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Llácer G., Martínez-Valero R., Melgarejo P., Romero M., Toribio F.

in

Llácer G. (ed.), Aksoy U. (ed.), Mars M. (ed.).
Underutilized fruit crops in the Mediterranean region

Zaragoza : CIHEAM
Cahiers Options Méditerranéennes; n. 13

1995
pages 69-78

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SUMMARY - In Spain there are regular cultures of the 5 fruit tree species that are involved in the present work: about 20,000 ha of fig trees (*Ficus carica*), 3,700 ha of loquat trees (*Eriobotrya japonica*), about 1,000 ha of Japanese persimmon (*Diospyros kaki*), 2,600 ha of pomegranate (*Punica granatum*) and 227 ha of Barbary fig (*Opuntia ficus-indica*). In addition, in all cases there is a large number of scattered trees. Although the 5 species have traditionally been considered as marginal crops, all of them have a great significance in very localized situations. Because of the crisis that affects agriculture, and the need to search for new alternatives, the present trend is to intensify these cultures, a process that has progressed particularly in the case of loquat in the Alicante province. In the 4 species cited in the first place, studies have been undertaken to improve both the plant material and the commercialization.

Key words: Fig, loquat, Japanese persimmon, pomegranate, Barbary fig.

RESUME *- En Espagne, on cultive régulièrement les cinq espèces rapportées dans cet article. On a environ 20 000 ha de figuier (Ficus carica), 3 700 ha de néflier du Japon (Eriobotrya japonica), 1 000 ha de kaki (Diospyros kaki), 2 600 ha de grenadier (Punica granatum) et 227 ha de figuier de Barbarie (Opuntia ficus-indica). En plus, pour l'ensemble des espèces, il y a un grand nombre d'arbres disséminés dans différentes régions. Bien que les cinq espèces aient été considérées, traditionnellement, comme marginales, chacune d'elles revêt une grande importance dans certaines situations particulières. Vu la situation de crise que connaît l'agriculture et le besoin de chercher de nouvelles options, la tendance actuelle est d'intensifier la culture de ces espèces comme c'est le cas du néflier du Japon dans la province d'Alicante. Pour le figuier, le figuier de Barbarie, le kaki et le grenadier, des études ont été entreprises pour l'amélioration du matériel végétal et des circuits de commercialisation.*

Mots-clés *: Espagne, figuier, néflier du Japon, kaki, grenadier, figuier de Barbarie.*

Fig (*Ficus carica*)

Present Status

Fig production in Spain can be estimated as little more than 50,000 MT (Table 1; Toribio, 1983), equivalent to about 20,000 ha in a regular planting, and to more than one milion scattered trees. The most extensive regions are the Balearic Islands (8,500 ha), Extremadura (5,200 ha) and Andalusia (4,700 ha), that make up more than 90% of the regular cultivation and 76% of production, suggesting that other regions, such as the Valencian Autonomy, with a small area of regular plantings, have a large number of scattered trees.

Table 1. Spain fig production (1000 MT)

Autonomous Community	1985	1986	1987	1988	1989	Average	% for Spain
Galicia	2,06	1,24	1,27	2,02	1,81	1,68	3,28
Asturia	0,17	0,09	0,07	0,03	0,03	0,07	0,13
Cantabria	0,17	0,17	0,16	0,16	0,17	0,16	0,31
País Vasco	0,19	0,19	0,33	0,38	0,46	0,31	0,60
Navarra	0,26	0,23	0,20	0,24	0,23	0,23	0,45
La Rioja	0,22	0,21	0,23	0,23	0,23	0,22	0,43
Aragón	0,36	0,26	0,32	0,30	0,17	0,28	0,48
Cataluña	0,96	0,73	0,72	0,77	0,67	0,77	1,50
Baleares	18,44	22,53	18,06	17,82	10,80	17,53	34,25
Castilla-León	1,04	0,90	1,07	1,03	1,39	1,08	2,11
Madrid	0,14	0,16	0,21	0,16	0,20	0,17	0,33
Castilla-La Mancha	2,38	0,75	2,44	2,40	3,82	2,35	4,59
C. Valenciana	3,11	2,88	3,07	3,20	5,35	3,52	6,87
Murcia	0,58	0,41	0,56	0,37	0,34	0,45	0,88
Extremadura	9,92	8,32	17,59	14,70	12,58	12,62	24,65
Andalucía	9,27	8,05	8,51	8,35	10,14	8,86	17,31
Canarias	0,95	1,01	0,85	0,41	0,60	0,76	1,48
España	50,29	48,19	55,72	52,65	49,06	51,18	100,00

