

Loquat, production and market

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SUMMARY – The current state of the production and marketing of loquat in the world is described. China stands out as the main producer and Spain as the prime exporter. An important growth in the export of this fruit world-wide seems unlikely as it requires demanding distribution conditions, and large disbursements must be made for fruits to achieve commercial quality. Price analysis in Spain indicates that loquat is the horticultural fruit with the least loss of real income over the last 20 years. The difference between prices and costs indicates that acceptable profit margins exist for the grower and the price risk is low. However, the subjective risk that farmers perceive seems high due to the large investments that must be made to cope with labour costs. This prevents the possible expansion of loquat production.

Key words: Main countries, marketing, industrialisation, production costs, prices.

RESUME – "Nêfle, production et marché". L'étude de la situation actuelle de la production et du commerce mondial, démontre que la Chine est le principal producteur de nêfles tandis que l'Espagne est le premier exportateur. La croissance des exportations paraît improbable, dû à la difficulté de la distribution des fruits et aux coûts élevés pour l'obtention de meilleures qualités commerciales. L'analyse des prix en Espagne nous indique que la nêfle est le produit qui présente le moins de perte de pouvoir d'achat dans les dernières 20 années. La différence entre les prix et les coûts indique l'existence d'un bénéfice acceptable pour l'agriculteur et un niveau réduit de risque des prix. Cependant le risque subjectif que l'entrepreneur perçoit pour les hautes dépenses qu'il a besoin de faire, concernant les coûts de main-d'œuvre, rend difficile la possibilité d'expansion de la nêfle.

Mots-clés : Principaux pays, commercialisation, industrie, coûts de production, prix.

Introduction

According to most authors, loquat species (*Eriobotrya japonica* Lindl.) comes from China, and was later introduced into Japan. There are records of loquat having been cultivated in Japan since 1180. In the XIX century, loquat was a regular commercial crop with different cultivars. It was introduced into Europe in the XVIII century, but only as an ornamental tree in Botanical Gardens. In Spain, it was introduced two hundred years ago (Rodríguez, 1983). It spread quickly throughout the Mediterranean regions, including Valencia and by 1821 it was already being used for productive ends, as well as for ornamental.

The spreading of the species was easy in those areas where citrus were grown, however, loquat has stricter environmental requirements than citrus. Flower and fruit development cycle extend during the winter which implies an average temperature of over 15°C. The tree is rustic but the fruits can be damaged by wind and frost; temperatures below –2°C damage open flowers and small fruits, recently set fruits can be damaged at a temperature of –1°C.

For people familiar with the crop, loquat represents a fruit that announces the spring, a nice sweet-acid fruit if it has been harvested at the right point of ripeness and if it has been transported with the necessary care.

Loquat acreage is not large. However, the acreage could be increased as an alternative crop, aimed at enlarging fruit production, which is important in those cases when there is a surplus from the main fruit crops.

Situation of the main producing countries

There are no FAO's statistics available for loquat production, therefore the present data come from that published in journals and mostly from personal communications by researchers from the producing countries. There are some countries where loquat is an important commercial crop and other countries where the crop is located in family orchards and isolated trees. Table 1 shows those countries where the acreage of loquat as a regular crop is higher than 30 ha.

Table 1. Area, production and exports of loquat in the main countries

Countries	Area (ha)	Production (t)	Exports (t)
China	42,000	200,000	2,000
Japan	2,420	10,245	
Pakistan	10,000 (var. local)	12,800	
	1,000 (Tanaka)	16,000	1,600
Israel	330	3,000	
Egypt	33	440	
Greece	300	2,750	
Morocco	385	6,400	
Portugal	243	950	
Italy	663	4,412	
Turkey	1,470	13,500	147
Chile	138		37
Brazil	300	2,400	
Spain	2,914	41,487	19,400
Total	62,196	314,384	23,184

Although loquat has spread world wide, only 13 countries are included in this table. Both data from production and acreage show that the crop is not important enough to be included in FAO statistics.

