

March 2013 - No. 209

FRUITROP

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English edition

Close-up

MANGO

<http://passionfruit.cirad.fr>

Soursop: indescribable flavour...
but perishable!

Fruit quality and conservation:
post-harvest deterioration

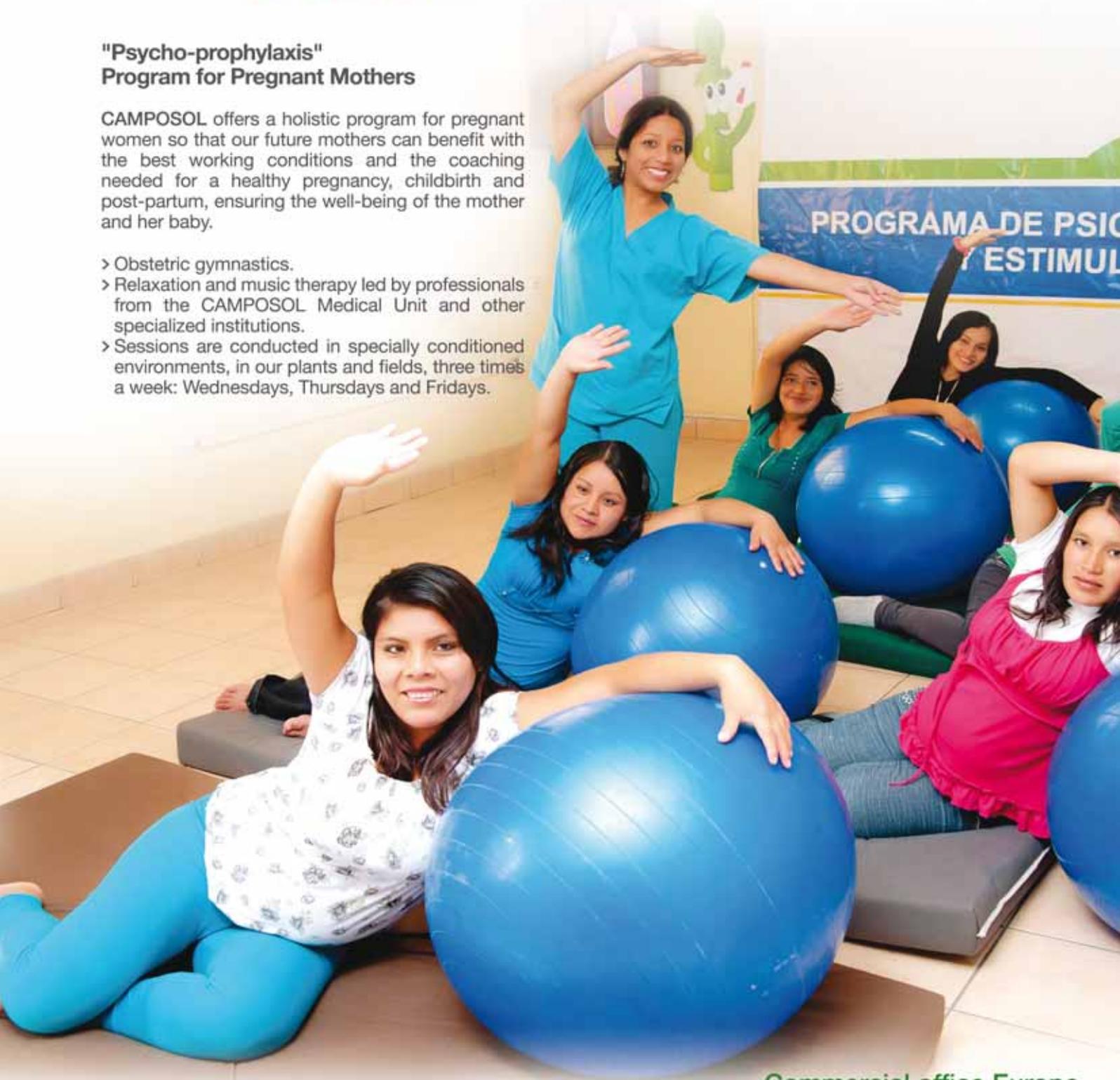


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More fruit and vegetables are purchased during slumps
This is what is revealed in a recent study by the Spanish Ministry of Agriculture and Food. The figures are clear. Whereas household food consumption increased by 07% in volume from 2011 to 2012, fresh fruit consumption increased by a substantial 2.7 %! The greatest demand in 2012 was for water melons, strawberries, melons, bananas, easy peelers and oranges. Cherries, apples, pears and grapes were not concerned. Spanish shoppers also favoured 'modern' stores rather than traditional outlets. Finally, purchase followed a search for low prices, the leading criterion far ahead of quality and proximity of retail outlets. But should we be happy with this excellent trend for our sector? Nothing is less sure as the increase in the consumption of fresh fruits goes along with the serious economic crisis that is shaking Europe. Indeed, this renewed interest in fruits is accompanied by an increase in the purchase of 'basic' items, in other words unsophisticated foods like pasta, rice and vegetables. This is a sign that the slump is having a strong effect on behaviour. So even if it is good for the fruit and vegetable sector, it is difficult to rejoice about the recession that we are experiencing.



Denis Loeillet



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Printed by
 Impact Imprimerie
 n°483 ZAC des Vautes
 34980 Saint Gély du Fesc, France

Separate French and English editions

ISSN
 French: 1256-544X / English: 1256-5458

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Subscription rate
 EUR 220 / 11 issues per year

This document was produced by the Markets News Service of the PERSYST department at CIRAD, for the exclusive use of subscribers. The data presented are from reliable sources, but CIRAD may not be held responsible for any error or omission. Under no circumstances may the published prices be considered to be transaction prices. Their aim is to shed light on the medium and long-term market trends and evolutions. This publication is protected by copyright, and all rights of reproduction and distribution are prohibited.

FRUITROP

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Cover photograph: Denis Loeillet

Banana

February 2013