Nearly all the production area is dryland, very often associated with grape vines and olive trees. The trees are pruned in vase with spacings varying between 8 x 8 to 12 x 12 m. The fig tree has traditionally been considered as a marginal crop, with minimum cultivation care. Production has almost not varied over the last years (Table 1). Most of the production is destined for drying: 5 million kg of dry figs are sold in the large urban centres of Spain. A small proportion is exported to Germany and France. Conversely, fig paste (2 million kg) is basically exported to the USA and to Venezuela. Fresh fruit consumption and fruit processing into syrup make up a small percentage, though increasing, of the production destined for the domestic market.

Many varieties are cultivated; all the varieties are multiplied by cuttings. No rootstocks are utilized. They still have mostly local names and the most currently known ones are as follows: (i) 'Calabacita': dried, fig paste, and in syrup; (ii) 'Cuello de Dama Blanco': dried and fresh; (iii) 'Colar' (breba): fresh; (iv) 'La Casta': fig paste; (v) 'Napolitana Negra': fresh.

Future prospects

Over the recent years, may be because of the crisis situation that the agricultural sector is undergoing and because of the need for searching new alternatives, a movement of interest has been shifted towards a better knowledge of the fig tree cultivation. According to Toribio (1993), the lack of profitability of this crop is due to the following causes:

(i) Plant material (varieties) not appropriate for the present demand of the market, that evolve rapidly towards demanding fresh, early figs (brebas) with large size and higher quality.

(ii) Lack of cultural care: pruning without any technical criterium, absence of fertilization and disease treatments, etc.

(iii) Exceedingly large trees that greatly increase the harvest costs.

(iv) Lack of studies on characterization and identification of varieties, inducing a great heterogeneity of the supply.

(v) Absence of adequate marketing channels for the sale of fresh fruit.

(vi) Diversifying the supply in excess, and unsuitable display of the fruits.

(vii) Even for the traditional production of dried figs, the quality, and above all the small size make the competition with other countries difficult.

The trend in new plantings is already the use of smaller spacings (4 x 4m or 4 x 5m), shaping the trees in low vase and using drip irrigation. Nevertheless, the solution of the above mentioned problems must start with the study of the plant material. For this reason, a survey was performed in Extremadura, Andalusia, Balearic Islands, Catalonia and Valencia. With the materials that have been judged to be more suitable, a large collection has been created at the Service of Research and Technological Development of Badajoz (Extremadura), with the purpose of characterizing varieties and evaluating their agronomic behaviour. Some foreign varieties were introduced, as well, to study their adaptability.

Although the study of the plant material is fundamental, many other points remain to be investigated. Studies on the methods of propagation and tree training, spacing, pruning, fertilization, soil maintenance, and fresh fruit conservation have been already initiated.

Loquat (*Eriobotrya japonica*)

Present status

Loquat culture in Spain occupies about 3,700 ha as regular plantings, reaching to a yield of about 35,000 MT. Moreover, there are countless trees scattered in small, family orchards all over the eastern and southern parts of the country. Out of the regular plantings, 95% are concentrated in three areas: province of Alicante ranking in the first place with more than 50% of the Spanish production; the provinces of Malaga and Granada comprising the second and the provinces of Valencia and Castellón the third area of production. The first two areas have almost doubled their production in the past ten years (Rodríguez and Rodríguez, 1993).

The rise in production has not only been a result of the expansion of the cultivated area, but mainly of the intensified cultivation: new dense plantations, trickle irrigation, varietal reconversion, and increasing cultivation under plastic greenhouses (Rodríguez and Rodríguez, 1993).

So far, the conventional spacings were 6 x 6 m, which gave a production of 100-150 kg/tree. At present, with a spacing of 3 x 3 m there are 4 trees instead of one, and with the trickle irrigation, yields of 50-60 kg/tree are reached, which means 200-240 kg of fruit from an area of 36 m^2.

