

Citrus Industry In The Kingdom of Morocco

Ahmed Ait-Oubahou¹

Summary

An average of 500 to 600 thousand tons of citrus fruits are exported annually from Morocco mostly to Europe. Plantations of citrus cover more than 76500 ha for an annual production oscillating between 1.2 to 1.5 million tons. The variability in production is due to several factors that include, sanitary conditions (gummosis and virus diseases), aging (over 55% of plantations are more than 30 years old and 8 to 10% have over 40 years of age) and drought conditions in different producing areas during the last decade. Drought conditions have affected severely some parts of the Souss Valley where water table has reached more than 200 m in depth. These factors and others have a direct impact on both quality and quantity of the production.

Keywords: Citrus; Production; Exportation; Morocco.

Introduction

The kingdom of Morocco has a long tradition in producing wide varieties of citrus fruit. As in the whole Mediterranean basin, cultivation of citrus goes back to roman era. The real development of the citrus industry started in the beginning of the last century. At that time large orchards were created by French occupants. Nowadays, two distinct sectors coexist in Morocco. One modern, where the production is geared for export and the second, traditional, where the production is oriented to local market and processing. Modern sector is composed of large farms and the latter is composed mostly of small farms with an average area less than 5 ha.

The annual production of the country oscillates from 1.2 to 1.5 million tons obtained from approximately 76500 ha (MADRPM, 2004). Citrus cultivation represents an important source of employment for thousands of families. As over 40% of the production volume is exported, it is considered the first crop oriented to foreign markets. It is thus an important source of hard currency. Morocco is classified the 4th largest fresh citrus exporting country in the world and the 2nd largest of clementine type exporter. European Union markets are by far the main destination of Moroccan export. However, in the last years, there was a significant diversification towards Russia and Canada.

Main production areas

There are several citrus production areas in Morocco differentiated following the climate, availability of water and the geographical situation. Another major difference is the percent of total area both in surface as well in produced volumes. Therefore, the most important citrus production areas in the country as shown on the map (Fig. 1) are Souss Valley, the southernmost citrus area is located near the city of Agadir, the Gharb located north of the capital Rabat, Moulouya valley in the northeast region of the country near the Algerian borders, Tadla or the inland central area near the high Atlas mountains and the Haouz sur-

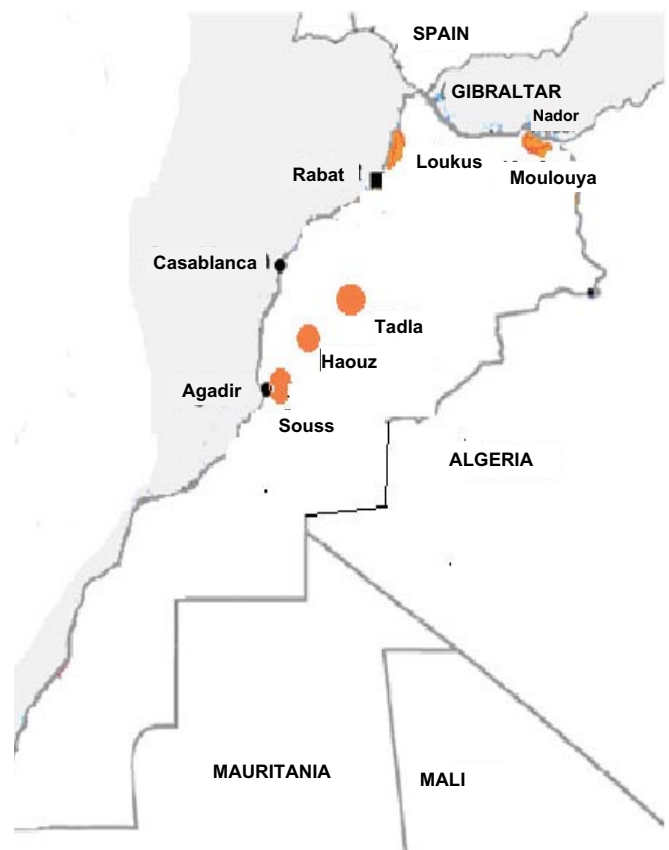


Fig. 1. Main citrus producing areas (orange coloured) in the Kingdom of Morocco.

rounding the red city or Marrakech. Table (1) illustrates the citrus distribution between different regions.