Balanced until the beginning of February, the banana market began to change, with a worsening confirmed at the end of the month. First, the supply of dollar bananas, which had still been moderate in January, returned to levels close to normal (Supply from Ecuador was still short but shipments from Colombia and Costa Rica returned to normal). Second, arrivals from the West Indies and Africa were still substantial even if they were not as large as in January. But above all, spot volumes at very competitive prices arrived in various European ports throughout the month, exerting strong pressure on the market. In addition, while competition from the season's fruits remained limited (early end of the easy peeler season in Spain and a shortage of apples and pears) and banana retail prices returned to normal levels for the season, demand was weak as a result of cold weather and school holidays in several countries in Europe. Thus, after being stable, green prices decreased, first in Eastern Europe and then in Italy and in France in mid-February. The prices became lower than those of past years. Contract prices in Germany held at a stable level but pressure on the free market gradually increased. In Spain, competition from imported bananas whose prices had become more competitive and increasing shipments from the Canaries caused the already dull market to worsen, with prices dropping 19% below the average. The Russian market succumbed to the pressure of massive arrivals in February and prices collapsed halfway through the month.

■ EU and US banana consumption: strong increase in January 2013. The 2013 banana year started with a bang. The last beginning of year to have been as vigorous in terms of volumes imported was 2008. January 2013 saw 400 000 tonnes of banana crossing the EU frontiers, 5% more than in 2012. And not all sources come out on the positive side. In the dollar group, Colombia is struggling (- 2%) while Brazil and Honduras are quietly leaving the stage. The list of decreases is long in the ACP group: the Dominican Republic (- 10%), Surinam (- 29%), Ghana (- 5%) and all the Windward Islands (- 31%). So the performance of the sources gaining ground is even more remarkable. After being off colour for many months, Ecuador had its finest January ever on the European market, gaining 7%. Costa Rica also recovered and gained 4%. Peruvian momentum continued (+ 14%). More surprising, Mexico increased by 300%, shipping 4 100 tonnes. Among ACP sources, African producer countries forged ahead, like Côte d'Ivoire which returned to its best levels (+ 33%) and Cameroon which was close to its 2010 performance (+ 19%). Belize also continued its fine series with a 26% growth.