The varietal reconversion has been implemented mainly in the area of Callosa d'Ensarriá (Alicante), major producing area of Spain. Native varieties, 'Fuster', 'Nadal', 'Polop', etc., producing small-size fruits and lower yields have been abandoned and were substituted by the 'Algerie' variety, of larger fruit size and higher yield which now accounts for more than 95% of the whole production in this zone. The origin of this variety was a seed sown by a Valencian man in an Algerian gardén in 1950. Later, he brought budsticks to Callosa where they were graft-multiplied (Rodríguez, 1983). The rest of the Spanish cultivation areas grow preferably foreign varieties, such as 'Magdall', 'Golden' and 'Tanaka'. In all cases, seedling loquats are used as rootstocks.

Culture under plastic has the following advantages (Rodríguez and Rodríguez, 1993):

(i) It advances maturation, resulting in higher prices and extended harvest period; it avoids the maturation of the fruit within a limited period.

(ii) It eliminates damages produced by wind and, indirectly, reduces the incidence of "purple spot", a physiological disorder which will be further referred.

(iii) It prevents sun-burn on fruits.

Fruit of more uniform colour and of higher quality are therefore obtained. This is particularly important in the newly obtained varieties, from spontaneous mutation of 'Algerie', ('Peluche', 'Saval 1', 'Saval Dulce', etc.) having very big fruits but with a very sensitive peel.

About 80% of Spain's production is exported to foreign countries, basically to Italy (55%), Portugal (15%) and France (10%). The rest of the production, 20%, is sold as fresh fruit in the markets of Spain, mainly in Madrid and Barcelona. A very small amount, 0.3%, is processed to be sold as syruped fruit (A. Rodríguez, pers. comm.)

Future prospects

At present, in the Alicante area, the loquat culture has been stabilized, however, in Malaga and Granada it continues to grow, whereas in the area of Valencia-Castellón it appears to be in full decline.

The major limiting factors for the loquat culture in Spain are as follows:

(i) Climatic factors: a quite special micro-climate is needed to obtain early and high quality fruit, the only profitable fruit. As the Valencia-Castellón area can not provide an early production, this has caused its regression.

(ii) Intensified cultivation requires more hand labour, and it is increasingly expensive.

(iii) Lack of markets, and rising competitiveness of other tropical or subtropical fruits.

(iv) Significant sensitiveness of the Algerie variety to "purple spot".

Most of the attention has been placed on the last factor mentioned (Tuset *et al.*, 1989). The purple spot is a physiological disorder directly related to the calcium (Ca) content in the fruit tissues. Calcium is an essential element for the structure and function of the cell membranes. Any factor causing a decrease in Ca content of the fruit favours the alteration of the cell wall and the appearance of the purple spot. There is a clear correlation between the amount of young and vigorous shoots at the time of fruit development and the incidence of purple spot, due to the competence that occurs between the fruit and the new growing tissues. Therefore, the use of exceedingly high amounts of nitrogen fertilizers, severe pruning and excess thinning should be avoided and abundant amounts of organic matter should be added.

Cell walls altered by the decrease of Ca are more permeable, and therefore more sensitive to anything that can favour transpiration, such as strong winds and intense sun exposure. Hence, the need to avoid hydraulic unbalances (excess water followed by drought periods), to maintain the limbs 'well dressed' with leaves, to use windbreaks, and above all, mesh or plastic covers becomes more apparent.

Other limiting factors for the cultivation of loquat are more difficult to deal with. In order to open new markets and improve competitiveness, it would be necessary to obtain earlier varieties of higher quality, larger size and less sensitive to purple spot, and to handling practices. It would also be necessary to reduce cultivation costs, basically those of hand thinning.

In 1992, surveys were initiated on native material in the eastern area with the following objectives:

(i) To detect trees exhibiting some of the traits cited above.

(ii) To prevent loss of traditional material, without commercial value at present, but constituting a more valuable genetic stock.

After the survey, with the resulting materials, two collections were established in addition to some foreign varieties; one at the IRTA in Reus (Tarragona) and the other at the IVIA in Moncada (Valencia). The last one, that consists of 33 native type varieties, is expected to be the nucleus of a future Spanish germplasm bank for loquat. It is also foreseen to establish experimental plots in Callosa d'Ensarriá (Alicante) to study varietal behaviours and different forms of tree training.