Souss Valley is by far the most important area for production in the country. It represents 35% of total area and about 80% of clementine export. It is also the area where modern techniques and technologies for citrus production and handling are well implemented. Table (1). shows the distribution of citrus in the main producing areas of the country.

Production

The actual production of the country is rather low in

¹ Institut Agronomique et Vétérinaire Hassan II, Complexe Horticole d' Agadir BP. 1123 Agadir 80000 Morocco. Tel./Fax:(+212) (2) 8248892, Email :aoubahou@iavcha.ac.ma or aitousbahou@yahoo.fr

Table 1. Citrus distribution (ha) in different regions of Morocco

Production zone	Total area (ha)	%
Souss valley	26850	35
Gharb-Loukous	19800	25.9
Moulouya	12780	16.7
Tadla	10320	13.5
Haouz	4230	05.5
Other places	2520	03.2
Total	76500	100

(MADRPM, 2005).

Table 2. Production and export (,000 Tons) of citrus from Morocco in 2003-04 and projections for 2010

Citrus type	Production		Export	
	2003-04	Projection for 2010	2003-04	Projection for 2010
Clementine and mandarin	440	650	199	350
Orange types	730	1200	247.2	500

(MADRPM, 2005).

comparison to the surface area. Annual production oscillates from 1.2 to 1.5 million tons corresponding to an average yield lower than 18 tons/ha. Reasons for such low yields are due in part to shortage of water in some areas, to age of plantation in the Gharb-Loukous area and to a large number of small farms. In another part, these variations from year to year are also caused by natural alternate bearing of citrus and especially frequent within clementine mandarin varieties. A national citrus development plan was set in late 90's aiming to reach a total production of about 1.85 million tons by 2010. Different means to reach that goal were fixed by the ministry of agriculture and professionals.


Photo 1. High promising late variety of mandarin "Afourer" produced in the area of Marrakech.

Table 3. Profile of citrus varieties produced in Morocco

Variety	Total area	%
Orange type	50230	65.6
W. Navel	16250	21.2
Salustiana	1305	1.7
Hamlin	600	0.8
Blood type	3275	4.3
Valencia Late	26800	35.0
Others	2000	2.6
Total small fruit types	26270	34.5
Clementine type	21300	28
Ortanique mandarin	2305	3.0
Others	2670	3.5

(MADRPM, 2005).

Variety profile

Although more than 20 varieties of oranges and mandarins are produced in the country, oranges which include Valencia late commonly called Maroc late in the country, Washington Navel, Salustiana and blood types are dominant in term of areas planted. Small fruit types, constituted mainly of clementine types and late mandarin varieties represent approximately 35% (Table 3).

Due to low return of orange types, especially Valencia late and W. Navel, and the increasing demand of the market for easy peeling varieties, new plantings are oriented to Clementine Fina, Nour, Nules, Larache and Sidi Aissa, Bekria, Marisol, Oroval, Bruno, Esbal and late varieties of mandarin hybrids which include Afourer, Ortanique and Nova (Photo 1). Few growers have also introduced the new varieties of Navel such as Fukumoto and Kara Kara. The production of lemons and pomelos is not very important in the country and thus the export volume is negligible.

In the early 80 s a large operations of topworking or tree removal were conducted in the country and concerned



some varieties with low commercial value such as Montreal (4500 ha), Blood orange type (4000 ha) and 700 ha of Vernia) or causing problems of pollination to Clementine types such as (Wilking Mandarin).

