

Citrus

A report by Eric Imbert

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The 2009-10 winter citrus programme should do a lot of good to Mediterranean growers suffering from a succession of poor economic performances in preceding seasons. The production deficit in Spain, the main export source, means that supplies should be medium to light supplies on the major Western European markets, with a return to good prices at all stages in the chain—especially for oranges and easy peelers. Nevertheless, this season will not erase the deep-seated problems experienced by the citrus sectors in certain countries. Changes in comparison with last season reveal the traces left by a succession of crises in recent years and confirm the major current trends in Mediterranean citrus growing. Although cultivated areas are tending to stabilise or even decrease in the main EU producer countries in which cost prices are high, the increase is continuing strongly in Turkey and Egypt, while Morocco is displaying fresh ambitions.



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Winter citrus

Medium-term trends for Mediterranean production



Régis Domergue

Easy peelers — Mediterranean
Exports by main exporting countries

000 t	2002-04 average	2007-09 average	Evolution
Spain	1 387	1 424	+ 37
Turkey	228	301	+ 79
Morocco	204	283	+ 24
Italy	31	60	+ 73
Israel	28	52	- 5
Cyprus	32	26	+ 29
Greece	30	24	- 6
Egypt	7	11	+ 4
Total	1 945	2 181	+ 236

Source: CLAM

Easy peelers — Mediterranean — Production and outlets

000 t	2002-04 average	2007-09 average	Evolution
Production	4 257	4 963	+ 706
Domestic sales	1 658	2 101	+ 443
Industry	419	351	- 68
Losses/withdrawals	213	315	+ 102
Export sales	1 967	2 196	+ 229

Source: CLAM

With a harvest of some 19 million tonnes per year, the Mediterranean region is one of the main centres for citrus production in the world, just behind Brazil and China. The region has a strategic position as it controls more than 50% of world trade in fresh citrus. Harvest forecasts for the 2009-10 season were published at the meeting of the Mediterranean Citrus Liaison Committee (CLAM) held in Madrid at the end of October. Changes in comparison with last season are particularly interesting as they are strongly representative of current trends in Mediterranean citrus production. **Fruitrop** reviews the situation.

EASY PEELERS

Star Mediterranean production in search of its second wind

The 4.8 million-tonne forecast for easy peelers in 2009-10 seems to confirm the trend for the stabilisation of Mediterranean production. The Mediterranean controls over 70% of world trade in this category of citrus and production has hardly changed for three seasons. This dull situation followed a period of tremendous growth with a production increase of about 1 million tonnes in less than a decade. The cause is the fresh fruit market—practically the only outlet for easy peelers. In years of positive alternate bearing, the markets have to handle 500 000 to 650 000 t per month from November to January and are saturated. Financial results have frequently been disastrous for growers in recent seasons, especially in countries where cost prices are high. As a result, planting has come to a halt in Spain, which controls more than 40% of Mediterranean easy peeler production and accounted for the greater part of growth in recent years. The annual rate was more than 2 million trees until 2003-04 and then fell, hardly exceeding 500 000 trees in 2006-07 (the most recent data available).

Two main lines of growth can be used by Mediterranean producers in the years to come. The first targets the growth of markets where the standard of living is at an intermediate level, and in particular Eastern Europe. Consumption per person is still moderate, leading to considering that this approach has very significant development potential that is closely correlated with economic growth. Cost price and attractive supply features (long production calendar and the organoleptic qualities



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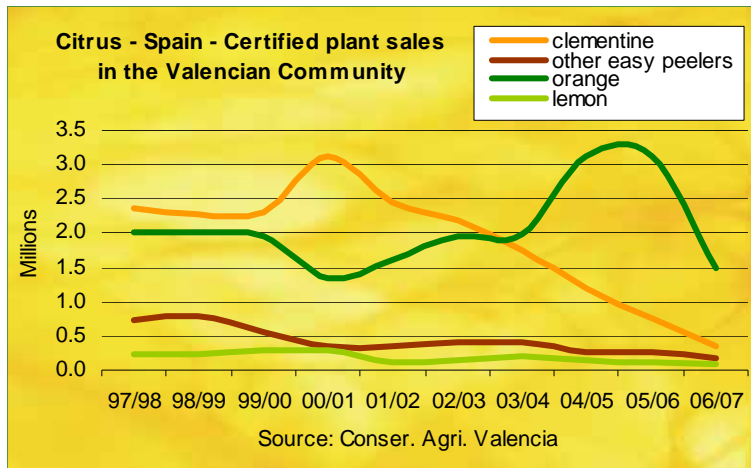
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of the varieties shipped) will be the key criteria in the choice of potential suppliers. The second line aims at increasing consumption during the second part of the season, especially on the profitable Western European markets. This means changing the range of varieties available from February onwards for example by replacing 'Fortuna' from Spain and 'Ortanique' (Spain, Morocco, Israel and Cyprus) by cultivars with more agricultural or commercial advantages (seedless, easy peeling, etc.). This is happening in the countries that are most advanced in varietal range but growth potential should not be overestimated. In the medium term, triploid varieties should allow even greater lengthening of the season (spring) and ensure complete absence of seeds. However, we shall have to wait for a few more years for these cultivars to receive technical validation and then be able to give a more marked boost to Mediterranean production.



ORANGE

Moderate but steady growth

The slight but steady increase in orange production (+ 4% from 2008-09 to 2009-10) is also a sign. This stately progress has allowed Mediterranean production to gain more than 700 000 t in five years, clearing the 10-million tonnes mark in 2006-07 and approaching 11 million tonnes this season (10.7 million tonnes expected in 2009-10). This increase has benefited first of all domestic markets in 'emerging' countries (Morocco, Turkey and Egypt) whose harvest has gained more than 400 000 t during the same five-year period. Given the increase in population, this trend will not reverse in the years to come. For example, taking the countries for which it is possible to make consumption estimates with a degree of reliability (Morocco, Turkey, Egypt and Tunisia), the population increase of 30 million expected by

2020 represents an increase of some 350 000 t in the quantities to be sold. This figure should be adjusted in the light of possible transfers of orange consumption to easy peelers and also changes in diets in favour of healthy foods such as fruit and vegetables made possible by an increase in the standard of living.

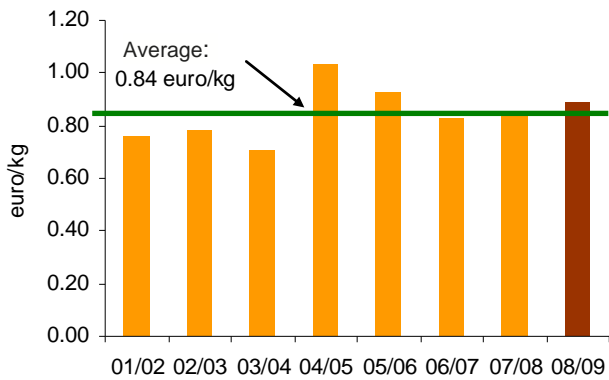
Increases in exports have been more moderate, with precise geographic targeting. Imports by the eastern countries, and especial those outside the EU (Russia, Ukraine, etc.) have continued to increase steadily. In contrast with forecasts, total citrus consumption in the new member

countries (NMCs) has remained practically stable at 760 000 t, but consumption transfers totalling some 50 000 t have taken place at the expense of oranges. Growth of the Middle East-

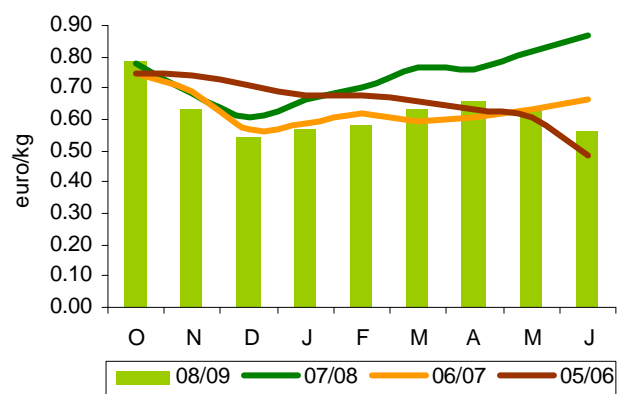
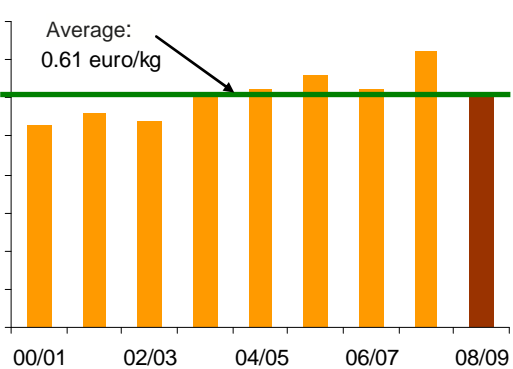
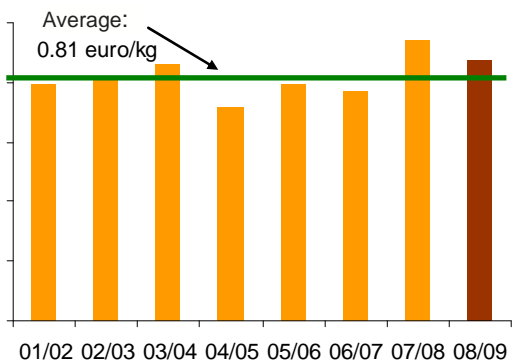
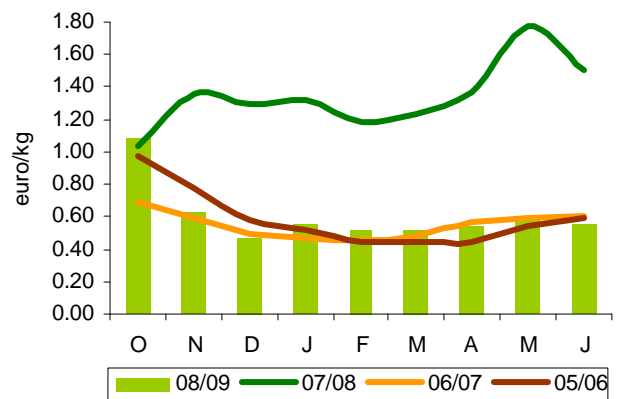
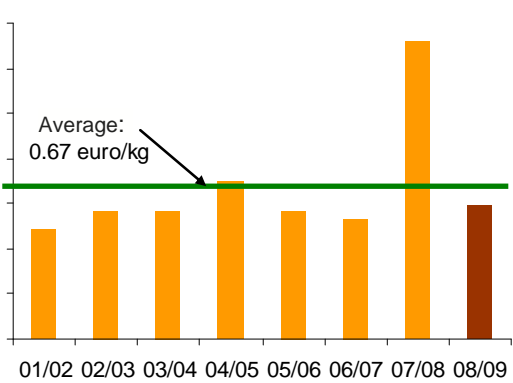
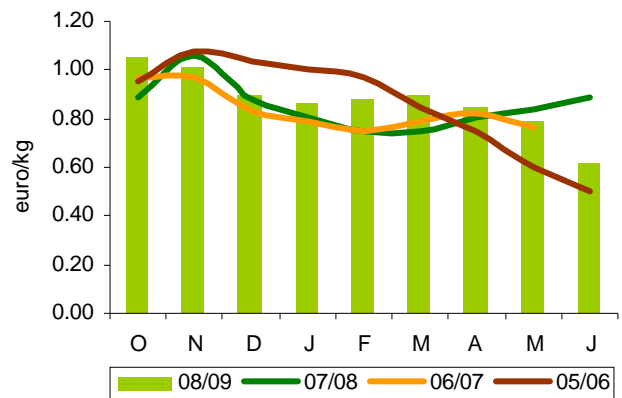
Easy peelers — Mediterranean — Marketing calendar											
		S	O	N	D	J	F	M	A	M	
Clementine	Clemenrubi										Spain
	Marisol										Spain
	Oronules										Spain
	Clemenpons										Spain
	Fine										Corsica, Morocco
	Oroval										Spain
	Orogrande										Spain
	Nules										Spain
	Hernandina										Spain
	Nour										Morocco
Other easy peelers	Nova (Clemevilla, etc.)										Spain, Morocco, Israel, Turkey
	Minneola										Israel, Turkey, Cyprus
	Nadorcott										Morocco, Spain
	Or										Israel
	Fortuna										Spain
	Ortanique										Morocco, Spain, Cyprus, Israel

Photo © Régis Domergue

Average import price in France



Average monthly import price in France



ern markets has been much more distinct. Volumes have doubled in five years to some 500 000 t thanks to the efforts made on development by Egyptian exporters to neighbouring countries and, more recently, by Turkish exporters to Iraq. This trend should also be confirmed in the coming years. The growth period seems to have finished on the Western European markets and sales of fresh oranges seem to be competing with increasing supply pressure from easy peelers at the beginning of the season and richer, higher quality orange juice supplies. The emergence of a good quality range of table oranges ('Lanelate', 'Navelate', etc.) has enabled the market to stabilise at about 1.6 million tonnes but at the price of a shift of consumption to the second or even the third part of the season! The very late cultivars mean that Mediterranean sources can now provide substantial supply to the market in the spring and even the beginning of the summer. This shift means that southern hemisphere exporting countries have to re-deploy part of their 'Navel' harvest to other markets, especially those of the Middle East. The 2009 summer season was a perfect illustration of these changes. The Spanish 'Valencia Late' season continued until August-September in the EU and the volumes of 'Navel' from South Africa sank below 7 million boxes after oscillating between 8 and 9 million boxes in preceding seasons.