Japanese persimmon (*Diospyros kaki*)

Present status

In Spain, the persimmon cultivation (astringent varieties) has been known for many years, and its most common presence is as isolated trees in home gardens. There are some areas where it is grown regularly as an important crop in the economy of some of the zones, such as the Ribera and the Palancia valley in the Autonomy of Valencia. In Andalusia, the Granada province is a traditional area for the culture of this crop, although there are plantings in other places such as Málaga, Jaén and Huelva. In Catalonia there are also regular plantings, but the isolated trees predominate. In the rest of Spain, the culture is virtually unknown.

Data existent in the MAPA Statistics Yearbooks on persimmon culture do not allow to determine the production and acreage occupied by this species, since as a minor crop it usually appears together with some others having the same characteristics. Benedicto (1986) evaluated the cultivated area as 600 ha, with a production of about 3,000 MT. Since then, no studies have been conducted in this regard, although we are aware of the existence of changes in the census. Over the last 5 years, in the Autonomy of Valencia, about 200,000 trees have been planted: 90% of the Rojo Brillante variety and 10% of the Sharon type (J.M. Chornet and F. Rodríguez, pers. comm). In Andalusia the culture has increased considerably with respect to the data from Benedicto. In Catalonia, during the recent years, regular plantings have been established, but the area planted is still small. In Spain, at present, the cultivation area is thought to be about 1,000 ha and the production, around 8,000 MT. Surface distribution could be presented as follows: (i) Andalusia: 550-650 ha; (ii) Autonomy of Valencia: 200-250 ha; (iii) Catalonia: 50-100 ha.

Regular conventional culture has been developed in irrigated land (flooding), and with spacings of about 30 m^2 per tree (6 x 5, 5.5 x 5.5, 5 x 5 m), and trees are generally vase shaped with three primary scaffolds. In the newly established plantings in the Valencia area, recommended spacings and pruning methods are maintained, but flood irrigation is not changed to trickle methods. Some plantings are established as associated culture with citrus. The most commonly planted variety is Rojo Brillante, although there are plantings with Picudo, Tomatero, Gordo; and Cristalino varieties. Lately, non-astringent varieties have been started to be used.

In Andalusia, in the conventional culture of persimmon the Gordo variety was used as in Catalonia. During the recent years there has been an important introduction of the Triumph variety, commercially known as Sharon fruit. The recent plantings are made on flat land with narrow spacings (5 x 3m) and with drip irrigation.

In Catalonia the trees in the new plantings are trained as the traditional vase shape or in lean-to form and always irrigated with drip. The astringent varieties are preferably used.

The rootstock used in all the cultivation areas is *D. lotus*. It is very difficult to find varieties grafted onto other rootstocks.

The production has a very local destination, preferably being consumed in the areas where it is grown; only in few markets in the interior of the Peninsula, persimmon is sold although recently the number of consumers is increasing. In decreasing order, Barcelona, Madrid, Sevilla, Valencia, Granada, Las Palmas, Córdoba, Zaragoza and Murcia are the cities with the highest consumption rate.

Exports, that could be estimated as 15% of the production, is destined for Portugal and France, consumer countries used to the soft texture of the astringent persimmon.

Future prospects

Comparing consumption in the cities that, according to Benedicto (1986) were the most important consumers, and according to the data from the MERCASA network of 1993, it appears that a consumer increase of 50% has been created, the emergence of new markets that sell persimmon is also remarkable (Table 2). In addition to this, the presence of sweet fruits (non-astringent) with a texture similar to that of apple will help to foresee an increasing trend in the consumer number.

The setting up of a research project about underutilized fruit trees, financed by the I.N.I.A. has allowed the gathering and setting up a collection of native cultivars and of foreign astringent, variable and sweet varieties in Catalonia (IRTA), which is going to facilitate the extension of the culture, by making the most important varieties of the world available to the growers.

The limiting factors are similar to those of the other Mediterranean producing countries; from the agronomical viewpoint, the incidence of the attacks of the fruit fly *Ceratitis capitata* that has affected up to 30% of the production, and commercially, degreening and transport, fairly overcome, and the reduced domestic and exterior markets can be stated. The implementation of campaigns to increase consumption would be of utmost importance.