With recent privatisation operation of the state owned orchards (formerly belong to SODEA) in 2005 and 2006, new pulse of development was given to citrus production in the country. In fact, more than 50000 ha of fruit trees, originally belong to SODEA since 1973, were rented to new investors including nationals and international companies.

A large collection of citrus germplasm was maintained in the country in citrus experimental stations (El Menzeh, Kenitra; Sidi Allal Tazi and Mamora, Rabat; SODEA, Temara; Kedima, Taroudant and Souihla near Marrakech). The list contains over 600 accessions (local or imported) and the main varieties are given in Table (4).

Table 4. Partial composition of citrus germplasm bank in Morocco

Variety	Variety
Clementine:	Blood oranges:
Aïn Taoujdate ; Berkane ; Fina	Washington Sanguine;
Carte Noire ; Larache ; Marisol	Sanguinelli, Maltaise; Moro
Muska ; Nour ; Nules ; Oro grande	Navel oranges:
Orovral; Sidi Aïssa	Washington Navel; New Hall
Tardive de Mars	Thompson; Fisher; Robertson
Mandarin types:	Navelate; Lane Late
Afourer; Fortuna; Nova	Lemons:
Ortanique; Temple	Lisbone ; Femminello; Eureka
Common oranges:	Grapefruits:
Valencia Late; Salustiana; Hamline	Marsh; Shambar; Rubby; Star Rubby

Nursery management

Over one hundred of small nurseries produce citrus plants in the country with an annual capacity of about 5 million trees. However, the largest ones that produce certified citrus plant material are SODEA (Société de développement agricole), Domaines Agricoles and SAPIAMA or Domaines Abbas Kabbage. Certification concerns trees free from diseases such Tristeza, psorosis, exocortis and cachexia. SODEA and Domaines Agricoles have nurseries in different regions of the country and SAPIAMA is located in the Souss Valley. The annual production capacity of the 3 nurseries alone oscillates between 1.9 to 2.5 million trees of different varieties. The capacity of production is ventilated as shown in Table (5) based on data obtained directly by the author from each nursery.

Rootstocks

Sour orange (*Citrus aurantium*) is by large the most dominant rootstock used in Morocco in over 95% of grafted citrus trees. Sour orange is well known for its tolerance

Table 5. Average production capacity of certified citrus trees (,000 trees) of the three major citrus nurseries

Nursery name	Average annual production (,000 trees)
SODEA Souss, Ouled Teima, Taroudant	800 to 1000
Les Domaines Saouda, Ouled Teima	600 to 800
SAPIAMA, Kabbage Souss, Taroudant	450 to 600

to several diseases and nutritional disorders, but also of its sensitivity when combined with another variety to Tristeza. Yet, there is no evidence of the existence of Tristeza in the country, the risk of introduction is increasing as the insect vector that transmits the virus exists both in Madera and in Spain. The high activity of transport by trucks between Spain and Morocco may facilitate the entrance of the vector into the country. The authorities as well as the professionals are taking the problem of Tristeza seriously and thus diversification of rootstocks can be seeing in the nurseries. The main rootstocks, nowadays used, include citrange types (C35, Troyer and Carrizo), Citrus macrophyla, Citrus volkameriana, Citrumelo Sacaton and Swingle. The origin of seeds is either INRA (National Agriculture Research Institute) of El Menzah, Kenitra or imported from Australia, USA or Corse, France.

In the main citrus collection around the country, rootstock varieties include sour orange, Cleopatra mandarin, Carrizo and Troyer citrange, Citrumelo Sacaton; Volkameriana; Rough lemon; Lime Rangpur; Sweet lime and several other lines.

Production structures

Different structures such as tunnels and large greenhouses are used for production. Seeding as well as grafted planted are produced in small plastic bags with substrates composed of a mix of sandy soil, manure and mineral fertilisers. Irrigation is generally drip irrigation and in some case, sprinkling system is adopted. A type of production system is shown by Photo (2).