LEMON

Crisis and stabilisation and even decrease of planted areas

The decrease in lemon production expected in 2009-10 seems to confirm the tendency for Mediterranean production to shrink. The harvest reached nearly 3 million tonnes in 2006-07 and will probably hardly exceed 2.5 million tonnes in 2009-10. The cause of the strong decrease is mainly conjunctural but it also illustrates the crisis experienced by the sector, especially in producer countries with the highest cost prices. The rocketing of world production since the mid-1990s has saturated all market segments. Fresh lemon sales are stagnating in Western Europe while the growth of Eastern European markets is fading—sales even decreased last season because of the economic slump. There do not seem to be many new markets to gain, given the competition from lime throughout the tropics and limited interest in acid products in Asia. And will the good concentrated juice market behaviour observed since 2008 continue? The cause is conjunctural to a considerable degree, related to the weather problems in Spain and California in 2007.

As a result, orchards are being grubbed up and abandoned in Spain, the country that is hardest-hit as production costs are high and drought is becoming increasingly severe. Professionals consider that present production totalling nearly 1 million tonnes should be reduced by about 20%. Planted areas do not seem to be increasing in Turkey either, even if increased growth on the Eastern European markets is very recent. The planted area seems to be stabilising. There remain the ambitions of Egypt. Growers harvest some 300 000 t of Mediterranean sweet lemon for the domestic market and for neighbouring countries and would like to de-

Orange — Mediterranean — Production and outlets			
000 t	2002-04 average	2007-09 average	Evolution
Production	9 824	10 613	+ 790
Domestic sales	4 553	5 455	+ 902
Industry	1 971	1 683	- 289
Losses/withdrawals	448	489	+ 40
Export sales	2 851	2 986	+ 135

Source: CLAM

Orange — Mediterranean Exports by main exporting countries			
000 t	2002-04 average	2007-09 average	Evolution
Spain	1 450	1 348	- 102
Egypt	437	806	+ 369
Morocco	256	295	+ 38
Greece	299	218	- 81
Turkey	164	199	+ 35
Italy	82	92	+ 10
Israel	28	28	- 1
Cyprus	33	15	- 18
Total	2 796	3 000	+ 204

Source: CLAM



Lemon — Mediterranean Exports by main exporting countries			
000 t	2002-04 average	2007-09 average	Evolution
Spain	525	385	- 140
Turkey	176	277	+ 102
Italy	19	44	+ 26
Egypt	9	25	+ 16
Morocco	-	11	+ 11
Cyprus	13	5	- 8
Israel	2	3	+ 1
Greece	19	1	- 18
Total	762	751	- 11

Source: CLAM

Lemon — Mediterranean — Production and outlets			
000 t	2002-04 average	2007-09 average	Evolution
Production	2 385	2 374	- 11
Domestic sales	929	1 134	+ 205
Industry	484	373	- 111
Losses/withdrawals	209	113	- 96
Export sales	763	754	- 9

Source: CLAM

FRESH CITRUS



BORN IN TURKEY



Grapefruit — Mediterranean — Production and outlets

000 t	2002-04 average	2007-09 average	Evolution
Production	497	602	+ 105
Domestic sales	61	104	+ 42
Industry	194	183	- 12
Losses/withdrawals	2	37	+ 34
Export sales	240	280	+ 40

Source: CLAM

Grapefruit — Mediterranean
Exports by main exporting countries

000 t	2002-04 average	2007-09 average	Evolution
Turkey	107	130	+ 23
Israel	67	83	+ 16
Spain	31	37	+ 6
Cyprus	28	16	- 11
Egypt	0	7	+ 7
Italy	5	3	- 2
Greece	2	1	- 1
Total	239	277	+ 38

Source: CLAM

velop export plantations, especially in the Nile Valley between Cairo and Aswan.

GRAPEFRUIT

Back in favour...
probably a short-lived trend

Mediterranean grapefruit production will increase considerably once again, exceeding the peak recorded in the last 10 years. The harvest decreased until the mid-2000s but has gained more than 100 000 t since 2004-05. However, the 650 000 t forecast put grapefruit way behind the other groups of citrus fruits that are Mediterranean specialities. What is behind the increase? It is certainly not the still disastrous economic returns on the concentrated juice market. The white grapefruit orchard area—devoted mainly to this outlet—is shrinking steadily in the Mediterranean area. However, the fresh fruit market is opening up. First, the Eastern European markets have doubled and now equal the 120 000 to 130 000 t sold in Western Europe. In addition, the collapse of production in Florida, the main supplier of Western Europe, has benefited Mediterranean sources.

Some producer countries such as Israel, and Spain to a lesser degree, have gambled on re-launching the planting of coloured grapefruit. Thus, although the white grapefruit harvest should continue to decrease, that of red and pink varieties should continue to grow, but at a more moderate rate. Cultivated areas seem to have stabilised in Turkey. Likewise, planting seems to have stopped in Israel. However, the young orchards planted in recent years should nevertheless take production

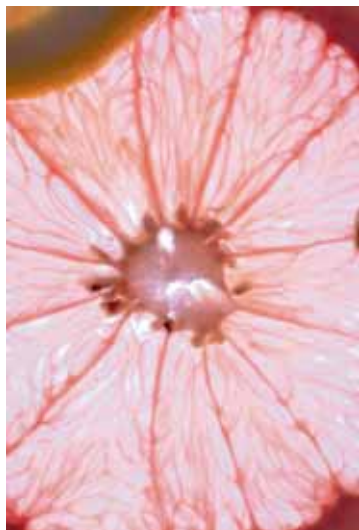
to 140 000 t in the near future, a 40% increase on today's crop. A slight increase is also expected in Spain. Egypt seems to have ambitions for grapefruit and some growers wish to invest in the crop.

Decline or stagnation
amount EU producers

The evolution of production in each of the major countries also seems to be typical of their current dynamics. Growth seems to have stalled in the major EU production countries. These are confronted with an increasingly competitive market, high production costs and sometimes an increasing shortage of water. The Italian harvest is thus tending to decrease with the end of processing subsidies and the country's lack of competitiveness on both the export market (an average of 200 000 t is exported when production exceeds 3.5 million tonnes in a normal year) and the domestic market (Italy is a net importer of citrus). The same can be seen in Greece, where the harvest has decreased by some 300 000 t in the last five seasons. Competitiveness on the fresh fruit market is also involved there. The decrease is even more noticeable in Cyprus, where production has decreased by more than half in ten years and is now only 150 000 t (shortage of labour and especially of water for agriculture, ageing varietal range). The Spanish giant is also affected. Production had increased steadily until the mid-2000s but is now tending to stabilise. It should not change much in the medium term as the Western European markets are saturated and this is where 90% of Spanish sales go. New plantations should only be to supply high value-added segments, and especially easy peelers for the end of the season, such as 'Nadorcott', whose production should soon exceed 100 000 t.

Turkey and Egypt are accelerating!

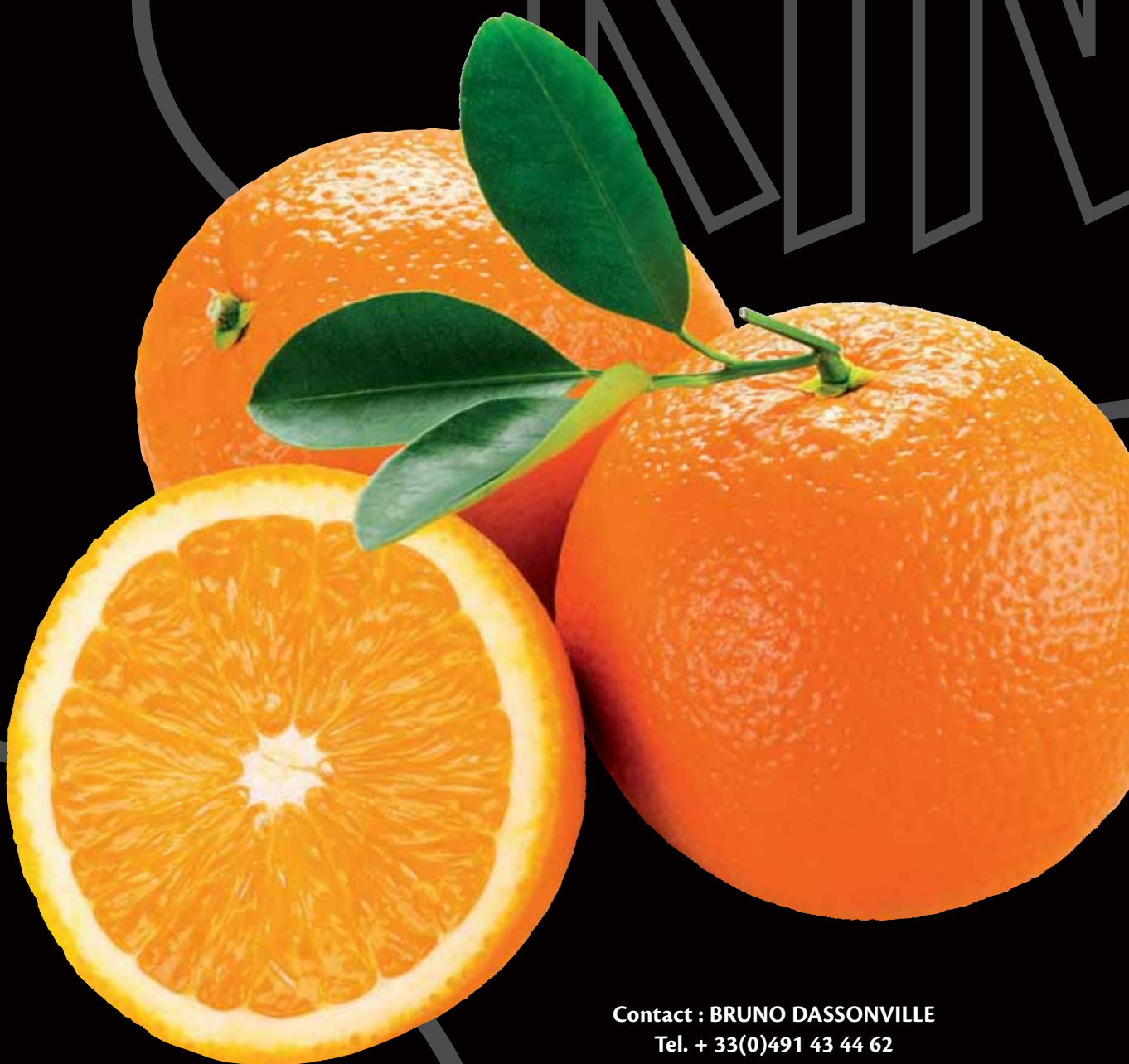
The 'new' major exporting countries should continue to maintain the dynamics of Mediterranean production. Egypt is indubitably one of the emerging powers in the region. Production has increased by about 1 million tonnes in 10 years and, with a harvest approaching 3.5 million tonnes, the country has become the second largest Mediterranean producer. Exports have also rocketed, with shipments increasing fourfold in the last decade and now approaching 900 000 t. And Egyptian professionals do not seem to want to stop there. The declared target is production of 5 million tonnes and exports of 1.2 million tonnes in five years. Planting is still brisk in the new perimeters in the desert and in the upper Nile Valley and yields are increasing. Another objective is the broadening of today's varietal range for export that consists mainly of Navel and Valencia. The easy peelers and sweet lemons grown today can only be sold on the domestic market. However,



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Packing station
in Turkey



Citrus orchard
in Egypt

although Egypt has advantages in terms of water supply and labour cost, will climate and local conditions allow the development of competitive early and late citrus production?

The growth of Turkish citrus growing is no less spectacular as production has increased by about a million tonnes in a decade and now stands at 2.8 million tonnes. The growth of the domestic market and growing demand in the Eastern European countries (Russia, Ukraine and Romania) are the two driving forces behind this trend. Turkish exports cleared a million tonnes in 2008-09, making it the second largest Mediterranean exporter after Spain and ahead of Egypt. Although the areas under lemon and grapefruit seem to be stabilising, oranges and easy peelers are still making progress and fresh increases in production are to be expected with the aim of shipping larger quantities to the Eastern European countries. As in Egypt, the economic model of citrus growing is based above all on cost price competitiveness. The range of varieties is still very traditional in oranges and above all in easy peelers.

Strong Moroccan ambitions

Morocco may well provide the main impetus for growth in the coming years. Production has stagnated at 1.3 million tonnes since the beginning of the decade and should now increase rapidly and even more than double by the end of the decade according to the road map set for the profession by political decision makers (see box). Even if this seems a very ambitious target, it is true that Morocco does not lack advantages, especially as regards easy peelers. Cost price is competitive and the range of varieties matches the expectations of the European market at the end of the season (especially with 'Nour' and 'Nadorcott'), differentiating the sources from Turkish competition on the Eastern European markets.

The major markets for the next decade?

Although it seems almost impossible to perform a quantitative study as the geographic scale is large and production varied, some quality features give an idea of trends. First, domestic markets are growing in emerging countries where production should increase strongly in the coming years and would

Citrus — Mediterranean — Extrapolation of domestic market consumption to the other countries of the region			
	Population (million)		Potential increase of citrus consumption (000 t)
	present	in 2020	
Algeria*	35.4	40.6	115.5
Jordan*	6.5	7.5	23.2
Libya*	6.5	7.7	25.6
Syria*	22.5	26.5	88.1
Lebanon*	4.3	4.6	7.4
Morocco	32.4	36.2	84.7
Egypt	84.5	98.6	314.2
Turkey	75.7	83.9	181.2
Tunisia	10.4	11.4	22.0
Total	278.1	317.0	861.7

* present consumption is for the average for Morocco/Egypt/Turkey/Tunisia, for lack of information / Source: CLAM – population forecast: UNO

Citrus — Mediterranean — Extrapolation of consumption on local markets											
	Current population	Consumption in 2007-09				Population in 2020		Consumption in 2020			
		Total citrus		Oranges		Total	Increase	Total citrus		Oranges	
		million	000 t	per capita	000 t	per capita	million	million	000 t		000 t
								in 2020	evolution	in 2020	evolution
Morocco	32.4	693	21.4	454	14.0	36.2	3.8	775	+ 81	508	+ 53
Egypt	84.5	2 112	25.0	1 158	13.7	98.6	14.2	2 466	+ 354	1 352	+ 194
Turkey	75.7	1 431	18.9	912	12.0	83.9	8.2	1 585	+ 154	1 010	+ 98
Tunisia	10.4	265	25.5	150.5	14.5	11.4	1.0	290	+ 25	165	+ 14
Total	202.9	4 501	22.2	2 674.5	13.2	230.1	27.1	5 103	+ 602	3 035	+ 360

Source: CLAM – population forecast: UNO

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Removal of HLB contaminated orange trees, at the border of a commercial orchard (Brazil)

HLB, or greening: a new threat to Mediterranean citrus

Huanglongbing (HLB, meaning 'yellow shoot disease'), is one of the nine citrus diseases known to be spread by both grafting, and natural contamination through insect vectors. In the past decade, the disease has gained pandemic status as a result of man's activity, possibly combined with

climatic change, thus allowing vector and pathogen alike to move long distances and threaten the major citrus producing areas of the world. The Mediterranean area is still unaffected but will not avoid the disease.