Except for Spain, export data displays the low level at which this crop is marketed.

The most important cultivars are: Tanaka, Algerie and Golden Nugget. There are also cultivars selected in the different countries where the species is grown. Beside these orchards of commercial cultivars, there are plantations with unselected native cultivars. These cultivars are not marketable, so they are only used for local consumption.

It seems that the genetic diversity of the species is wide, which will allow the breeding and selection of new cultivars. This fact will contribute to the reorganisation of non-commercial planting.

Below we will describe the situation of this crop in the main countries, and then go on, finally, to production and marketing details in Spain, which dedicates important zones of production that are highly specialised and commercially developed.

China

With respect to figures relating to surface area and production, China leads internationally. In the last ten years surface area and production have doubled. As this is the country of the loquat's origin the range of varieties is enormous and of great interest from a genetic viewpoint.

The loquat is grown in 10 provinces. There are also millions of trees growing in isolation.

Production is destined mainly to the national market, and local consumption is of interest; export figures do not reach 1% of production and this percentage is destined mainly to South East Asia. There is a trend towards increased production, specially with the better quality cultivars.

Japan

This is considered as an important country, particularly as the origin of commercial varieties. Table 2 displays the surface areas and production in detail.

Table 2. Evolution of area and productions of loquat in Japan

Year	1985	1990	1995	2000
Area (ha)	2,580	2,810	2,570	2,270
Production (t)	10,300	13,000	12,300	7,190

The regions with the greatest cultivated areas are Nagasaki and Kagosima.

The main destination is the home market and the principal consumer areas are: Tokyo (47.9%), Osaka (19.9%), Yokoama (7.5%), Kyoto (4.5%). Statistics are not available on the export and import and present trends would indicate a future drop.

Pakistan

This is one of the countries with the largest planted area and the main producer in Southern Asia. Fruits ripen in spring, as in all countries in the northern hemisphere and it is a very popular fruit, because there is no other fruit available in this season.

There are two varietal groups. The local kind, which comprises a surface area of 10,000 ha and an estimated production of 128,000 t; these do not usually reach the commercial quality necessary for export and are, therefore, consumed on the home market. In the other group of plantations, the main variety to be found is Tanaka, introduced in 1965 with 1000 ha in production from which 16,000 t are harvested and 10% is exported to the Middle East, principally Dubai. In Pakistan there has been a continued growth in the consumption of this fruit, year after year.

Israel

Production is destined to local and national markets. Currently they are not exported, given the high production costs involved and the rigorous labour requirements. Moreover, in initial attempts to export to Europe in recent years, they found Spanish competition to be too great.

The plantations are located along the Mediterranean coast. Thirty percent of loquat production in Israel takes place around Zichron Ya'acov and there are also orchards near the Sea of Galilee, where ripening is earlier.

The most important cultivars are Akko-1 and Akko-13, which have been selected in the same country. Tanaka and Golden Nugget stand out among the imported varieties.

In Israel the loquat is collected straight into small plastic containers, which hold 1 or 2 kg, and the fruit is consumed fresh. No increase in cultivated surface area is expected and at present there is a trend towards plantations under mesh screen.

Egypt

The scale of cultivation is of little importance given the area of commercial plantations, which comprise varieties of a local character.

Greece

Total production from plantations is destined to the home market. There is also a considerable number of trees outside plantations.

They import some fruit from Italy and Spain. In recent years production has been quite stable.

Morocco

Eighty percent of the planted area is to be found in the Moulouya region in the north west of the country. Total production is 6400 t with a yield of 15 to 25 t/ha; the most commonly cultivated commercial varieties are: Musca, Navela, Mkarkeb, Tanaka and Argelino.

The harvest ripens above all in the month of April. Loquat is considered to be a fruit of economic interest and the trend is towards a growth in its cultivation.