Photo 2. Greenhouse production of small citrus trees grown on plastic bags.

Planting density

Spacing systems are adopted for citrus in Morocco both for Clementine and/or oranges varieties. The most dominant spacing is 6x4 or 5x4 m for small fruit varieties and 6x5 to 6x6 for oranges. Higher densities are also found in several orchards in the area of Souss and Marrakech with 500 to 1000 trees/ha. In high density plantations when using sour orange as a rootstock, problem of shade and difficulties to spray are encountered (Photo 3). Top working



Photo 3. High density planting of citrus in Morocco.

was practiced when changing the variety in the 1990's. This method tends to reduce the time required for first fruiting and regular production. Nowadays, the growers prefer removal of old trees and planting new ones.

Organic and mineral fertilisers

Before planting, organic manure is often used depending on soil organic matter availability and content. The amount used varies from 40 to 60 tons per ha as most of soils in the country have low organic matter content. During growth and production different mineral combinations of fertilisers were used. Based on leaf and soil analysis the guide for the application of nutrients is used to guide the application of nutrients to the trees. The growers apply generally on about 1000 g of nitrogen, 600 g of potassium and 400 g of phosphorous mature tree. Fertigation is used



Photo 4. Fertigation system components used in citrus orchards.

in large orchards (Photo 4). Micronutrients such as iron are applied as foliar sprays in calcareous soils with high pH values during the winter period.

Irrigation

In contrast to citrus production in tropical areas, all citrus orchards in Morocco are irrigated by drip or furrow irrigation. Water comes either from dams (about 40%) and the rest from wells and tube wells. With water shortage in the



main producing regions of Souss Valley, Haouz and Moulouya Valley, the government of Morocco decided to allow incentives to farmers to switch from furrow to drip irrigation as well as to use certified trees. A total amount of 1500 \$US per ha is allocated to new plantations. Nowadays, over 29000 ha in the country are equipped with drip irrigation system. The Souss valley alone has more than 22000 which represent more than 80% of citrus orchards in that area. Citrus water consumption in the Souss valley is about 7000 m³/ha (MADRPM, 2004).

Disease and pest control

As in the main producing areas of citrus, several diseases and pests are present. The most important are California scale (*Aonidiella aurantii* Mask), red mites, leafminer (*Phyllocnistis citrella* Staiton) and fruit fly (*Ceratitidis capit-*





Photo 5. Spraying of a citrus tree.



Photo 6. Locust attack and damage of citrus trees in the Souss Valley (2005).

part of the exterior canopy is required.

Pruning is part of the operations adopted to mitigate alternate bearing in citrus. However, application of plant growth regulators especially gibberellic acid (GA₃), is the most important technique used to reduce the alternate-bearing pattern of clementine mandarins. GA₃ is applied at 50% to 100% petal fall at rates of 10 to 15 ppm once or repeated within 2 week period. GA₃ is necessary in clementine to ensure good fruit set and reduce cross pollination thus limiting seeding of fruits. Several varieties such as Wilking, Nova and Ortanique increase seeds in Clementine fruit. Wilking mandarin widely grown until mid 70's was eliminated officially by law as it induces, by pollination, the production of many seeds in the fruit, which thus



ata). Other minor pests such as aphids and thrips are also present. Pest control is based on chemical sprays (Photo 5) but in few orchards, biological control was used. Two insectaries in the Souss Valley produce parasitoids against California scale (*Aonidiella aurantii* Mask). Common diseases of citrus in Morocco include Phytophthora gummosis and psoriasis. Nematodes are also present mainly in sandy soils. *Tylenchulus semipenetrans* and *Pratylenchus vulnus* were present in several orchards. When the problem is serious, granular nematicides are used.