Adding European production to these import figures means that consumption in January 2013 can be estimated at 446 000 tonnes. This is 4% more than in January 2012 and 10% more than in January 2011. These figures demonstrate objectively what operators felt and that resulted in market prices that were satisfactory but not at all on the scale that some people

had forecast. Like other fruit markets, the banana market does not manage to profit from the vacant space left by certain competing fruits such as apples.

Trends in the EU and the USA were the same for once. The US market increased by 4% in volume in January 2013, reaching 335 000 tonnes. Costa Rica, Colombia and Panama above all lost respectively 6%, 7% and 76% in comparison with January 2012. Panama and Costa Rica clearly favoured the European market. Guatemalan exports continued to grow strongly (+ 10%) and became firmly established as the leading market supplier. As in Europe, Ecuador gained ground (+ 9%) but remained very far from its 2010 record. Not present in Europe, Honduras increased shipments by 10%. Mexico increased by an astonishing 68%. In terms of import value, the US market had hiccups in the form of a light 3% decrease in import price (customs source).

Source: CIRAD

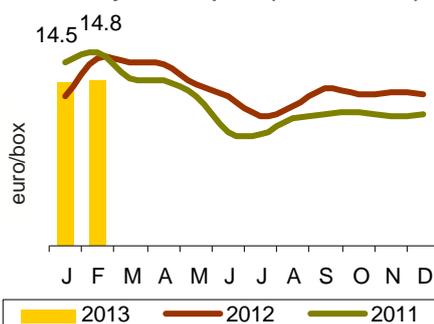


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NORTHERN EUROPE — IMPORT PRICE

February 2013 euro/box	Comparison	
	previous month	average for last 2 years
14.80	+ 2%	- 13%

Germany - Green price (2nd/3rd brands)



EUROPE — RETAIL PRICE

Country	type	Comparison		
		February 2013 euro/kg	January 2013	average for last 3 years
France	normal	1.61	+ 2%	+ 8%
	special offer	1.36	- 1%	+ 6%
Germany	normal	1.32	+ 3%	+ 3%
	discount	1.22	+ 2%	+ 11%
UK (£/kg)	packed	1.19	+ 2%	- 3%
	loose	0.78	+ 1%	- 6%
Spain	plátano	1.84	- 2%	+ 3%
	banano	1.33	+ 3%	- 3%

Banana

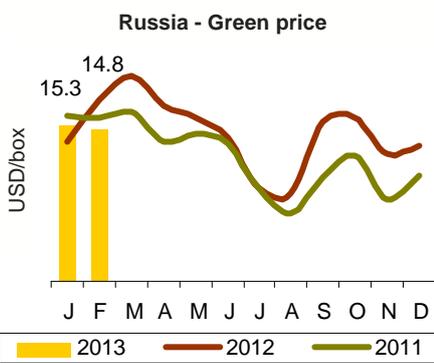
UNITED STATES



USA — IMPORT PRICE

February 2013 USD/box	Comparison	
	previous month	average for last 2 years
16.10	+ 1%	- 11%

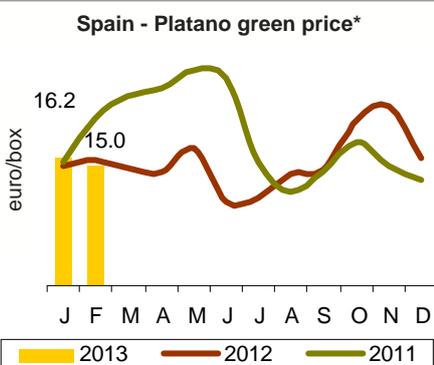
RUSSIA



RUSSIA — IMPORT PRICE

February 2013 USD/box	Comparison	
	previous month	average for last 2 years
14.80	- 3%	- 13%