Portugal

This country is an important consumer. Seventy two percent of production is located in the regions of Algarve and Beira Litoral.

The main commercial varieties are: Argelina, Tanaka and Golden Nugget, which are foreign varieties, and De Silves, De Lágrimas, Portuguesa and Palhinha, which are national varieties.

In the Algarve, loquat is marketed from March to June in non-returnable boxes that hold between 8 and 10 kg. The main market in the country is Lisbon. There is competition with Spain.

The productive surface area has dropped owing to the difficulties in finding labour to thin fruits and harvest. The most likely future trend is that there will be a drop in surface area but an increase in production, as a consequence of the removal of dispersed trees and plantations in bad condition on one hand and the new intensive plantations in the Algarve, on the other.

Italy

Italy is the number one importer and its market demands high quality. Almost its whole production is located in Sicily and is destined to local and national markets. At present they do not export but import between 12,000 and 15,000 t annually from Spain

In terms of production, there is a tendency towards the cultivars with the best traits. There has not been any variation in growing techniques in the last ten years.

Turkey

Turkey is one of the most important producers and almost all the plantations are situated in the South-eastern Mediterranean region.

The fruit is consumed fresh in the springtime and it ripens early. Small quantities are exported (between 30 and 150 t) to countries in the Middle East, and Central and Northern Europe.

The main problem facing the expansion of this crop in Turkey is the risk of frost and land availability, due to competition with other crops, including citrus, as well as greenhouses for the production of both ornamental and vegetable plants.

Brazil

Despite having the greatest extension devoted to citrus in the world and numerous zones with a suitable climate for the loquat, Brazil is estimated to produce only 2400 t, almost all of these from the Mogi das Cruces region in the State of São Paulo. Because of its location in the Southern hemisphere the harvest is sold in the July-November period. The most important market is São Paulo, where 975 t were recorded in 2001.

Chile

This country has ample resources to produce loquat and also has the means and the experience to commercialise a wide variety of fruits. Chile dedicates 209,000 ha to fruit production and the three main species are the table grape, apple and avocado pear; loquat cultivation is in the initial stages of development.

The main productive region is found in the centre of the country between regions IV and VI. The most commonly planted variety is Golden Nugget, and Tanaka and Early Red are also of interest.

Almost the entire production is consumed on local markets where the fruit is appreciated for its period of ripening. Export figures vary greatly from one year to another; the latest figure was 37 t, mainly to United States and Europe.

A slight expansion is forecast for the coming years.

Other countries

As well as the information we have received from the countries that are shown in Table 1, we have information about other countries, including Mexico, New Zealand, Australia, United States and Uruguay, where there are no plantations on a commercial scale but it is possible to find numerous loquat trees spread around or in small family orchards.

Loquat in Spain

According to the production shown in Table 1, the average value corresponding to the harvests of 1996 and 1997, updated to June 2001, is 42.27 millions of euro.

The distribution of the surface areas and production per region is shown in Table 3.

Table 3. Area and production of loquat in Spain

Region	Province	Area (ha)	Production (t)
Andalusia	Granada	725	10,875
	Málaga	416	6,160
Murcia		40	400
Valencia	Alicante	1,483	22,016
	Castellón-Valencia	250	2,036
Total Spain		2,914	41,487

As a consequence of environmental requirements, as stated in the introduction, and for other socio-economic reasons, most of the production is located in three areas.

The main area is in Alicante province, located in the Marina Baja, where Callosa d'Ensarrià, Altea, Polop and Bolulla are found in the Algar and Guadalest river valleys. The most important cultivar in this area is 'Algerie' and its mutations (Cardona, Buenet, Cayetana, Amadeo). They account for 95% of the total production. The rest correspond to Golden, Magdal, Peluche and Nadal.