Other pests include locust that may be devastating. Examples of locust damages to the citrus tree observed in the Souss Valley during the pest invasion in 2005 are shown in photo (6). It is important to notice that all the leaves of young trees and sometimes even the bark are damaged by the insect.

Pruning and alternate-bearing management. Most of the citrus trees are pruned annually to control tree vigor, fruit set and fruit size. Pruning is done manually with experienced labor in winter and spring just after harvest of each variety. The intensity as well as the type of pruning varies from one variety to another. For some varieties such as clementine Fina and Nules, the interior of the canopy is emptied to allow more light entrance, while for other varieties such as Clementine mandarin Nour, the removal of

affects the export quality of the clementines. Therefore, Wilking trees were topgrafted with another variety.

Other cultural practices

To ensure good production attention is given to tree protection from winds that can cause severe blemishes. Thus wind breaks are often used in most of the citrus areas in the country. Other practices include weed control and fruit thinning. Fruit thinning is done manually in some orchards when the tree load is high. However, the practice is not common as it is labour and time consuming.

During the first years of 2000, a large program of certification and traceability is adopted by growers of citrus. As most of the production is oriented to European markets, most of the growers are adopting Eurep GAP (European Retail Working Group produce Good Agricultural practices). These guidelines emphasise tracing and documenting various operations followed for production and handling the fruit. Other citrus producers are adopting Nature's choice certification package for the production oriented to English market. Organic citrus production is also increasing within the country and especially around Marrakech area.

Harvesting

Harvesting period starts at mid-September with very

early clementine varieties such as Bekria or Carte noire and Marisol and ends with Valencia late oranges in May to June of each year. The period of harvest and export of important varieties is shown in Figure (2).

Citrus type	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June
Oranges									
Navel									
Salustiana									
Sanguines									
Maroc late									
Easy peelers									
Clementine									
Nova									
Nour									
Afourer									
Ortanique									

Fig. 2. Period of production and export of different varieties. (EACCE, 2005)



Photo 7. Example of packinghouse in the Souss Valley, Morocco.

Harvesting operation is manual and requires a large number of workers. Fruits were picked either at mature green stage for degreening or at full orange colour stage. Picking stage corresponds to a total soluble solid (TSS) over acid (A) ratio (TSS/A) of about 7 to 8. Degreening is often required from the second week of October to the end of the first week of November.

Packinghouse operations

The actual number of packinghouses of citrus in the country is 61 with a total capacity of over 1.2 million tons. An important effort was given to packing infrastructures by the government. Large number of these facilities is adopting quality management systems. In fact, several of them are certified ISO 9001-2000 and few are certified BRC (British Retail Consortium) certificate. The implementation of the recent ISO 22000 protocols is also underway in several packing units. Each packinghouse employs

between 150 to 300 workers daily for up to 8 months a year (Fig. 9). Packouts are either sold in local markets or used for juice production. Parts of these discarded fruits for various reasons during sorting (small size, peel disorders and blemishes, etc) are exported to Spain.

Export

Over 40% of Moroccan citrus production is exported, mainly to Europe, Canada, Russia and Gulf States. Average export (% of total production) oscillates between 73% in early 70 s to less than 40% in the year 2000 as shown in Figure (3). The country is, therefore, classified as the 3rd or 4th largest exporter of citrus fruit and second for clementine mandarin after Spain in the Mediterranean basin.

The main destinations of Moroccan citrus are Europe and Russia for over 88%. North American countries imported about 9 to 10% of total export every year. The remaining part is exported to the Gulf States and African countries. Figure (4) shows export distribution of citrus fruits from Morocco.

