Felinem (9), which are all resistant to nematodes and less vigorous than GF-677. They currently represent 17% of the total. Other French interspecific hybrids such as Ishtara (1) and Cadaman (6) are still in use, as well as other Italian rootstock as Barrier (18), which together account for 8% (20).

Limitations and challenges for peach production in Spain

Large number of cultivars grown and high dependency on foreign cultivars. Peach is the most dynamic fruit species in terms of new cultivars released per year. Worldwide, 202 new cultivars were released in the 1970s, 625 were released in the 1980s and 1092 in the period 1991-2001. These new cultivars come from more than 70 scion breeding programs in the world. Half (50%) of the new cultivars originated in the USA, 30% in Europe, mainly France and Italy, and the remaining 20% in South Africa, Australia, China, Japan, Mexico and Brazil (2, 3). No peach scion breeding programs existed in Spain until recently. This fact made the country dependent on foreign cultivars, mainly those from the USA, Italy and France. The Spanish cultivar assortment is in continuous renewal. Traditionally grown, non-melting and yellow-fleshed cultivars in Murcia, Aragón and Cataluña are decreasing, except those ripening very late in the season, which underwent clonal selection. Most traditionally grown non-melting cultivars have been replaced by foreign non-melting cultivars with better yield. In the regions with warm winters, such as Andalucía, Murcia, Valencia and Extremadura, a replacement of traditionally grown germplasm by early and extra-early melting flesh cultivars suitable for export is the most common issue. The trends for the next few years indicate the same tendency, with a substantial increase in nectarines and platycarpa types, a slight increase of melting peaches and a decrease of non-melting cultivars. Among nectarines and melting flesh types, low-acid or sweet cultivars are increasing in importance (11). The high number of new cultivars in the market is confusing for growers and technicians. There is not time to establish experimental trials which can provide data about the agronomic performance of the new cultivars. Consequently, some new cultivars are grown in areas without any experimentation, and later show poor adaptation. In addition, most of the new cultivars are protected and, in some cases the producing license is restricted to some growers or the cultivar is sold under the "club system". This dependency on foreign cultivars without previous experimental data has become expensive and unreliable.

Lack of internal fruit quality. Despite the increase in production, peach consumption in Spain is decreasing, as it is in other western countries (Europe and USA). Poor internal fruit quality, perceived when the fruit is consumed, is the main reason claimed by consumers for declining to buy fresh fruit (2,

12). Most of the fruits from new cultivars have high external quality (size, color, appearance), but many lack internal fruit quality. This phenomenon occurs mainly in early ripening cultivars, whose fruits are sold in spite of their poor quality because they are the first in the season. The internal fruit quality is related mainly to two factors: firmness and flavor. Firmness is essential for postharvest management and marketing. Lack of firmness results in harvesting immature fruits, which implies less flavor, aroma, texture and juiciness. As a consequence, the consumer is disappointed and does not buy peaches again that season.

Pests, diseases and abiotic stresses incidence. Pests affecting peach species include Lepidoptera, such as *Anarsia lineatella* (peach twig borer) and *Cydia molesta* (oriental fruit moth), Aphididae, such as *Myzus persicae* (green peach aphid), Diaspididae, such as *Quadraspidiotus perniciosus* (San Jose scale), Thripidae, such as *Frankiniella occidentalis* (western flower thrip) and Diptera, such as *Ceratitis capitata* (Mediterranean fruit fly), which has become the most important pest for stone fruits. Another problem that can cause important crop losses is soil infestation with nematodes, which can be solved by using resistant or tolerant rootstocks. Among fungi affecting the canopy, there are *Monilinia laxa,* inducing blossom and twig blight and fruit brown rot, *Cladosporium carpophilum,* causing scab particularly in later cultivars, *Sphaeroteca pannosa,* producing powdery mildew, *Taphrina deformans*, causing leaf curl and *Phomopsis amygdali* and *Leucostoma* spp., producing constriction and perennial cankers respectively. Fungi from the soil (e.g. *Armillaria mellea and Rossellinia necatrix*) can cause damage, depending on the area and the rootstock used (10, 16). Among bacteria, there are *Agrobacterium tumefaciens,* inducing crown gall and *Xanthomonas arboricola* pv. *pruni,* producing bacterial spot, the latter recently detected in Spain (19). On the other hand, strains of Plum Pox (Sharka) virus occurring in Spain do not damage peaches (4); however this fact could change if more aggressive strains already existing in France and Italy eventually spread to Spain.

Abiotic stresses include those related to cold temperature and spring frosts that mainly affect fruit set and yield in early cultivars. High temperatures during summer result in the presence of double fruits and fruit drop before ripening. Post-harvest stresses include chilling injury (vitrescent dark spots), that mainly affect late non-melting cultivars grown in Aragón. Other abiotic stresses are those related to soil conditions (calcareous soil, salinity, drought, waterlogging) that can be overcome by using appropriate rootstocks.

High crop management cost. Among the different activities conducted for orchard management, one of the higher costs is the application of pesticides for dealing with the different pests and diseases described above. Labor costs, including thinning, pruning and harvesting, are also very important. Obtaining new cultivars resistant to pests and diseases is one of the most important goals in the current peach breeding programs, aimed at reducing the application of pesticides, which implies a decrease of the costs, a reduction of residues in the fruits and a better preservation of the environment. These three issues should be taken into account in future crop management. Other breeding goals are cultivars with proper growing habits (i.e., columnar or upright) that could reduce the cost of pruning, training and harvesting.

Conclusion. Peaches have arisen as an important crop in Spain over the last 15 years, during which production has doubled. However, several problems need to be solved, most of which are related to the cultivars in use. Some of these problems can be addressed by breeding new cultivars. Spain only started peach scion breeding programs recently (in 1989) but now there are at least 14 breeding programs, including both public and privately funded ones (13).

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Cherry Size Not Improved by ATS at Bloom

In Austria, researchers tried blossom thinning 'Blaze Star', 'Samba', 'Techlovan' and 'Merchant' (all on Gisela 5 rootstock) sweet cherries with ammonium thiosulfate (ATS). Different concentrations of ATS and different application times were tested. Crop load was significantly affected ($P < 0.01$) by application, cultivar and year, but fruit size was not improved by any of the application strategies. For the full article, see Schoedi et al. 2009. J. Sci. Food Agric. 89(7):1236-1240.