Asymmetrical blotchy mottle of leaves, with regard to the main leaf vein



© Joseph Bové

In June 2009, **FruiTrop** (168) published a full review of knowledge of this disease and the measures to be taken.

The article is in French, English and Spanish and can be downloaded free of charge from

<http://passionfruit.cirad.fr>

seem to form considerable scope for increased sales. If the somewhat simple calculation made for orange is extended to cover all citrus, the figure is 900 000 t (see table). The trend in exports to the Western European markets seems to be more qualitative substitution than an increase in the quantities shipped. This approach should not be neglected by producer countries where production costs are high as it is a way of increasing value-added. The development in the medium term of a spring easy peeler market could give fresh impetus. Likewise, the efforts made to enter the profitable Asian markets should be maintained, even if procedures are a constraint.

Meanwhile, it seems that an increase in volumes should be sought more on the Eastern European markets. Apparent consumption is still much smaller than in the other EU countries whereas a colder climate and smaller competition from spring produce are in favour of high citrus consumption. This is still a strong argument even if the orange market in the NMCs is a strong exception to the argument. The return of economic growth appears to be a determinant feature in the rate of expansion of these markets. However, the rise in the standard of

living will cause changes in demand that should not be ignored. Qualitative requirements will also increase and the countries with a citrus sector whose economic model is based on a good compromise between a competitive range and attractive production costs seem to be in the best position to benefit from the growth of these markets. Here, Morocco seems to be in a better position than Egypt or Turkey. The dynamics of the Far Eastern markets where produce of standard quality is still welcome also has significant potential for the coming years.

New markets for the Mediterranean in the medium term as a result of the spread of greening?

Finally, the impact of a spreading disease such as greening on world citrus growing should not be ignored. The consequences of this bacterial disease on production in Florida could change the situation on the processed orange market in a radical manner. If the recovery of world demand is confirmed, the Mediterranean might find a position among the new players, at least for segments with the greatest value-added, such as NFC juice (not from concentrate).

The arrival and spread of the disease in California, where the psyllid vector was observed in 2008, would cause a total, long-term change in the world fresh market landscape. The 110 000 hectares of citrus in California yields more than 3 million tonnes of fruits, 2.5 million tonnes of which is sold on the fresh market. The region makes a large contribution to the 600 000 tonnes of oranges and lemons shipped from the United States each year—mainly to Canada, Korea and Japan. However, Mediterranean producers should also think of protection against the arrival of this devastating disease, whose most virulent form is at the door, in the east of the zone ■

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Citrus — United States exports — Total volumes and main destinations

000 t	2002	2003	2004	2005	2006	2007	2008
Japan	334 747	347 652	243 321	251 626	295 396	301 405	242 200
Canada	272 426	271 992	252 064	245 283	190 173	280 422	230 582
South Korea	144 264	164 316	131 759	123 529	101 200	127 644	83 314
Hong Kong	87 244	88 537	78 940	92 303	46 079	68 426	82 668
China	37 592	34 586	32 449	37 294	20 282	36 621	43 745
France	32 462	38 200	16 046	15 926	25 538	29 792	23 695
Australia	11 080	16 147	15 032	16 223	18 739	35 960	22 267
Netherlands	26 396	37 976	24 006	15 173	23 639	34 280	22 089
Malaysia	32 930	29 756	24 011	30 703	10 427	25 779	19 252
Singapore	20 816	19 611	16 927	17 263	5 211	16 292	14 242
Unit. Arab Em.	591	1 430	1 320	1 511	190	16 790	12 243
Mexico	28 005	18 156	26 137	22 315	15 153	21 894	10 093
Total	1 109 224	1 147 848	921 336	924 980	805 477	1 075 014	870 485

Source: USDA

Citrus — Evolution of apparent consumption
of 8 NMCs that joined the EU in 2004

000 tonnes	2002-03 average	2007-08 average	Evolution
Total	761 052	809 387	48 335
By group of citrus fruits			
Easy peelers	242 640	319 289	+ 76 649
Orange	303 052	279 507	- 23 545
Lemon	157 618	145 649	- 11 969
Grapefruit	57 742	64 941	+ 7 200
By country			
Czech Rep.	137 501	140 794	+ 3 293
Hungary	100 178	71 469	- 28 709
Poland	372 176	393 688	+ 21 512
Slovakia	56 653	60 227	+ 3 575
Slovenia	31 091	62 178	+ 31 088
Baltic states	63 453	81 031	+ 17 577

Citrus — Evolution of apparent consumption
of 2 NMCs that joined the EU in 2008

000 tonnes	2002-03 average	2007-08 average	Evolution
Total	150 829	204 555	+ 53 726
By group of citrus fruits			
Easy peelers	26 035	47 133	+ 21 097
Orange	77 403	80 772	+ 3 370
Lemon	30 770	36 604	+ 5 834
Grapefruit	16 620	40 046	+ 23 425
By country			
Bulgaria	46 073	47 584	+ 1 511
Romania	104 756	156 971	+ 52 215

Citrus — NMCs — Apparent consumption

	Population (million)	Consumption kg/capita/year
Czech Rep.	10.2	13.8
Hungary	10.1	7.1
Poland	38.2	10.3
Slovakia	5.4	11.2
Slovenia	2.0	31.1
Baltic states	7.1	11.4
Total 8 NMCs	73.0	11.1
Bulgaria	7.7	6.2
Romania	22.3	7.0

Source: EUROSTAT

Citrus in the NMCs:
different trends

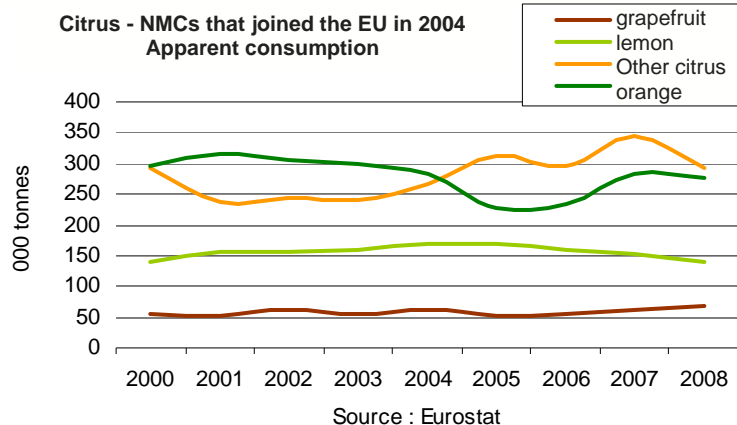
The joining of the EU by eight Eastern European states in 2004 was welcomed with enthusiasm by the major citrus exporting countries around the Mediterranean. The economic growth resulting from manna from Brussels would certainly result in increased citrus consumption, whose close correlation with the rise in GDP has been demonstrated. Five years later, it has to be admitted that the results are more than mixed and certainly far from matching the expectations of Mediterranean producers. Overall, customs figures show that total volumes have remained similar to those of before EU enlargement, that is to say an annual 760 000 to 770 000 t. The sudden jump in 2007, a year of overproduction and low prices, and the general slump in 2008 resulting from the financial crisis show the extent to which these markets are sensitive to the prices applied and to the economic context.

A few positive signs in trends by category of produce stand out from the clearly negative ones. The increase in sales volumes of easy peelers and grapefruit has been steady and significant. Annual consumption per person of easy peelers is still 1.5 kg less than in Western Europe, seeming to indicate considerable scope for growth. In contrast, is the grapefruit situation becoming stable as consumption levels are now similar? The trend for lemons is more disturbing. Imports in the region seem to be in the process of peaking at about 200 000 t whereas annual consumption per person is more than 40% less than in West Europe. Oranges are the most disappointing case as the volumes sold have decreased since EU enlargement. Might this be a transfer of consumption benefiting easy peelers? However, volumes seem to be increasing again and the scope for progress is enormous when it is observed that consumption levels in the region are hardly a quarter of those of Western Europe.

Trends vary considerably in consumer countries as well. The Baltic countries, Slovenia and, to a lesser degree, Poland and Slovakia display good progress. In contrast, consumption is stable in the Czech Republic and purchases are dwindling in Hungary.



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Citrus - NMCs that joined the EU in 2004
Apparent consumption

Source : Eurostat



7 - 9 February 2008

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Moroccan citrus: lofty ambitions

The setting up of the 'Green Morocco' plan shows the determination of Moroccan political leaders to re-establish agriculture in the centre of the economic development of the country in the coming decade. The vast renovation and overall development programme for the farming sector has two main axes. Traditional agriculture must be brought up to date, especially in the most depressed areas, in an approach that is not only economic but also social (fight against poverty, settlement of rural populations, etc.) and environmental (especially water management). The cereal sector, which uses large quantities of water and is not very productive, is targeted in particular. The plan also covers high value-added export crops, aiming at enhancing competitiveness at the international level but making more use of Morocco's assets in terms of labour cost, know-how and closeness to the large European market. It also takes into account the country's weaknesses in water resources as 80% of its area is now classified as semi-arid.

The ambition for the citrus sector is to increase production from some 1.3 million tonnes to 3.8 million tonnes by the end of the next decade may seem enormous. But beyond the figures, it shows above all the strong intentions of the Moroccan sector. Serious efforts will be made to increase productivity that is currently too low at 15 t/ha for all plantations and about 26 t/ha when only the truly productive orchards are counted. Professionals will thus address the problem of ageing orchards, a particularly marked feature for clementine and 'Navel' oranges in the Gharb and the Moulouya. The 2006 census shows that 40% of the trees in Morocco are more than 25 years old, of which some 25% are more than 34 years old. In all, about 30 000 ha of old orchards should be rehabilitated. The improvement of water use is also one of the levers to be used by professionals. Great efforts have already been made since the early 2000s and the proportion of trickle irrigation increased from about 10% and reached some 50% in 2006. However, gravity irrigation is still commonly used in the Gharb, the Loukkos and the Moulouya. The aim is to achieve practically total coverage by trickle irrigation by 2018.

The installation of 20 000 ha of new orchards is also scheduled.

Incentives will be set up to encourage growers to use registered seedlings with the best commercial potential. The new orchards will be targeted geographically according to the water supply potential in each region. Most of the new plantings will therefore be in the Gharb. No large-scale developments are planned in the more arid areas like the Souss, currently the leading production region. The research and development dimension has not been forgotten and a citrus sector technical institute will be established to provide support for growers, especially in irrigation, choice of varieties and rootstocks.



The plan is also aimed at developing, modernising and grouping the constituents of the chain from packing to dispersal on the destination markets. Packing stations will be modernised and new large units set up. Maintaining the cold chain and concentrating flows will be key features of the policy for the renovation of logistics. Sea transport will return to a leading position and two or three port platforms will be set up for the distribution of produce to the various European markets.

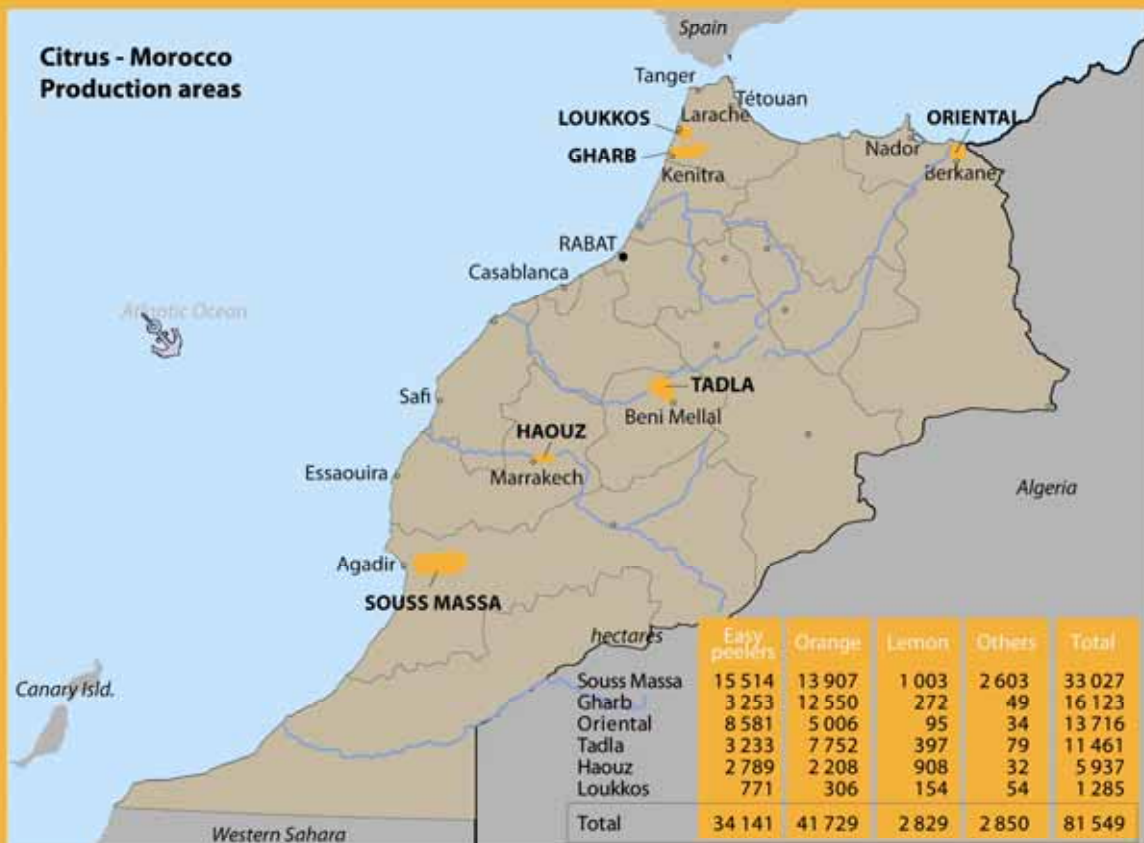
And what about the major question of the funding of these operations? The Moroccan government will provide funding and will use tax credits in particular to subsidise investments in micro-irrigation, the purchase of registered planting material, the renovation of packing stations and part of the technical institute. However, it is aimed to attract private national or foreign investment by improving the profitability of the sector. The success in recent years of the two privatisation operations concerning SOGETA land showed that this is possible.