For export to foreign destinations, ships with different

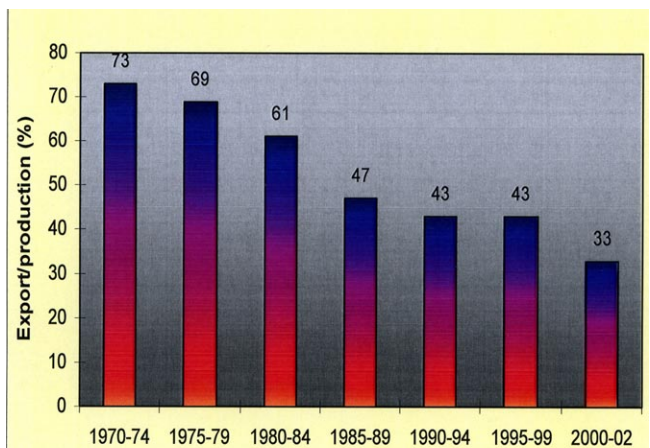


Fig. 3. Evolution (%) of export over production during the last 3 decades.

capacities were used. The main ports are Agadir, Casablanca and Nador. Time to destination varies from 5 to 13 days, respectively for Europe and North America.

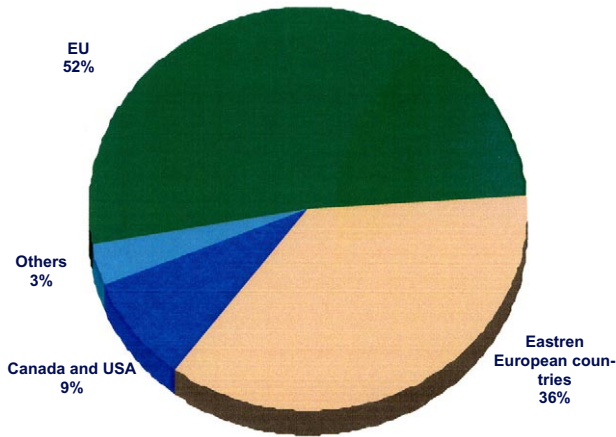


Fig. 4. Citrus export (%) by destination (EACCE 2005).

Conclusion

Moroccan citrus industry is under continuous changes, imposed by the high competition in the foreign markets

and the increasing demand and requirements of the consumer for quality produce. Some of these changes concern variety profile and the implementation of new techniques and technologies in order to reduce production cost, increase yield and improve fruit quality.

References

- EACCE. 2005. Etablissement Autonome du Contrôle et de Coordination des Exportations. Données générales des exportations des agrumes. www.eacce.org.ma
- MADRPM. 2004. Annual Report, Direction de la production végétale, Ministère d Agriculture, du Développement rural et de la pêche maritime, Rabat, Morocco.
- MADRPM. 2005. Annual Report, Direction de la production végétale. Ministère d Agriculture, du Développement rural et de la pêche maritime, Rabat, Morocco.

صناعة الموالح في المملكة المغربية

أحمد آيت أوباحو¹

الخلاصة

ما بين 500 و600 ألف طن من الموالح تُصدّر سنوياً من المغرب إلى الدول الأوروبية وأمريكا الشمالية. تتراوح المساحات المزروعة بالموالح في المملكة المغربية بما يناهز 76500 هكتار التي تُنتج سنوياً ما بين 2.1 إلى 5.1 مليون طن. أسباب هذه التغيرات في الإنتاج تعود إلى بعض الأمراض مثل الكوموزيس والفيروسات، إلى شيخوخة بعض المزارع حيث يتعدى عمر 55% من الأشجار 30 سنة وتصل نسبة الأشجار التي تخطت عمر 40 عاماً ما بين 8 إلى 10%. كما أنّ الجفاف الذي ساد في السنوات الأخيرة وخاصة في وادي سوس ساهم على انخفاض الإنتاج كمّاً ونوعاً.

¹ معهد الحسن الثاني للزراعة والبيطرة، ص.ب. 1123 أنغادير 80000 المملكة المغربية، هاتف/ فاكس: 8248892 (2) (+212)، بريد إلكتروني: aoubahou@iavcha.ac.ma
aitoubahou@yahoo.fr