In these valleys loquat comprises an actual agricultural system, based fundamentally on the following elements:

- (i) Good-quality water, favourable climate and the possibility of taking advantage of steeply sloping land, which is adequate for manual cultivation.
- (ii) Cultivated varieties and available technology.
- (iii) Social acceptance of this activity in the area and the availability of human resources.
- (iv) Efficient marketing with a predominance of vertical integration.

The second area is located in Andalusia, provinces of Granada and Malaga, area with subtropical climate. The cultivars grown are Golden Nugget (80% of total) and Magdal. There is a small amount of Tanaka.

The third area is located in the river Palancia valley, which includes part of the provinces of Castellón and Valencia. It extends from Sagunto to Segorbe. The main cultivar grown is Tanaka. There are other cultivars that have disappeared due to their small fruit size and lack of post-harvest potential, such as Saguntí, Temprano de Petrés and Temprano de Torres.

There are areas planted with loquat in Valencia that are of little importance, in La Huerta Norte, Ribera del Júcar, Campo del Turia and Hoya de Buñol.

Varieties and rootstocks

The genetic diversity of this species is very wide, and we would like to point out the existence of a germoplasm bank housed in the Valencian Institute of Agricultural Research (IVIA). At present 90 commercial varieties are planted here and are undergoing evaluation, with another 10 Chinese varieties that have recently been added.

We will not go into a detailed list of the different varieties, given this is dealt with in a publication by Martínez-Calvo *et al.* (2000) in which they evaluate 34 from the aforementioned collection, and identify the stages of growth according to the BBCH scale.

Given the wide range of varieties that are available, it is worth pointing out the fact that Spanish commercial production depends on only four: Magdal, Algeria, Golden Nugget and Tanaka; the majority of production corresponds to Algeria, the production of which is excessive.

In selecting and obtaining new varieties the trend is towards achieving greater earliness, taking care of aspects such as the sugar/acid ratio, resistance to diseases such as scab and others, lower propensity to purple spot and the ability of the fruit to retain its good condition throughout the post-harvest process.

With respect to rootstocks, in the three productive areas in 90 to 95% of cases a loquat seedlings is used, which comes from a seed. The chosen variety is then grafted onto this and production begins 3 years later. This combination gives rise to a relatively large tree that is tolerant to lime and has a very extensive productive period. In any case, nowadays the size of the tree presents fewer problems for handling due to the form of pruning applied.

In 5% of cases the quince has been used as a stock. When this stock is used the tree becomes productive more quickly, and produces larger-sized fruits. It is more resistant to root choking and more tolerant to salinity than the loquat seedlings but, due to its lack of affinity, its lifespan is reduced to around 20 years (Rodríguez, 1983).

Growing techniques

The crop is mostly located in family farms, which did not disturb technical improvement. The trend of orchards is to increase the planting density, drip irrigation, to apply water stress after harvesting, to

protect the trees from wind and to grown under screen which represents 10% of total acreage in the Alicante province.

According to cultural practices, loquat is a fruit crop very demanding. Production of high quality fruits, according to the market demand, requires large investments of labor, mostly focused on thinning and harvesting.

The limiting factors from pest and diseases are:

(i) Scab, which is caused by *Fusicladium eriobotryae*. Symptoms appear in the whole tree. It can damage flowers and fruits all over the development. The damage on fruit can produce the lost of the crop. Control of the scab relies on 3-4 treatments.

(ii) Soil fungus. Fungus from genera *Armillaria*, *Rosellinia*, *Phytophthora*, and *Polyporus* produce dying of trees in a rate of 1 to 5%.

(iii) Pest is not very important. Loquat is a host of trips and mites that can be controlled by pesticides.

The main limiting factor is purple spot. This is a physiological disorder the origin of which is unclear. It is accentuated by greater thinning and, lately it has been related to the growth of skin and pulp, concentration of sugars and a drop in mineral elements in the skin (Cariglio *et al.*, 2002).