The response of markets is another big question. An increase in domestic sales is important but seems realistic in the light of the increase of the population and a higher standard of living. The volumes processed remain modest but will probably ensure a minimum supply level. The main challenge is more that of the development of export markets. The figures in the plan show an increase from about 500 000 to 600 000 t per year to 1.3 million tonnes. Morocco has advantages as cost prices are low and the varietal range of easy peelers is very competitive in the second part of the season.

The Moroccan sector is growing even before the start of the operational phase of the plan, in particular thanks to the investments made in the recently privatised SOGETA orchards. The areas cultivated in 2009 should make it possible to attain annual production of 2 million tonnes towards 2015.



CITRUS IN MOROCCO

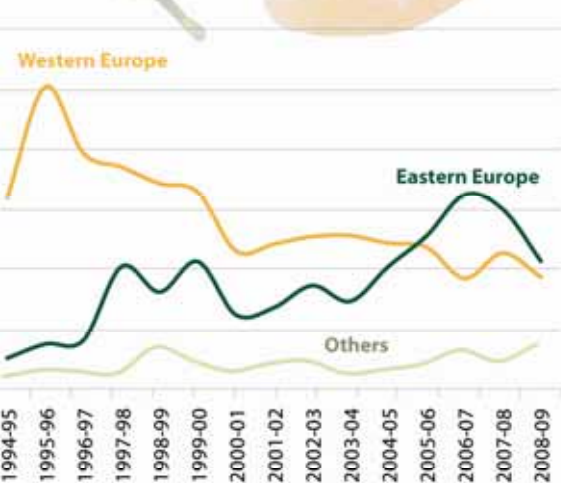
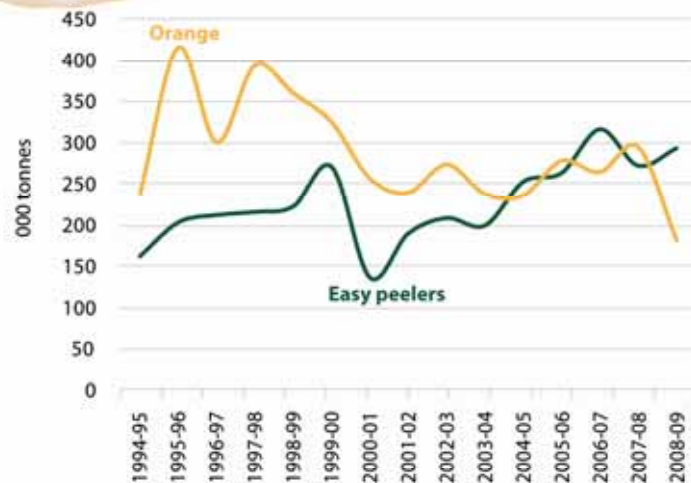


Citrus - Morocco
Composition of the planted area in 2006
Hectares

Easy peelers	Clementine	24 631
	Nour	5 678
	Total clementines	30 309
	Ortanique	569
	Nova	652
	Afourer	723
Orange	Others	1 888
	Total easy peelers excl. clementine	3 832
	Total easy peelers	34 141
Orange	Naveline	1 716
	Navel	12 538
	Navelate	1 762
	Total Navel group	16 016
	Blood Washington	2 269
	Other blood oranges	237
	Total blood oranges	2 506
	Salustiana	1 226
	Valencia Late	21 480
	Hamlin	230
Lemon	Total orange for juice	22 936
	Others oranges	271
	Total oranges	41 729
Grapefruit	Lemon	2 829
	Grapefruit	76
	Others	2 775
Total citrus		81 550

Tonnes 98-99

Easy peelers	Clementine	163 885
	Nour	21 001
	Nova	5 573
	Ortanique	26 478
	Nadorcott	1 960
Orange	Others	3 579
	Total easy peelers	222 477
Orange	Navel	63 239
	Navelate	-
	Maroc Late	240 302
	Salustiana	28 250
	Blood oranges	28 914
Lemon	Total oranges	360 705
	Lemon	71
	Grapefruit	80
Grapefruit	Others	-
	Total citrus	583 332

**Citrus - Morocco
Plantation age****Citrus - Morocco
Exports by destination****Citrus - Morocco
Exports by product****Citrus - Morocco - Exports by variety**

99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09
193 502	95 777	122 434	139 120	143 062	169 854	189 945	201 180	181 638	180 515
38 618	14 581	39 658	47 554	36 752	63 313	48 159	91 933	59 907	86 671
7 054	4 461	5 261	6 062	1 893	3 943	3 780	3 243	6 041	4 832
20 683	14 015	13 252	5 859	8 805	8 435	10 729	8 186	10 435	8 090
5 412	4 682	6 744	7 416	7 365	6 010	9 922	11 617	11 731	13 248
5 506	2 258	2 148	2 363	1 148	1 161	763	277	2 403	153
270 775	135 775	189 496	208 375	199 025	252 716	263 296	316 436	272 155	293 510
61 672	18 991	31 900	35 560	13 493	39 311	23 305	30 274	31 965	24 346
-	-	-	-	-	-	-	-	-	1 387
196 199	193 011	153 297	175 527	178 277	135 542	187 585	163 389	192 790	106 925
37 117	20 367	27 827	31 170	24 017	29 530	29 533	31 880	28 146	19 269
30 745	24 729	27 083	33 327	22 880	32 241	38 455	39 405	43 200	30 504
325 733	257 097	240 106	275 584	238 666	236 624	278 877	264 948	296 101	182 430
78	45	36	47	44	63	2	365	13 130	5 968
65	347	391	459	288	472	487	1 238	1 347	1 240
-	0	0	-	-	0	-	-	0	-
596 650	393 263	430 029	484 466	438 022	489 875	542 663	582 987	582 733	483 147

Source: EACCE, professional source

Graphics: Chez Vincent



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Citrus in the Mediterranean region Forecasts for the 2009-10 season Towards a supply deficit on the Western European markets



After a substantial 2008-09 season (the second largest by volume after 2006-07), the Mediterranean citrus harvest will return to an average level in 2009-10. However, the return to an average production level in Italy, where one of the main outlets is the processing industry, masks the deficit in Spain, the main exporting country. As a result, there should tend to be a deficit in exports of easy peelers and especially oranges and lemons to the West European countries that account for more than 80% of Spanish shipments. Morocco, with an average harvest, should seize this opportunity. In contrast, the major exporting countries (Egypt and Turkey) whose natural markets tend to be in the eastern EU and in the Middle East, should have very large or even record harvests. Supply to these destinations should be very large, especially as regards oranges. In this context and given the fragility of these markets last year as a result of the economic slowdown, transfers of volumes to Western Europe are possible within the limits of sourcing habits, the respect of EU standards (maintained for the citrus fruits subject to such) and retail distributors' certification requirements. The small Spanish harvest should result in smaller volumes being sold for processing despite the return to normal of Italian production and better behaviour of the world orange juice market.

EASY PEELERS

A slight supply deficit,
especially in the heart of the season

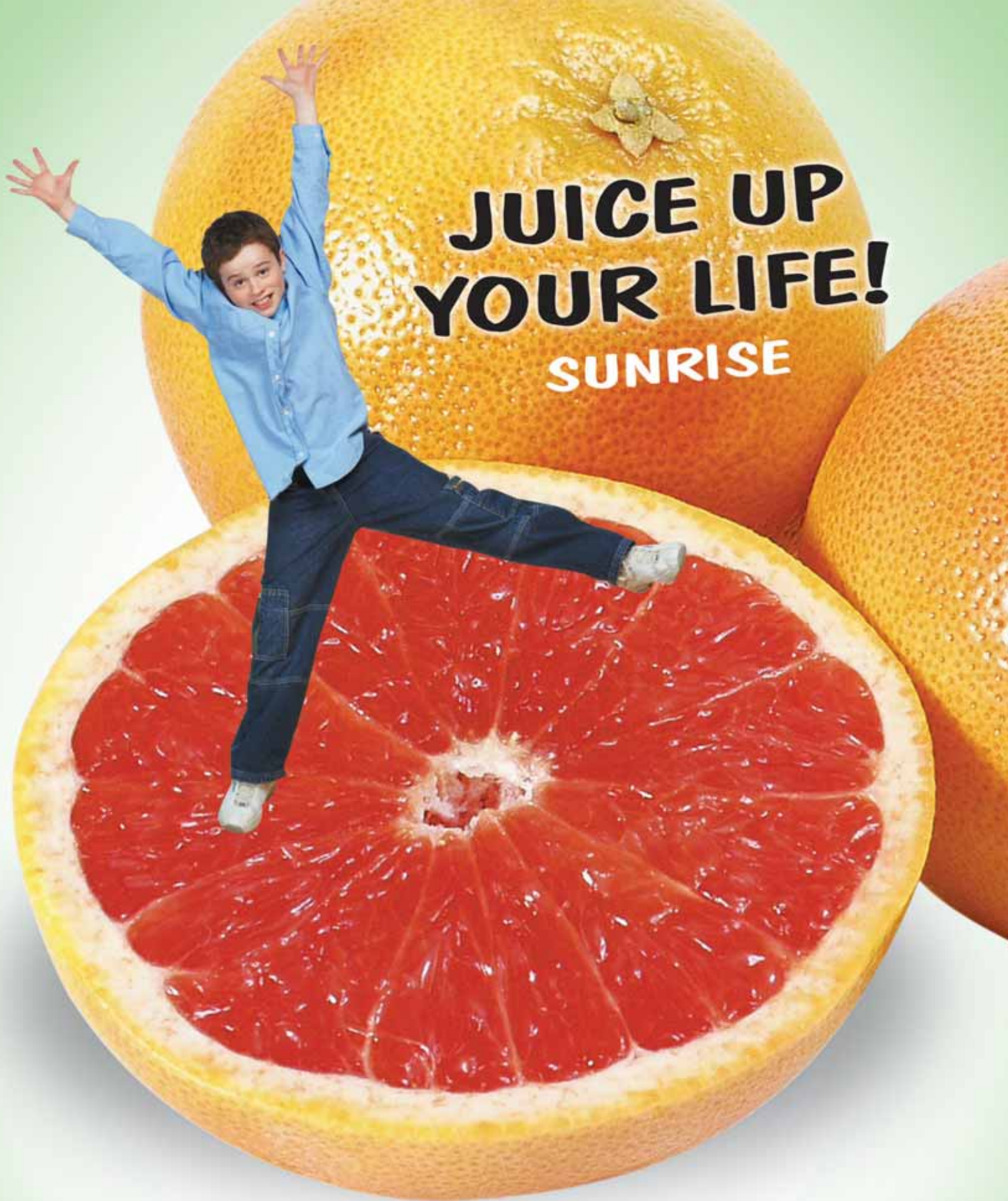
The last season was substantial but Mediterranean production is now returning to an average level with even a slight deficit when the cumulated harvest of the major exporting countries is examined. The large Turkish, Moroccan and Israeli harvests will merely alleviate the total production decrease resulting from the Spanish deficit. Supply has been fairly moderate during the first part of the season and the early Spanish clementines have sold well. Even though production is normal, export volumes have been slightly short as a result of the high proportion of sorting rejects following heavy rainfall in October. The decrease in the volumes available will be all the more marked during the usually very busy November-December period. The Moroccan harvest of 'Fine' clementine is substantial and that of Spanish 'Clemenvilla' normal. However, the 'Nules' clementine harvest in Spain forming a large proportion of the volumes sold at this time of year, is light. Supply should return to an average level in January-February. The

Easy peelers — Mediterranean — 2009-10 export forecast

000 tonnes	Season		Evolution	4 last seasons average	2009-10 / average
	2009-10	2008-09			
Spain	1 350	1 430	- 6%	1 485	- 9%
Morocco	309	294	+ 5%	286	+ 8%
Corsica	16	16	0%	19	- 14%
Israel	66	55	+ 20%	48	+ 37%
Turkey	350	381	- 8%	287	+ 22%
Italy	44	48	- 8%	62	- 29%
Cyprus	24	24	- 1%	31	- 23%
Greece	34	22	+ 52%	30	+ 13%
Egypt	10	10	+ 1%	8	+ 25%
Total	2 202	2 280	- 3%	2 268	- 3%

Source: CLAM

photo © Régis Domergue



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Moroccan 'Nour' harvest is smaller than last year's but that of Spanish 'Hernandina' is normal. Likewise, the exports of the later varieties shipped in the greatest volumes should be at least average, with normal production of 'Fortuna' and 'Ortanique' in Spain and a good harvest of 'Minneola' and 'Or' in Israel. Only the Nadorcott harvest should be somewhat small, even though the planted areas have increased in both Spain and Morocco.