Table 2. Loquat markets, in MT, the Spanish MERCASA network

Markets/years	1983	1993
Barcelona	1010	1555
Madrid	418	942
Sevilla	-	860
Valencia	442	379
Granada	284	369
Las Palmas	-	230
Cordoba	-	196
Zaragoza	43	195
Murcia	70	141
Alicante	-	125
Badajoz	-	92
Malaga	152	92
Jerez	-	71
Bilbao	18	59
Tenerife	-	39
Iruña	-	15
Santander	-	8

Pomegranate (*Punica granatum*)

Present status

The pomegranate culture in Spain is centered in the Alicante province (Autonomy of Valencia), which possess an acreage of 2,000 ha out of the 2,600 ha cultivated in the whole country (77%). Traditionally, pomegranate has occupied marginal lands, with soils and waters exceedingly saline for the culture of other crops. In recent years, the rise of prices in the foreign markets has provoked the extension of the culture out of the limits of its traditional area, occupying good lands and reaching a production value of about 24,000 MT, a fact that can be thought to be a critical point between supply and demand (Melgarejo, 1993). Prices have been stabilized, or even have dropped.

The traditional culture is intensive: planting spacings of 3 x 3m or 4 x 4 m; vase shaped trees, flood irrigated with an increasing trend towards trickle irrigation in new areas.

There is a large number of pomegranate varieties, but commercially, only two varietal groups (populations) are utilized. The most important is 'Mollar' of high quality that is harvested from mid-September to mid-November. The other population is named 'Valenciana', of poorer quality but earlier, a reason why it receives higher prices. Both varieties are grafted onto sour rootstocks propagated by woody cuttings.

More than 70% of production is exported as fresh fruit, basically to the United Kingdom (36%), France, (29%), Italy (16%) and other countries of the European Union. According to Melgarejo (1993) there are more than 40 exporting companies,

nearly all sited in the Alicante province. The most important domestic markets are the large cities such as Madrid, Barcelona, Bilbao, Zaragoza and Valencia.

Future prospects

To go beyond the top limits reached at present, the profitability of the pomegranate culture in Spain depends on a number of problems that need to be solved, in similar way to that set out for the fig tree, which range from lack of the selection of plant material used to diversification of the supply.

Regarding the plant material, at the EUITA of Orihuela (Alicante) 62 different kinds of pomegranate, coming from Spain, Morocco and Israel, have been collected, to evaluate them under homogeneous conditions, and make a varietal and clonal selection. Simultaneously, a selection of rootstocks is being performed, and the floral biology, pollination and nutrition are being studied. From the commercial viewpoint, the study of conservation and processing the fruit has been started. There are good expectations in terms of processed products, such as: jams, confectionery, grains in syrup, minimal processing products, dehydrated and frozen products; as well as making use of the by-products such as the fruit rind.

The creation of associative concerns, of sufficient dimension so as to deepen in the following work lines, will be of fundamental importance in the future:

(i) Concentrate the supply.

(ii) Increase the quality by avoiding the commercialization of exceedingly unripe fruit.

(iii) Increase the technological level of the handling industry.

(iv) Mechanize the process of fruit peeling, and removing the grains.

Barbary fig (*Opuntia ficus-indica*)

Present status

Barbary fig production is estimated as 18,000 MT in Spain (south-eastern areas) shared by 227 ha of regular crop and 1,400,000 scattered plants. Regular culture is intensive, with plants spaced 5 x 5 m or 6 x 4 m and trickle irrigated. The plant material used, lacking any selection method, has local names, which nearly always refer to the fruit colour: 'Verdales', 'Morados', 'Sanguinos', 'Blancos'. The plants are multiplied by cuttings. All the production is destined for the domestic market, and its consumption as iced fruit drink (sherbets) in the restaurants is very common.

Future prospects

In the other four species mentioned, studies are already initiated to improve both the plant material and the commercialization; however, in the case of Barbary fig everything has to be done for the Spanish conditions. Doubtless, the production of high quality non-prickly varieties would give drive to this fruit species so little studied so far.

Acknowledgements

We express our appreciation to A. Rodríguez Pérez, J.M. Chornet Roig, and F. Rodríguez Mulero, of the Agriculture and Fisheries Authority of the Autonomy of Valencia for the invaluable information provided.

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