Fruits can be affected at a rate of 15-25% and the commercial value can decrease by 40% compared to regular fruits (Tuset *et al.*, 1990). Marketing costs increase as fruits must be separated and classified more carefully.

According to the authors mentioned in the previous paragraphs, the percentage of fruits affected by purple spot can be reduced by between 51 and 65% by applying calcium salts during the five-week period prior to fruit colour change. Also a positive effect has been achieved using giberellic acid treatments. The practice of bagging, frequently used in Japan, prevents fruit from dehydrating and is efficient against purple spot. The drawback of this method is that it involves manual labour and is, therefore, very expensive.

Marketing and industrialisation

Loquat ripens between March and May, even in the first half of June, and choosing the right harvesting moment is decisive in obtaining the ideal organoleptic quality. Loquat produce fruits that are very sensitive to handling. Inappropriate harvesting can lead to unmarketable spotted fruits. As a point of orientation we indicate the approximate percentages marketed per month in Alicante: 3% in March, 26% in April, 62% in May and 9% in June.

Loquat can be stored from 20 to 25 days in a cold chamber at 3-6°C; the main drawback is the gradual loss in acidity that affects quality to a great extent (González *et al.*, this volume).

Marketing by individual growers is of some importance, however, the production based mainly on small plots, family farms and large labour requirements mean an association is necessary to market the product. Growers are organized in cooperatives, individual growers bring their production classified and packed. Once in the cooperative warehouse the product is revised and graded according to quality by anonymous reviewers. The grower receives money according to the quality of his production.

Spanish exports represent between 36 and 47% of total production. There is a wide range of destinations, however, over 80% of exports are destined to Italy, Portugal and France. Despite the wide range of countries where the loquat is consumed, there is a relationship between consumption and Mediterranean people.

Industrialisation of the loquat in order to obtain different products of interest is technically viable, however, the main problems derive, in part, from the prime material which is costly, and the inevitable influence of the seed/pulp ratio, moreover, competition with products made from other fruits that are more readily available in larger quantities, and with the total mechanisation of the elaboration process.

In Alicante, unmarketable fruit is destined to juice production, the proportion varies yearly according to the weather conditions, but can reach between 10 and 20% of production. Category I fruits are conserved in syrup, the average figures are around 100 t per year. Jam manufacture is another interesting possibility. Monofloral honey from the blossom of the loquat tree is also a characteristic product of the areas where it is cultivated.

Costs and prices

Figure 1 shows costs of productions (including harvest marketing) and percentage of every item. The reference area is Alicante.

Concept	Pts/ha	Euros / ha	%
1.- VARIABLE COSTS			
1.1.- Water, fertilizer and chemicals	233261	1401,93	8,59
1.2.- Labor	2026230	12177,89	74,65
1.3.- Machinery	9773	58,74	0,36
TOTAL VARIABLE COSTS	2269264	13638,55	83,60
2.- FIXED COSTS			
2.1.- Depreciation plants and machinery	88976	534,76	3,28
2.2.- Depreciation equipment and other fixed costs	53860	323,71	1,98
2.4.- Taxes and insurances	128890	774,64	4,75
TOTAL FIXED COSTS	271726	1633,11	10,01
TOTAL COSTS without opportunity costs (1+2)	2540990	15271,66	93,61
3.- OPPORTUNITY COSTS			
3.1.- Rent of land	96000	576,97	3,54
3.2.- Interets own capitals	77421	465,31	2,85
TOTAL OPPORTUNITY COSTS	173421	1042,28	6,39
TOTAL COSTS with opportunity costs (1+2+3)	2714411	16313,94	100,00
COST / Kg without opportunity costs	102	0,61	
COST / Kg with opportunity cost	109	0,65	

Fig. 1. Summary of production costs of Loquat in Alicante (Spain). Surface: 1 hectare. Variety: Algeria. Yield: 24,926 kg/ha

The labour cost represents 75% of the total, which ranked loquat species in the first position among the horticultural crops in Spain (Caballero *et al.*, 1992). Additionally, we calculated the unit cost with and without opportunity cost.