ORANGE

Deficit in the West and large volumes in the East

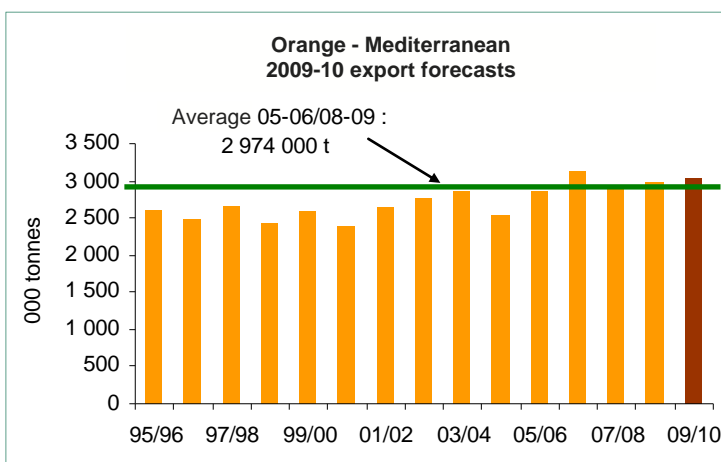
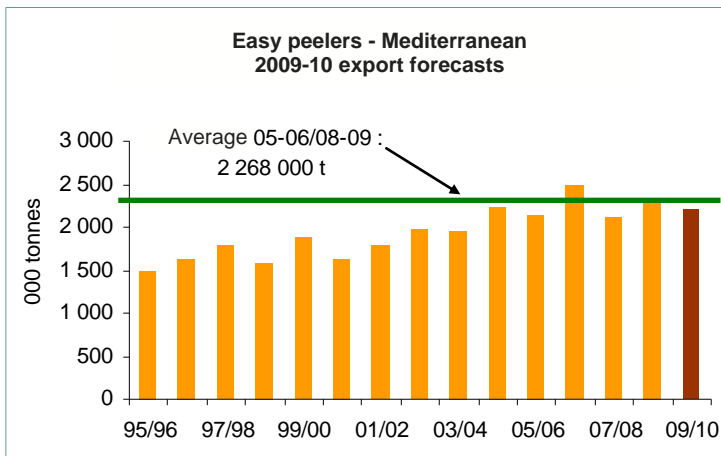
The good level of the Mediterranean harvest should not be misunderstood. The volumes of fresh oranges available on the Western European markets should display a distinct deficit. Spain covers three-quarters of the supply of the region and the harvest will be well below average. Fruit size is clearly better than in 2008-09 and this will make it possible to reduce the decrease expected in exports. However, supply will probably be much smaller than usual in the first part of the season as the 'Naveline' harvest is small in all production regions. The deficit will continue to be significant when the late varieties ('Lanelate' late 'Navel' and 'Valencia') have taken over. However, the shortage should be reduced by an Andalusian harvest close to normal in these varieties.

In contrast, the usual suppliers of the Eastern European countries will have very large harvests, except for Morocco where production is average. Turkish and Egyptian harvests are at record levels again whereas Greece is returning to normal after a serious deficit in the last season. Competition may well be very fierce on these markets, which revealed their fragility in 2008-09 with the economic downturn, with a 10% decrease in consumption. The proportions of Egyptian and above all Moroccan produce shipped to the EU should be larger than in previous years. Likewise, great attention is likely to be paid to the diversification markets in the Middle East.

LEMONS

Lemonade to be a luxury in the spring!

The scenario is similar to that of oranges. In a normal season Spain handles 85 to 90% of fresh lemon supply to the Western European markets but production is well down this season. The use of all the available potential—in the knowledge that part of the crop is left on the trees in a 'normal' year for lack of a market—and a decrease in the volumes sold for processing will limit the decrease in the volumes earmarked for the fresh market. However, availability should decrease noticeably from January-February and become very limited in March-April as the Verna crop is particularly short. This opportunity should attract competing sources. Turkey is the only other major player on the market and production is large, greatly exceeding that of the last two years. This should make it possible for it to ensure nor-



Orange — Mediterranean — 2009-10 export forecasts					
000 tonnes	Season		Evolution	4 last seasons average	2009-10 / average
	2009-10	2008-09			
Spain	1 220	1 422	- 14%	1 354	- 10%
Morocco	216	183	+ 18%	255	- 15%
Israel	36	28	+ 29%	29	+ 25%
Tunisia	23	21	+ 12%	23	+ 1%
Turkey	250	250	0%	201	+ 25%
Italy	131	65	+ 103%	94	+ 40%
Cyprus	12	12	- 1%	18	- 32%
Greece	292	207	+ 41%	246	+ 19%
Egypt	855	802	+ 7%	755	+ 13%
Total	3 035	2 988	+ 2%	2 974	+ 2%

Source: CLAM

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mal supplies for its natural markets in Eastern Europe. Some quantities may be transferred to the EU but the produce available for Turkish exporters will be limited when the Spanish deficit is at its deepest. In this context, Italy and Morocco could make a greater contribution than in other years to supplying the Western European market.

GRAPEFRUIT

Trend confirmed

Supplies will differ greatly from one segment of the market to another. USDA affirms that Florida grapefruit supplies will be smaller than average. With less than 20 million field boxes, the harvest will be 9% smaller than the last one and 20% down on the average of the last three seasons. In addition, USDA reports that fruit size is smaller than both last year and the 2007-08 season. The volumes for export should therefore be more moderate, especially during the first part of the season (4.0 million export boxes shipped to the EU in 2008-09 and an average of 4.4 million during the last three seasons). The weak dollar will only partially make up for their high cost price. Operations for the control of greening alone increase production costs by nearly 50%.

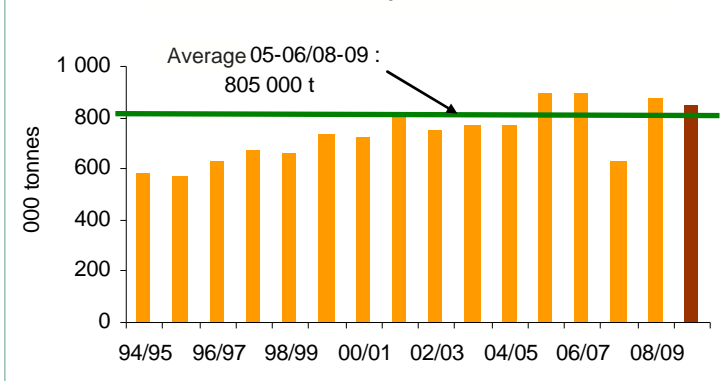
The last orchard census (2009) shows that production capacity is decreasing in Florida. Cultivated areas and numbers of trees have decreased by more than 40% since the 2004 hurricanes. The downward trend has been continued: 370 000 trees have been lost each year between the 2006 and 2008 censuses and 380 000 between those of 2008 and 2009. During the same period, planting decreased from 85 000-90 000 to 55 000 trees per year.

In contrast, the Mediterranean grapefruit segment should be well supplied. Spanish export capacity is about 10% larger than average at nearly 40 000 t. Likewise, the growing areas under coloured grapefruit in Israel means that the potential for exporters is 7% greater than average. And the Turkish harvest is back to a record level after an 'off' season in 2008-09. The Western and Eastern European markets should therefore be well supplied. Is there a risk of transfer to the EU market of the volumes of Turkish grapefruit generally shipped to the large markets in Russia, Romania and the Ukraine, all hard-hit by the financial crisis? Exports since the beginning of the season indicate a small growth. However, Western European market expectations have evolved and size would seem to be a limiting factor ■

Eric Imbert, Cirad
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**Lemon - Mediterranean
2009-10 export forecasts**



Lemon — Mediterranean — 2009-10 export forecasts

000 tonnes	Season		Evolution	4 last seasons average	2009-10 / average
	2009-10	2008-09			
Spain	370	464	- 20%	418	- 11%
Cyprus	5	5	0%	8	- 38%
Turkey	360	330	+ 9%	307	+ 17%
Greece	1	1	+ 14%	3	- 71%
Italy	80	39	+ 105%	38	+ 111%
Egypt	23	26	- 12%	24	- 5%
Morocco	7	7.2	- 3%	8	- 9%
Total	846	872	- 3%	805	+ 5%

Source: CLAM

Grapefruit — Mediterranean — 2009-10 export forecasts

000 tonnes	Season		Evolution	4 last seasons average	2009-10 / average
	2009-10	2008-09			
Spain	36	37	- 1%	37	- 2%
Israel	78	85	- 9%	82	- 4%
Cyprus	12	16	- 24%	19	- 38%
Turkey	145	128	+ 13%	136	+ 7%
Italy	4	3	+ 29%	3	+ 26%
Egypt	13	13	- 3%	4	+ 227%
Total	288	282	+ 2%	281	+ 2%

Source: CLAM

photos © Régis Domergue

Citrus — Mediterranean production in 2008-2009

	000 tonnes	Total	France	Spain	Morocco	Algeria	Tunisia	Italy	Israel	Cyprus	Greece	Turkey	Egypt	Gaza**
EASY PEELERS	Production	5 046.7	19.0	2 219.5	522.0	111.0	44.2	527.0	122.7	40.5	59.8	650.0	731.0	-
	Domestic sales	2 055.7	-	318.5	225.5	111.0	44.2	380.0	42.0	12.2	29.1	251.0	642.2	-
	Industry	339.3	-	236.7	3.0	-	-	45.0	26.0	4.3	0.4	18.0	5.8	-
	Losses/withdrawal	372.2	3.0	233.9	-	-	-	54.2	-	-	8.0	-	73.1	-
	Export sales	2 279.5	16.0	1 430.4	293.5	-	-	47.8	54.7	23.9	22.3	381.0	9.9	-
ORANGE	Production	10 827.8	-	3 466.2	715.0	415.0	167.9	1 500.3	126.9	70.0	727.1	1 230.0	2 350.0	59.4
	Domestic sales	5 511.5	-	895.5	500.5	415.0	147.3	1 029.1	45.0	35.9	243.0	897.9	1 294.2	8.1
	Industry	1 619.1	-	860.0	32.0	-	-	350.0	54.0	22.0	186.0	82.0	18.8	14.3
	Losses/withdrawal	672.1	-	288.8	-	-	-	56.7	-	-	91.6	-	235.0	-
	Export sales	3 025.1	-	1 421.9	182.5	-	20.6	64.5	27.9	12.1	206.5	250.1	802.0	37.0
LEMON	Production	2 633.6	-	882.9*	42.0	44.0	41.8	655.9	55.0	8.0	29.6	550.0	320.0	4.4
	Domestic sales	1 086.9	-	112.0	36.0	44.0	39.2	310.4	51.0	2.3	26.3	204.7	259.2	1.8
	Industry	488.4	-	307.2	-	-	-	160.0	2.0	0.7	-	15.0	2.6	0.9
	Losses/withdrawal	181.1	-	-	-	-	-	146.5	-	-	2.6	-	32.0	-
	Export sales	878.4	-	463.7	7.2	-	2.6	39.0	2.0	5.0	0.7	330.3	26.2	1.7
GRAPEFRUIT	Production	580.6	4.0	45.5	-	-	-	8.0	248.3	34.0	6.3	170.0	60.0	4.5
	Domestic sales	112.6	-	5.0	-	-	-	3.9	22.0	0.6	3.3	36.3	40.5	0.9
	Industry	173.3	-	3.4	-	-	-	1.0	141.0	17.6	0.7	5.5	0.5	3.6
	Losses/withdrawal	8.4	-	0.6	-	-	-	-	-	-	1.8	-	6.0	-
	Export sales	286.4	4.0	36.5	-	-	-	3.1	85.3	15.8	0.5	128.2	13.0	-
OTHERS	Production	78.2	-	-	-	-	43.1	20.4	14.7	-	-	-	-	-
	Domestic sales	52.9	-	-	-	-	42.9	-	10.0	-	-	-	-	-
	Industry	20.4	-	-	-	-	-	20.4	-	-	-	-	-	-
	Losses/withdrawal	-	-	-	-	-	-	-	-	-	-	-	-	-
	Export sales	4.9	-	-	-	-	0.2	-	4.7	-	-	-	-	-
TOTAL CITRUS	Production	19 166.9	23.0	6 614.1	1 279.0	570.0	297.0	2 711.6	567.6	152.5	822.8	2 600.0	3 461.0	68.3
	Domestic sales	8 819.5	-	1 331.0	762.0	570.0	273.6	1 723.4	170.0	51.0	301.7	1 389.9	2 236.1	10.8
	Industry	2 640.5	-	1 407.3	35.0	-	-	576.4	223.0	44.7	187.1	120.5	27.7	18.8
	Losses/withdrawal	1 233.8	3.0	523.3	-	-	-	257.4	-	-	104.0	-	346.1	-
	Export sales	6 474.3	20.0	3 352.5	483.2	-	23.4	154.4	174.6	56.8	230.0	1 089.6	851.1	38.7