CANARIES



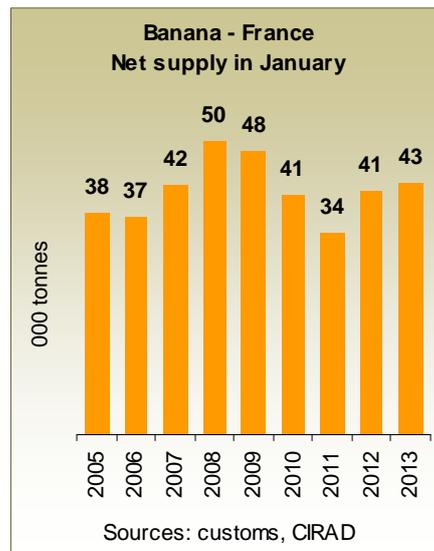
CANARIES — IMPORT PRICE*

February 2013 euro/box	Comparison	
	previous month	average for last 2 years
15.00	- 7%	- 19%

* 18.5 kg box equivalent

■ Banana consumption in France: January 2013 was a heavy month. With nearly 43 000 tonnes sold in January 2013, the French market confirmed the European trend for a strong increase in the volumes released. This was 4% more than January 2012 and 10% more than the three-year average for 2010-11-12. This was a good start to the year especially as January 2012 had been a good month. Re-exports reached a record of more than 21 000 tonnes in January, compensating for a very large increase in arrivals from other EU member states.

Source: CIRAD



© Régis Domergue

Banana - January 2013 (provisional)

tonnes	2011	2012	2013	Difference 2013/2012
EU-27 — Total supply	407 379	429 809	446 243	+ 4%
Total import, of which	362 712	379 319	400 126	+ 5%
MFN	289 368	306 204	321 153	+ 5%
ACP Africa	44 312	40 034	48 786	+ 22%
ACP others	29 032	33 082	30 188	- 9%
Total EU, of which	44 667	50 491	46 117	- 9%
Martinique	9 157	12 547	9 968	- 21%
Guadeloupe	3 336	5 040	5 380	+ 7%
Canaries	30 421	31 150	29 601	- 5%
USA — Imports	338 007	360 992	378 291	+ 5%
Re-exports	41 832	40 009	43 239	+ 8%
Net supply	296 175	320 984	335 053	+ 4%

EU sources: CIRAD, EUROSTAT (excl. EU domestic production) / USA source: USA customs

EUROPE — IMPORTED VOLUMES — FEBRUARY 2013

Origin	Comparison		
	January 2013	February 2012	cumulated total 2013 compared to 2012
French West Indies	↗	- 2%	- 7%
Cameroon/Ghana	↘	+ 8%	+ 21%
Surinam	=	0%	+ 4%
Canaries	↗	0%	- 3%
Dollar :			
Ecuador	↘	- 39%	- 24%
Colombia*	↗	0%	+ 6%
Costa Rica	↔	- 4%	+ 2%

Estimated thanks to professional sources / * total all destinations

Orange

February 2013

The change in variety from 'Navel'/'Naveline' from Spain and 'Navelate' allowed prices to perk up a little on a market that remained difficult nonetheless. The Spanish 'Navel'/'Naveline' season ended poorly in the first half of the month, with large volumes remaining to be cleared upstream, but the fruits were very fragile. The switch to 'Navelate' allowed a very noticeable improvement in the quality of supply. Prices firmed but were still disappointing. Supply was completed by larger than average quantities of 'Salustiana' from Spain. Volumes of 'Maltese' from Tunisia were contained but sold fairly well as supply was comparatively satisfactory.