Figure 2 indicates the price trends received by growers. The trend suggests that loquat species is the crop with the lowest real income losses in the last two decades, with prices updated to June 2001.

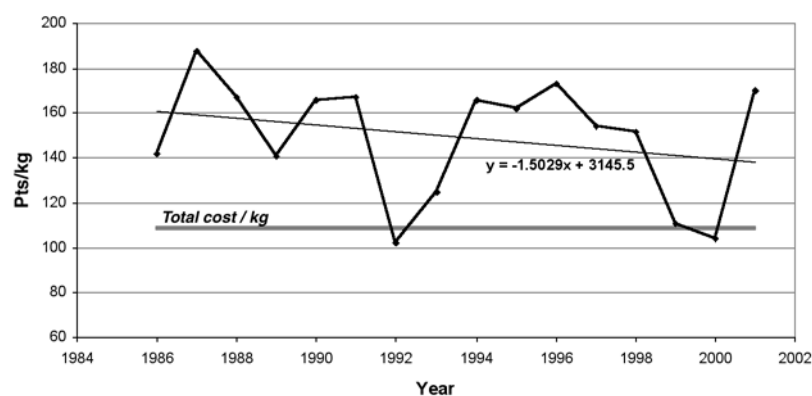


Fig. 2. Evolution of prices to grower, trend and prices risk. Data: Coop. Callosa d'En Sarriá, Alicante (Spain). Current prices June 2001.

From the straight line representing costs in Fig. 2 one can see that, on one hand, acceptable profit margins exist for the grower and, on the other, there is a low price risk, given that in only two of the 16 years studied have prices fallen below costs. This comparison has been made possible because, due to the cultivation characteristics and specially the high predominance of manual labour, there have been no changes in production techniques which would have led to an acute variation in cost composition.

With regard to plantations cultivated under mesh screen, this technique represents an important change, in which it is necessary to establish a balance between the costs generated by the high investment, which must be amortized, and the advantages in terms of quality and lower harvest risks.

With the production indicated in Fig. 1 the installation of mesh screen increases the unit cost by 0.174 euro/kg, which represents 19% of income.

Currently, the increase of the income in orchards under mesh screen is estimated at 20%. In orchards that are exposed to wind damage, netting insures economic viability.

Conclusions

The harvest season at the beginning of spring determines good conditions for marketing, as consumers are ready to demand new fruit. Extended consumption will depend on the investment of marketing, focusing on enlarging its diffusion, especially diffusion in those areas far from its production.

Marketing loquat should take into account the cultivar's fruit quality while keeping a good distribution. It seems contradictory that cases of rejection have been recorded, with negative statements regarding its flavour, which are a result of deficient conditions in the ripeness of the fruit at the point it is sold to the consumer (Caballero and Benedicto, 1990).

Although it is a very well known species, dating from ancient times, the market is not widely developed. Moreover, China represents 64% of worldwide production. Main producers beside China are: Spain, Pakistan, Turkey and Japan. International trade is very low, only 7.4% of the total production, from which 83% corresponds to Spain.

According to the data available from Spain, loquat is the horticultural fruit with the lowest loss in real income over the last 20 years.

The labour cost is the most important factor limiting the spread of this crop's cultivation, mainly due to thinning and harvesting. Chemical thinning is under study. Up until now, quality grading and packing must be done by hand, which increases the costs.

Although loquat cultivation is an activity with acceptable profit margins, in Spain, economically viable production is limited to just two areas: Alicante and the coasts of Granada and Malaga. In the Palancia Valley (Valencia and Castellón) it was important in other times, but there is a strong trend to decrease. If the socio-economic conditions of the market do not change we may be reaching a stable state of cultivated areas and production.

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