* the official estimate is 751 000 tonnes/ ** estimate / Source: CLAM

Citrus — Mediterranean production estimate in 2009-2010

	000 tonnes	Total	France	Spain	Morocco	Algeria	Tunisia	Italy	Israel	Cyprus	Greece	Turkey	Egypt	Gaza*
EASY PEELERS	Production	4 920.0	19.0	2 019.6	570.0	111.0	36.4	593.0	157.8	40.5	91.7	550.0	731.0	-
	Domestic sales	2 100.1	-	299.1	258.0	111.0	36.4	469.0	51.5	12.5	44.5	176.0	642.1	-
	Industry	305.4	-	215.0	3.0	-	-	12.0	40.7	4.3	0.6	24.0	5.8	-
	Losses/withdrawal	312.2	3.0	155.5	-	-	-	68.0	-	-	12.6	-	73.1	-
	Export sales	2 202.3	16.0	1 350.0	309.0	-	-	44.0	65.6	23.7	34.0	350.0	10.0	-
ORANGE	Production	11 209.2	-	2 722.7	710.0	415.0	189.0	2 331.0	162.3	70.0	969.8	1 230.0	2 350.0	59.4
	Domestic sales	6 041.8	-	848.5	462.0	415.0	166.0	1 616.6	40.0	36.0	308.4	900.0	1 241.2	8.1
	Industry	1 477.4	-	556.0	32.0	-	-	420.0	86.3	22.0	248.0	80.0	18.8	14.3
	Losses/withdrawal	618.0	-	98.2	-	-	-	163.4	-	-	121.4	-	235.0	-
	Export sales	3 072.0	-	1 220.0	216.0	-	23.0	131.0	36.0	12.0	292.0	250.0	855.0	37.0
LEMON	Production	2 466.7	-	558.3	70.0	44.0	37.2	630.0	61.3	8.0	33.5	700.0	320.0	4.4
	Domestic sales	1 299.4	-	100.0	63.0	44.0	35.2	380.0	55.8	2.3	29.9	325.0	262.4	1.8
	Industry	230.7	-	88.0	-	-	-	120.0	3.5	0.7	-	15.0	2.6	0.9
	Losses/withdrawal	85.1	-	0.3	-	-	-	50.0	-	-	2.8	-	32.0	-
	Export sales	851.5	-	370.0	7.0	-	2.0	80.0	2.0	5.0	0.8	360.0	23.0	1.7
GRAPEFRUIT	Production	658.3	4.0	41.1	-	-	-	10.0	216.9	26.0	5.8	290.0	60.0	4.5
	Domestic sales	200.6	-	1.0	-	-	-	4.0	25.0	0.8	3.0	125.0	40.9	0.9
	Industry	157.0	-	3.0	-	-	-	2.0	113.9	13.2	0.8	20.0	0.5	3.6
	Losses/withdrawal	8.5	-	1.1	-	-	-	-	-	-	1.4	-	6.0	-
	Export sales	292.2	4.0	36.0	-	-	-	4.0	78.0	12.0	0.6	145.0	12.6	-
OTHERS	Production	88.0	-	8.0	-	-	45.4	20.0	14.6	-	-	-	-	-
	Domestic sales	54.9	-	1.0	-	-	45.4	-	8.5	-	-	-	-	-
	Industry	26.0	-	6.0	-	-	-	20.0	-	-	-	-	-	-
	Losses/withdrawal	1.6	-	-	-	-	-	-	1.6	-	-	-	-	-
	Export sales	5.5	-	1.0	-	-	-	-	4.5	-	-	-	-	-
TOTAL CITRUS	Production	19 342.2	23.0	5 349.7	1 350.0	570.0	308.0	3 584.0	612.9	144.5	1 100.8	2 770.0	3 461.0	68.3
	Domestic sales	9 696.9	-	1 249.6	783.0	570.0	283.0	2 469.6	180.8	51.6	385.8	1 526.0	2 186.6	10.8
	Industry	2 196.5	-	868.0	35.0	-	-	574.0	244.4	40.2	249.4	139.0	27.7	18.8
	Losses/withdrawal	1 025.4	3.0	255.1	-	-	-	281.4	1.6	-	138.2	-	346.1	-
	Export sales	6 423.4	20.0	2 977.0	532.0	-	25.0	259.0	186.1	52.7	327.4	1 105.0	900.6	38.7

* estimate / Source: CLAM



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Citrus — Mediterranean — Export forecasts in 2009-2010

000 tonnes	Total	France	Spain	Morocco	Algeria	Tunisia	Italy	Israel	Cyprus	Greece	Turkey	Egypt*	Gaza*
Total easy peelers	2 202.3	16.0	1 350.0	309.0	-	-	44.0	65.6	23.7	34.0	350.0	10.0	-
Satsuma	210.0	-	60.0	-	-	-	-	-	-	-	150.0	-	-
Clementine	1 355.0	16.0	990.0	272.0	-	-	42.0	-	-	30.0	5.0	-	-
Mandarin/Wilking	184.0	-	40.0	-	-	-	2.0	37.0	-	-	95.0	10.0	-
Ortanique	12.1	-	-	8.0	-	-	-	3.6	0.5	-	-	-	-
Nova	160.2	-	100.0	6.0	-	-	-	13.0	1.2	-	40.0	-	-
Others	281.0	-	160.0	23.0	-	-	-	12.0	22.0	4.0	60.0	-	-
Total oranges	3 072.0	-	1 220.0	216.0	-	23.0	131.0	36.0	12.0	292.0	250.0	855.0	37.0
Navel/Navelina	1 454.0	-	580.0	35.0	-	-	40.0	2.0	-	242.0	180.0	375.0	-
Salustiana	103.0	-	80.0	23.0	-	-	-	-	-	-	-	-	-
Shamouti	33.0	-	-	-	-	-	-	24.0	-	-	3.0	-	6.0
Common blond	32.0	-	-	-	-	-	-	-	-	5.0	27.0	-	-
Moro-Tarocco	80.0	-	-	-	-	-	80.0	-	-	-	-	-	-
Maltese	22.0	-	-	-	-	22.0	-	-	-	-	-	-	-
Sanguinelli	5.0	-	-	-	-	-	5.0	-	-	-	-	-	-
Other blood oranges	40.0	-	-	28.0	-	-	-	-	-	-	12.0	-	-
Verna	-	-	-	-	-	-	-	-	-	-	-	-	-
Oval	4.0	-	-	-	-	-	4.0	-	-	-	-	-	-
Late	1 299.0	-	560.0	130.0	-	1.0	2.0	10.0	12.0	45.0	28.0	480.0	31.0
Bitter	-	-	-	-	-	-	-	-	-	-	-	-	-
Total grapefruits	292.2	4.0	36.0	-	-	-	4.0	78.0	12.0	0.6	145.0	12.6	-
White grapefruits	86.2	-	36.0	-	-	-	-	15.0	12.0	0.6	10.0	12.6	-
Other grapefruits	206.0	4.0	-	-	-	-	4.0	63.0	-	-	135.0	-	-
Total lemons	851.5	-	370.0	7.0	-	2.0	80.0	2.0	5.0	0.8	360.0	23.0	1.7
Other citrus	4.5	-	-	-	-	-	-	4.5	-	-	-	-	-
Total	6 422.4	20.0	2 976.0	532.0	-	25.0	259.0	186.1	52.7	327.4	1 105.0	900.6	38.7

* estimate / Source: CLAM



The orange juice market

Reasons for hope

A catastrophic 2008-09 season

The 2008-09 season fooled a fair proportion of the orange juice professionals who had made forecasts. Prices of concentrate collapsed even though production levels were rock bottom in Brazil and in Florida, which between them control over 80% of world production. As an example, the price per tonne of Brazilian 66° Brix which had held at about USD1700 to 1800 in Rotterdam since the end of 2007 started to fall strongly in September 2008 and sank below the USD900 mark at the beginning of summer 2009. Prices had not been as disastrous as this since before the 2004 and 2005 hurricanes spread citrus canker and greening and knocked Florida production on the head.

And the reasons for such a fall? This season again they were sluggish demand and large stocks. The slump in international trade seems to have continued for the whole of 2008. This, together with the effect of the increase in prices of concentrate on retail prices and increasing competition from other types of beverages (especially 'energy' drinks), resulted in the world market shrinking by more than 20% since 2003-04. This is the equivalent of a loss of 3 billion litres, mainly in the EU and the USA. In addition, the size of stocks continued to weigh on the market. At the beginning of the 2008-09 season, Florida stocks were the equivalent of two-thirds of annual production! However, the market seems inclined to change direction. Concentrated juice prices have improved on the New York futures market since the beginning of 2009. The price rise on the physical market (to over USD1000 per t in September and over USD1500 at the end of October) seems to confirm the trend, that might finally be more solid and lasting this time.

An extremely small 2009-10 harvest...

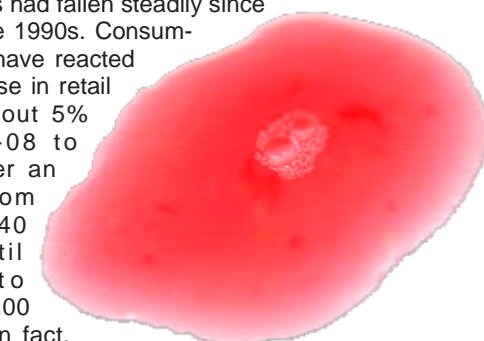
The small crop expected in the two leading producer countries in 2009-10 is the first parameter. According to USDA, the harvest in Sao Paulo state, the site of three-quarters of Brazilian orchards, should remain close to the 310 million field boxes of 2008-09, that is to say about 15% less than the average of recent years. And above all, with only 136 million field boxes, the Florida harvest will probably be one of the two smallest of the

last 20 years. This means that cumulated production in Brazil and Florida should be at a historically low 18 million tonnes. This is more than 2 million tonnes down on the average of the last three years.

...and, at last, encouraging signs in consumption

The long-awaited recovery of demand in the United States is the other piece of good news as regards sustaining market recovery. Orange juice consumption has increased steadily since the beginning of 2009, and the USA accounts for nearly 40% of world consumption. More than the level of the increase (less than 1% in comparison with last year), it is the change that should be noted as sales volumes had fallen steadily since the end of the 1990s. Consumers seem to have reacted to the decrease in retail prices of about 5% from 2007-08 to 2008-09 after an increase from USD4.30-4.40 per gal until 2004-05 to nearly USD6.00 in 2007-08. In fact, sales have increased in the reconstituted juice market segment (prepared from concentrate) where the prices are the most attractive. NFC juice is sold at prices 30 to 40% higher and consumption has continued to decrease. It remains to be seen whether the trend for recovery also applies to Europe, the largest market in the world. This would also be a strong signal. The 10% increase in exports in 2008-09 in comparison with 2007-08 of the exports of the leading supplier, Brazil, would seem to indicate that this is so, while waiting for other figures to confirm the trend.

Thus, in contrast with last season, the market seems to have been re-stimulated by the small harvest and recovery of demand. It is true that the size of stocks and the way the market functions with long contracts mean that there is considerable inertia. However, an upward trend seems to have started and, given the medium-term production prospects, it may well continue.



Increasingly serious structural difficulties in Florida

The sharp production fall in Florida is only partly the result of adverse weather conditions (drought and cold). The sanitary condition of orchards—already discussed at length in Fruitrop—is increasingly worrying because of the spread of citrus canker and, above all, of greening. Sector profitability is still decreasing. Returns for growers were some USD5.40 per field box in 2008-09 and are still distinctly higher than before the hurricanes, but they display a disturbing downward trend (see graph). Direct production costs have increased very strongly in recent years, in particular as a result of rocketing fertiliser prices. In 2007-08, they approached USD1250 per acre in comparison with USD775 five years before. Prevention of greening may well make the situation worse as insecticide spraying to control the vector and scouting of orchards cost a further USD500 per acre or so, resulting in a 40% overall cost increase. Under these conditions, it is not surprising that the orchard area continues to dwindle, as is shown by the last agricultural census conducted in Florida. The number of producing trees fell by 20% from 2004 to 2009, including nearly 800 000 lost from 2008 to 2009. It is true that the decrease seems slower than in previous years (1 250 000 trees per year lost from 2006 to 2008) and there seems to be more replanting, but the decrease is very visible. Should it be considered that the gloomiest mid-decade scenarios with forecasts of some 130 million field boxes are coming true?

No major increase in Brazilian production in view

In spite of these favourable prospects for a competing producer country, no solid signs of a significant increase in Brazilian production are visible. The small increase in cultivated area observed in 2007-08 did not continue. Production even seems to have been decreasing in recent years, as is confirmed by the 2009-10 harvest forecast. Two major factors slowing the development of the sector are still present.

First, the orchard sanitary situation is still a subject for concern, even if prevention is not as difficult as in Florida as the plantations are more remote from urban areas. It is reminded that all major diseases, including greening, are present in Brazil. Furthermore, although crop profitability has improved in the last two years it is still inadequate—especially for small growers with the least technical facilities. The slow-down of the international market is

aggravated by the fact that they have no negotiating power in comparison with the four sector giants with whom they sign supply contracts. According to USDA, the purchase contracts offered to growers by the industry in April 2009 ranged between USD2.90 and 4.50 per field box weighing more than 40 kg.

In this context, one can understand why some growers rush to switch to competing crops such as sugar cane. Brazilian production of the latter increased from production of 320-340 million tonnes in the mid-2000s to 550 million tonnes in 2008-09 and growth dynamics is still particularly strong. Even the Louis Dreyfuss group, the third largest orange juice producer in the world, has just made massive investments in Brazil—but in sugar cane.



Cautious challengers

The challengers are remaining very modest. Mexico, in fourth position in the international league table of orange processors, could gain weight. The Mexican orchard has been stable at some 335 000 to 345 000 ha since the turn of the century, with production oscillating between 4.2 and 4.3 million tonnes. However, it has assets in terms of cost price (land and labour prices are accessible) even if production structures are small and of a low technical level. However, the appearance of greening in the Yucatán in summer 2009 may well make investors think twice. Unfortunately, the prospect of the contamination of the large citrus zones on the eastern side of the country (Tamaulipas, San Luis Potosi and especially Vera Cruz state) is probable.

Production facilities in China have developed considerably in recent years. However, production is still very modest at 20 000 t in 2007-08 and probably less in 2008-09 as a result of production losses caused by bad weather. Greening is endemic throughout the south-western part of the country and remains a substantial slowing factor.

So everybody seems ready. Constraints and threats are serious and the market is still fairly volatile. If demand continues to gain momentum in the 2009-10 season, the market recovery observed today could probably be considered to be solid insofar as retail prices do not increase unreasonably. This new context could then generate greater ambition, in particular around the Mediterranean ■

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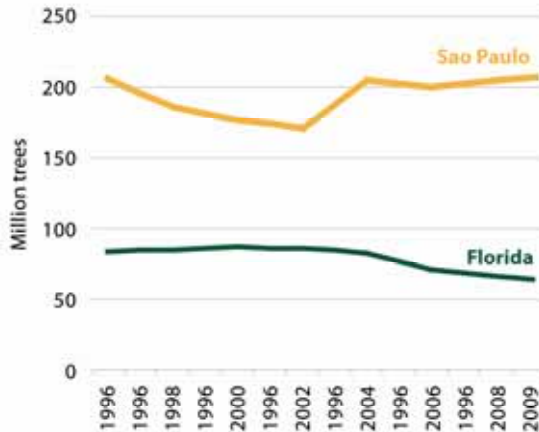
photos © Régis Domergue

ORANGE JUICE

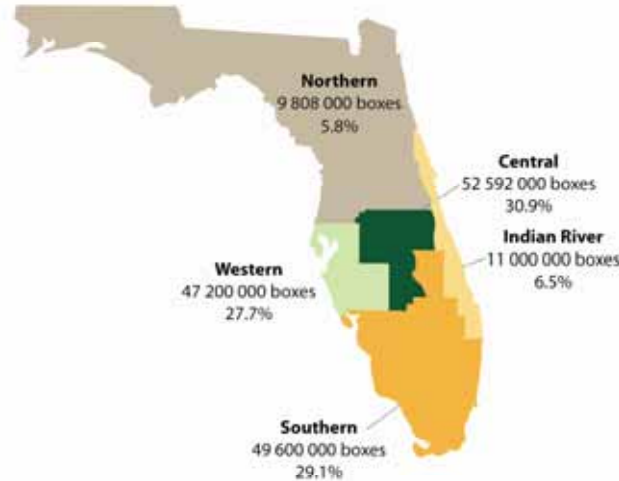
TWO LEADERS, TWO KINDS OF DYNAMICS

Orange - Florida and Sao Paulo

Evolution of the orchard area

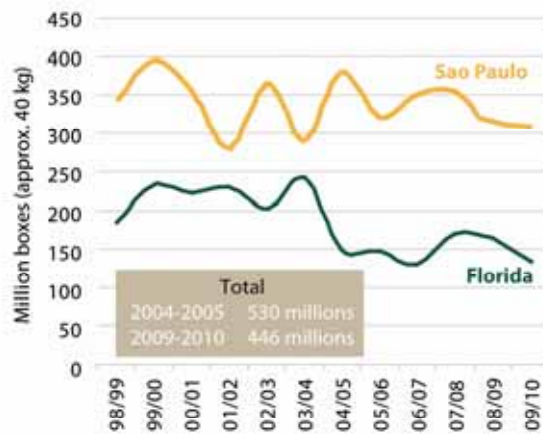


Orange - Florida 2007-2008 production 170 200 000 boxes 90 lb

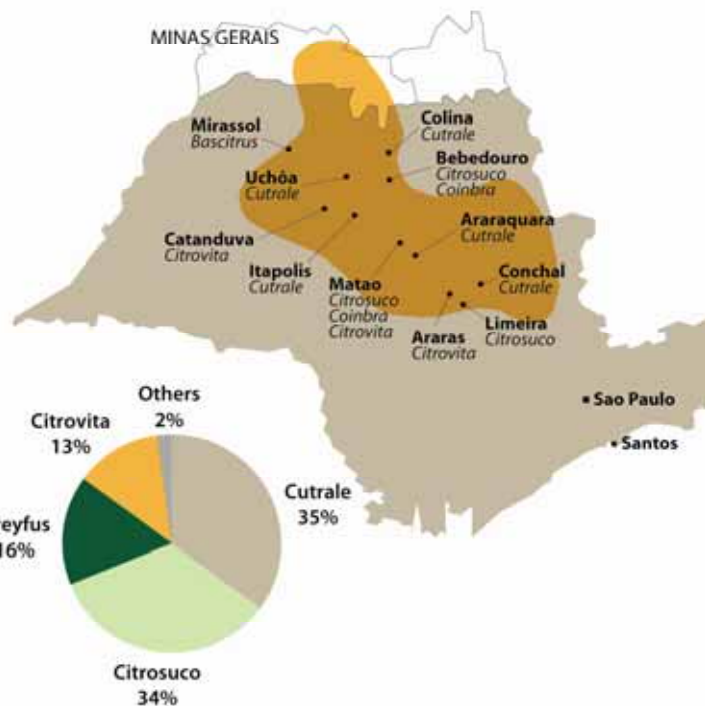


Orange - Florida and Sao Paulo

Evolution of production



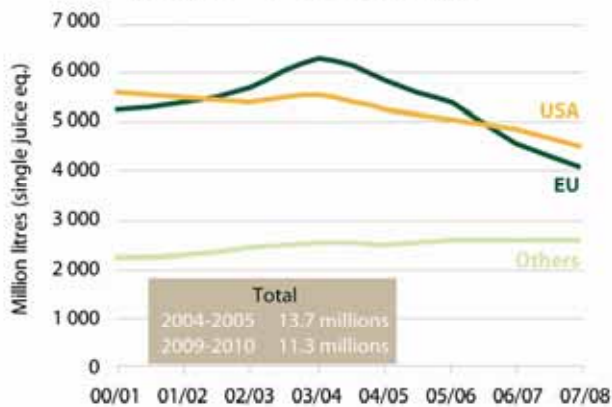
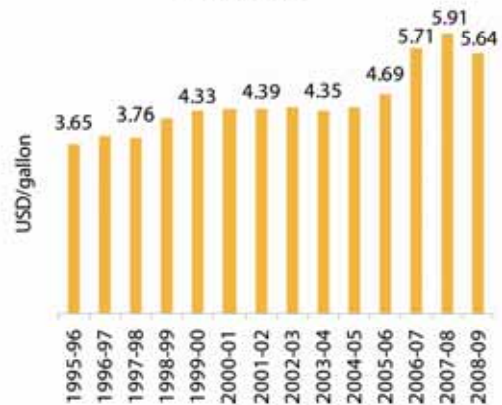
Sao Paulo - The main citrus production zone and the processing plants



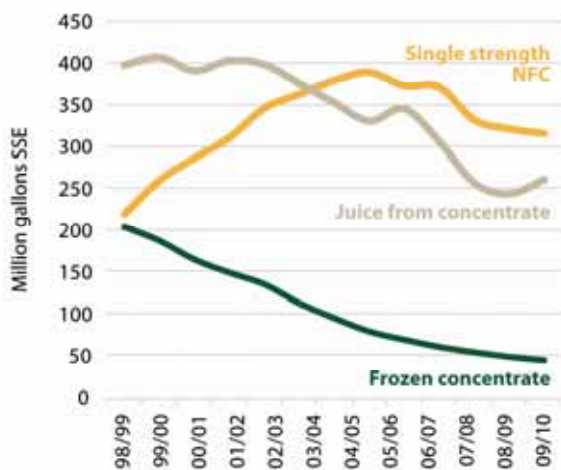
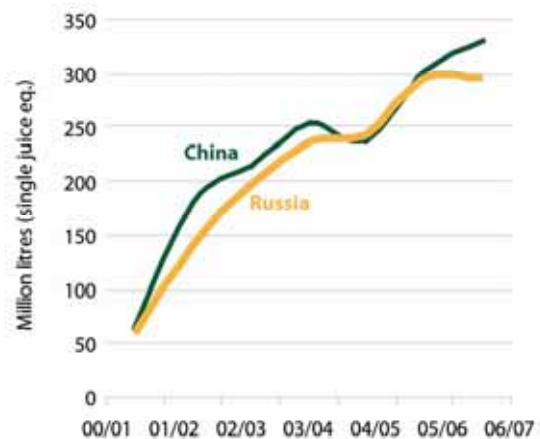
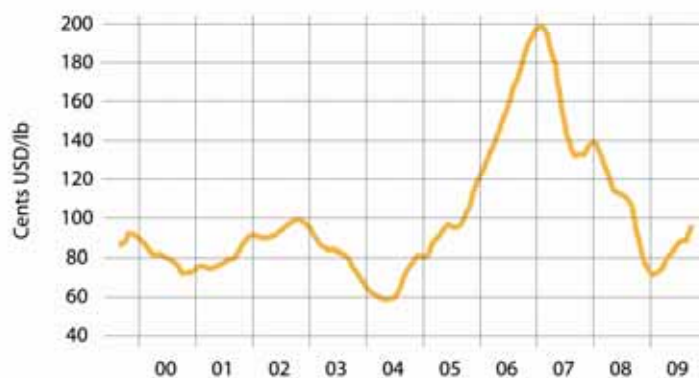
Brazil - Main juice producers

RETAIL PRICES DOWN... CONSUMPTION RECOVERING?

Orange juice - World consumption

Orange juice - USA
Retail price

Orange juice - USA - Consumption

Orange juice
Emerging countries consumptionFrozen concentrated orange juice
Weekly prices - NYBOT

Source: Nybot, Abecitrus, Associtrus, FAS, FDOC

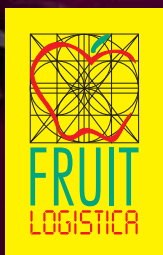
Graphics: Chez Vincent

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Citrus Cultivation

Henri Vannière

sixteenth century thanks to Portuguese navigators and the possibility of direct maritime trade with the Far East and China. These species were then disseminated in Africa and America. The first mandarins were introduced in the Mediterranean region much later. The fruit is mentioned at the beginning of the nineteenth century in Italy and not until 1850 in North Africa. However, the Mediterranean has been an important diversification zone for the three most important economic species—orange, mandarin and lemon. The grapefruit, *C. paradisi*, a natural hybrid of shaddock, is one of the rare commercial citrus fruits to have originated in the Caribbean.

The world's leading fruit crop grown between the latitudes 40° N and 40° S, citrus fruits were domesticated in Asia. Ancient texts refer to sour citrus fruits in India from 800 BC onwards, and mandarins, oranges and grapefruit in China at the time of Confucius. Trade and military conquests contributed strongly to the spread of citrus. This was first overland via Asia Minor and the Middle East as Roman and Greek influence spread (citron fruit, bitter orange) and then through Islam and the Crusades (sour citrus). The citron fruit was the first species grown in the Mediterranean several centuries before our era. New citrus fruits such as sweet oranges were introduced around the Mediterranean basin in the

Agronomy

The most suitable soils for growing citrus are slightly acid and well-filtering. The choice of rootstock is one of the essential factors for success, giving tolerance or resistance to biotic (soil pests and diseases, degeneration diseases) and abiotic constraints (acid or alkaline soils, salinity, reaction to cold or drought, etc.). It strongly influences factors such as vigour, the start of production and fruit yield and quality. The risk of contamination by tristeza has led to favouring *Poncirus* hybrids (Citrange, Citrumelo) as a replacement for sour orange. Disease-free plant material must be used. Today, new rootstocks are bred by hybridisation or the use of biotechnologies.

Certification plans have been set up in many countries. They combine the use of healthy plant material and prevention of possible recontamination by inoculum or a disease spread by an insect vector by siting outdoor nurseries in clean zones or by sheltered production in risk zones. The rootstocks are sown, replanted and then shield budded or chip budded, using a bud from a shoot of the desired variety.

It is recommended that the base of the trunk should be set in a slightly raised position at planting to limit attacks by *Phytophthora*. Tillage is reduced after planting so as not to damage the surface roots. The base of the trunk must be weeded. The maintenance technique

used (permanent plant cover, chemical or mechanical weed control) depends on soil/climate and economic constraints.

Preliminary pruning is performed in the early years. Annual maintenance pruning then balances and aerates the foliage and ensures the renewal of fruit-bearing shoots. Irrigation is essential in dry areas and can be in the form of subfoliar sprinkling or trickle irrigation (soakers, drip, etc.). Fertilisation can be combined with irrigation in this case (fertigation) to save inputs and ensure steady mineral nutrition.

Mineral fertilisation must make up for exports in fruits and prunings and ensure the growth of the vegetative organs. Fertilisation includes nitrogen, phosphorus and potassium. Trace elements are sprayed on the foliage. Fertilisation is based on the results of mineral analyses of leaves and soil.

Among growth regulators, gibberellic acid improves the setting of clementines and synthetic auxins increase fruit grade.



Citrus orchard
in Morocco



Grapefruit orchard
in South Africa

The influence of climatic conditions

Citrus originated in south-east Asia. The climate there is equatorial, tropical or subtropical according to the latitude and always strongly marked by a monsoon regime. The year features a hot, humid season (the monsoon season) and a fairly rain-free, often cooler season. The developmental cycle of citrus is keyed into these seasons. The hot, humid period is one of intense physiological activity, with shoot and fruit growth. Vegetative growth halts in the cool, dry period, a feature all the more marked when drought is severe or temperatures low. A marked halting of vegetative growth is essential before any flowering of certain citrus such as mandarin, orange, grapefruit and shaddock. Others with repeat-flowering such as citron, lemon and lime have less strict requirements but react to the same phenomena.

Temperatures between 21 and 30°C are optimum for physiological activity. This is strongly reduced when the temperature is lastingly and significantly higher than 35°C or lower than 13°C. Citrus growing is in fact limited by threshold and ceiling temperatures. Citrus trees are partially or totally destroyed at temperatures lower than 0°C. The extent of the damage depends firstly on frost duration and intensity and secondly on the susceptibility of plant parts and the type of citrus. Thus flowers, young leaves and fruits are more sensitive than branches and trunks. Citron, lime and lemon are more sensitive than mandarin, orange and grapefruit. Temperatures lower than -7°C are generally lethal for citrus trees. Temperatures higher than 50°C also cause damage.

Strong insolation is also better supported when the water supply is satisfactory. Irrigation must be used in citrus growing in arid or very dry regions. Plant water requirements are directly correlated with the climatic parameter total radiation (the main feature) related to insolation, temperature, wind, relative

humidity, etc. These parameters are used in water requirement models and irrigation management tools.

Temperature plays an important role in the changes of fruit pigmentation as maturity approaches. Temperatures lower than 15°C cause the disappearance of chlorophyll pigments from the epidermis. This reveals carotenoid pigments. The synthesis of carotenoids (yellow and orange) and lycopene (red, specific to shaddock and grapefruit) is enhanced by a temperature of between 15 and 35°C. Red anthocyanin pigments (blood oranges) require lower temperature but still higher than 12°C.

The synthesis and senescence of the various pigments are thus strongly affected by ambient temperature. In the tropics, the absence of low temperatures means that chlorophyll pigments do not disappear and the fruits remain green. Anthocyanin synthesis does not take place for the same reason and blood oranges remain blond. In contrast, the red pigmentation of grapefruit is more intense. The alternate high daytime temperatures and cool nights in Mediterranean zones create an optimum environment for the breakdown of green chlorophyll pigments and the synthesis of the yellow, orange and red pigments of the various types of orange, mandarin and lemon. The external colour of the fruits is thus very well expressed.



© Eric Imbert

Grapefruit orchard
in Spain



Citrus pests and diseases

Pests and diseases are numerous and can have serious economic impacts, possibly requiring quarantine (material subject to regulations concerning movement) and the forbidding of exports to other production zones to avoid the spread of harmful organisms. The use of tolerant rootstocks is an effective measure in the control of several organisms but the choice of variety is often dictated by the market. In addition to the production of healthy plant material, the control of these pests and diseases generally combines genetic, biological and chemical components in an integrated control framework.



Citrus diseases	Tristeza Virus: <i>Citrus Tristeza Closterovirus</i>	Huanglongbing (greening) Phloem bacteria: <i>Liberibacter africanum</i> , <i>L. asiaticum</i>	Citrus canker Bacterium: <i>Xanthomonas axonopodis</i> pv. <i>citri</i>
Distribution	All regions except some Mediterranean countries.	Asia, subtropical and tropical Africa, Middle East.	Asia, South America, Florida, certain regions of Africa.
Symptoms	Dieback of varieties grafted on sour orange (except lemon trees), vein clearing and stem pitting.	Shoot yellowing, leaf mottling, small poorly coloured fruits.	Corky pustules on leaves and fruits.
Susceptible species	Lime, orange and grapefruit trees.	Broad host spectrum. Affects orange and mandarin above all.	Broad host spectrum. Above all grapefruit, orange, lime and some mandarins.
Transmission	Aphids (<i>Aphis gossypii</i> , <i>Toxoptera citricida</i>).	Psyllas (<i>Diaphorina citri</i> , <i>Trysoza erytreae</i>).	By air and water.
Economic impact	Loss of trees and decreased production.	Tree dieback, shorter orchard life.	Harvest loss.
Quarantine organism	Present in the EU.	Not present in the EU.	Not present in the EU.



Citrus pests	Fruitfly Diptera Tephritidae: various species of the genera <i>Ceratitidis</i> , <i>Anastrepha</i> , <i>Dacus</i> , <i>Bactrocera</i> , etc.	Thrips Thysanoptera: thripidae. <i>Scirtothrips</i> spp. (<i>S. aurantii</i> , <i>S. citri</i> , <i>S. dorsalis</i>)	Diaspine Hemiptera: Diaspididae. Genera <i>Aonidiella</i> , <i>Unaspis</i> , <i>Chrysomphalus</i> , <i>Cornuaspis</i> , etc.
Distribution	American continent: <i>Anastrepha</i> . Africa: <i>Ceratitidis</i> , <i>Dacus</i> . Asia-Pacific: <i>Bactrocera</i> .	Variable according to the species. Present in the Mediterranean area: <i>Tetranychus urticae</i> , <i>Panonychus citri</i> .	Variable according to the species. Present in the Mediterranean area: <i>Aonidiella aurantii</i> , <i>Cornuaspis beckii</i> , etc.
Symptoms	Pricking caused by females laying eggs in the fruits.	Greyish patches in a ring around the fruit stalk (thrips feeding on young fruits).	Scale on leaves, shoots and/or fruits, trees weakened in case of large populations.
Susceptible species	Mandarin, orange, grapefruit. Mandarins and thin-skinned oranges susceptible.	Orange, mandarin, tangor, tangelo, lemon, etc.	Broad host spectrum.
Economic impact	Harvest loss.	Deterioration of the outside appearance of fruits.	Deterioration of the outside appearance of fruits.
Quarantine organism	Not present in the EU.	Not present in the EU.	Not present in the EU.



Main citrus varieties

Photos © Régis Domergue

ORANGE

EASY PEELERS

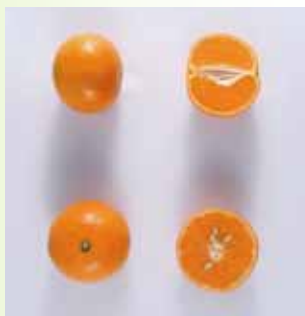
Clementine

This group of varieties is probably the result of hybridisation of *Citrus deliciosa* and an orange. Its success — considerable around the Mediterranean — is related to the interesting fruit characteristics (seedless in pure plantations, good colour and flavour) combined with a long sales period. Indeed, clementines are present on markets in the northern hemisphere from the end of September to the end of February thanks to the different cultivars (Marisol, Oroval, Oranules, Nules, Common or Fine, Hernandine, Nour, etc.).



Nova

Present on markets from mid-November to January, this medium-sized fruit is the result of a cross between common clementine and Tangelo. It has interesting qualities: marked skin colour, deep orange tender juicy pulp with no seeds and sweet flavour with low acidity. The fruits must nevertheless be picked rapidly to prevent the swelling of the peel. It is widely grown in Spain (Clemenvilla), Israel (Suntina) and Morocco.



Minneola

A hybrid between tangerine and grapefruit, this large round fruit is characterised by a pronounced stem-end neck. The peel is a particularly strong reddish orange colour. The pulp, with few seeds, has a very special flavour. The variety is grown mainly in Israel and Turkey.



Valencia Late

Originating in the Azores, Valencia is the most commonly planted variety in the world. This medium-sized variety is round and slightly oblong. The peel is thin, well-coloured and slightly grainy. The flesh is very juicy, with 2 to 4 seeds. It is also known as Maroc Late (from Morocco) and Jaffa Late (from Israel).

Navel

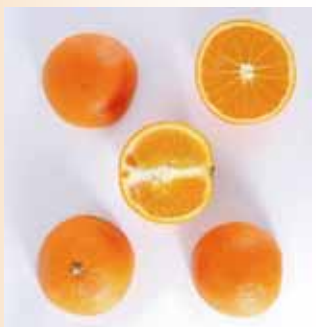
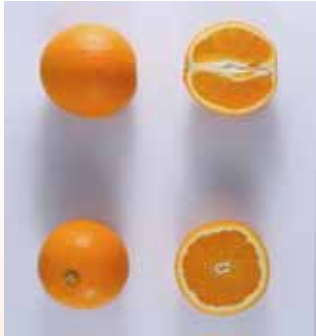
A round to oval dessert orange with a strongly developed navel. The peel is grainy, thin and fairly well coloured. The flesh is crisp, fine and not very juicy. Early cultivars (Naveline) and late cultivars (Navelate, Lane Late) in the Navel group are available on northern hemisphere markets from October to May.

Maltese

This high-quality well-coloured orange is grown almost only in the Cape Bon region of Tunisia, where conditions bring out its full potential. It is medium-sized and slightly oval. The soft peel is slightly grainy and easy to remove. The tender, juicy flesh is little coloured for a blood orange. The flavour is particularly pleasant with sweetness balanced by a good level of acidity.

Salustiana

Very popular in Spain, this blond juice orange is medium-sized to large. The peel is of medium thickness with fine granulation. The flesh is delicate and sweet with a very pleasant taste. It is also seedless.



LEMONS

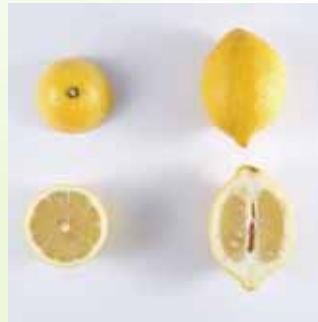
Eureka

This variety little planted in the Mediterranean forms the greater part of world production. It is widespread in the southern hemisphere. The fruit is of average size, elliptic to oblong in shape with a medium-sized apical nipple that is slender at the base. The peel is fine to medium thick. The pulp is generally seedless and rich in juice with high acidity.



Fino

This cultivar dominates Spanish production and is much grown in the Murcia region. The fruit is a regular spherical or oval shape. The nipple is shorter than that of Verna. The peel is thin and smooth. The pulp contains 5 to 8 pips and is juicier than that of Verna.



Verna

The fruit is medium to large with a pronounced, broad-based nipple. The rough epidermis is fairly thick. The juice has high acidity but extraction yield is only medium. One of the main Spanish varieties.



Limes

The Tahiti lime (*Citrus latifolia*) is a triploid variety and is the most widespread of the sour limes. The peel is green/yellow to pale yellow and contains an essential oil with a very characteristic odour. The pulp is generally seedless, yellowish green and rich in very sour juice. Another variety, Mexican lime (*Citrus aurantifolia*), is little exported as it contains a large number of seeds.





Citrus harvesting and storage

Citrus fruits are not climacteric and their quality does not therefore improve after harvesting. Suitable storage can slow their evolution: an appropriate positive temperature, 85 to 90% relative humidity and ventilation. Fruits must be harvested at a stage of maturation close to optimum ripeness—and hence optimum quality. Quality is characterised mainly by the juice content, the dry extract/acidity ratio and flavour. Fruits must be handled with care during the harvest and not be wetted, so as to limit subsequent risks of physiological deterioration or the entry of pathogens. Transport to the packing stations must be carried out as soon as possible.

Degreening and storage

As fruits approach the ripe stage, green chlorophyll pigments disappear gradually, revealing the other yellow, orange and red epidermis pigments. This change requires cool temperatures lower than 13°C. These temperature conditions are not found in the tropics or in a Mediterranean climate in early autumn when the early varieties are picked. The fruits therefore remain green or are poorly coloured. Degreening is possible if significant breakdown of chlorophyll pigments has started naturally. Degreening is performed by placing the fruits in a chamber with a controlled atmosphere containing 1.0 to 5.0 ppm ethylene. The temperature is set at 22 to 25°C for oranges, and at a lower temperature for lemons, with relative humidity of 85 to 90%. The technique reduces storage time since ethylene stimulates senescence in citrus fruits. The duration of chilled storage can be lengthened by the application of wax or a stretch film reducing respiratory exchange and water loss. In contrast, controlled atmospheres have little or no effect.

Physiological deterioration

This is caused mainly by impacts in the orchard that are revealed later or during storage.

Frost: in the orchard or after the harvest. The skin looks wet and translucent and the segments dry out.

Chilling injury: exposure to temperatures that are above freezing point but lower than the optimum storage temperature. They cause the bursting of the essential oil glands, resulting in the burning of tissue and the appearance of small sunken brown spots on the peel; these may become coalescent. Fungal damage may subsequently occur.

Oleocellosis: caused by temperature variations in the field or bruising during harvesting or storage. Symptoms are very similar to those of chilling injury.

Abrasion by brushing: caused by skin fragility, the use of brushes that are too hard or by too high a brushing speed. The upper layers of the skin are eroded, resulting in dry patches of varying width and flow of essential oil that burns the tissue.

Fungal damage

More than 75% of postharvest citrus rots are caused by two *Penicillium* moulds (*P. italicum* and *P. digitatum*). Some rots should not appear during storage if harvesting is performed carefully:

- bitter rot caused by *Geotrichum candidum* affects fallen fruits or fruits soiled with earth;
- *Cladosporium herbarum* causes symptoms similar to those of *Alternaria citri*. Contamination by rotting, infested plant wastes occurs during harvesting;
- black mould rot of peel caused by *Aspergillus niger* affects wounded or damaged fruits stored at a temperature of over 15°C;
- infection in the orchard by *Botryosphaeria ribis*, *Phylospora rhodina* or *Diaporthe citri* causes a brown and then blackish rot of the skin and the underlying tissues in the stalk zone during storage. It is controlled by orchard or postharvest treatments.

Citrus post-harvest diseases	Blue mould <i>Penicillium italicum</i>	Green mould <i>Penicillium digitatum</i>	Black rot Anthracnose <i>Alternaria citri</i>	Brown patch <i>Glomerella cingulata</i> (= <i>C. gloeosporioides</i>)	Brown rot <i>Phytophthora</i> sp.
Symptoms and parts of the fruit affected	Paling and softening of the skin; white down (mycelium) then appears; covered with blue spores; pulp affected simultaneously.	Slight paling and softening of the epidermis; then bright white down grows in circular layers, covers with green spores from the centre. The entire fruit (peel, pulp) is finally affected, fruit cannot be eaten from the beginning.	Black rot on columella and segments, and/or peel.	Spotting of unripe fruits developing into brown patches that become soft with ripening and then affect the pulp. Marked odour. Degreened fruits very susceptible.	Start: spotted discoloration of peel and then spread of the patches; variable colour with brown patches and finally fruit disintegration. In storage: fine white mycelium with brown areas; characteristic odour.
Infection pathway	Spores on intact epidermis, fruit to fruit contamination.	Spores on wounded epidermis.	Wounds, penetration by the navel and the style scar.	Fruits wounded in the field.	Spores on intact epidermis.
Site of infection	From packing to consumption.	In the orchard, but above all from picking to consumption.	Orchard and warehouse.	Orchard.	Orchard: splashing with water. Packing: contaminated washing water. Storage: fruit to fruit contamination.
Species and varieties susceptible	All varieties.	All varieties.	Navel orange, madarin, lemon.	All varieties, but above all mandarins.	All varieties (orange more susceptible).