Oranges: devastating floods in Queensland. According to Citrus Australia, about 15% of production has been lost. The area north of Burnett, and especially Gayndah and Mundubbera, was particularly hard-hit and it will take years for production to return to normal. With the 2011 census reporting 4 645 ha, the area under citrus in Queensland is in fourth position after the large orchard areas in south-east Australia (Riverina, Murray Valley and Riverland). It accounts for 40% of domestic production of lemons and 55% of easy peelers.

Source: Citrus Australia

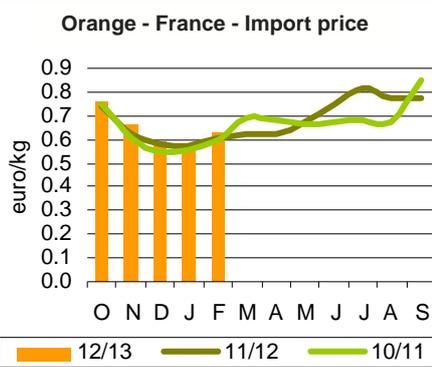


© Denis Loeffler

Asian Citrus Holding goes into fresh orange exports. Asian Citrus, the leading citrus producer in China, has announced its determination to go into the world market. The group's two plantations are at Hepu in Guangxi (3 100 ha) and at Xingfeng in Jiangxi (3 700 ha). Another 3 500-ha production unit is being developed

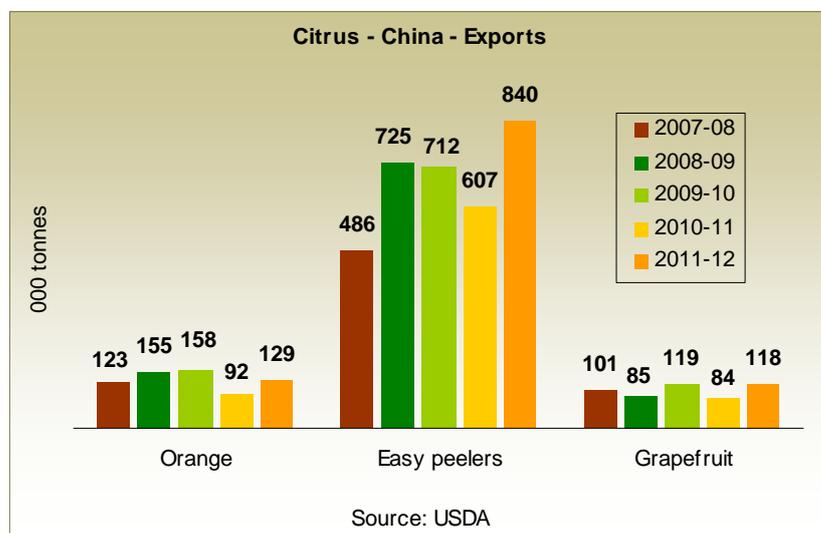
in Hunan. Asian Citrus produces winter oranges ('Hamlin', 'Pineapple' and 'Hay Jiang') and 'Valencia' at Hepu. If the ongoing testing of exports to Vietnam is conclusive, the group plans to diversify shipments to other ASEAN markets.

Source: Reefer Trends



PRICE	Type	Average monthly price euro/box 15 kg	Comparison with average for last 2 years
	Dessert oranges	9.45	+ 4%
Juice oranges	8.85	+ 3%	

VOLUMES	Type	Comparison	
		previous month	average for last 2 years
Dessert oranges	=↗	+ 4%	
Juice oranges	=↗	+ 12%	



Source: USDA

VOLUMES	Varieties by source	Comparison		Observations	Cumulated total / cumulated average for last 2 years
		previous month	average for last 2 years		
	Navel/Navelina from Spain	↗	+ 15%	True start to the season at the beginning of the month. Quantities larger than average. Large fruits.	+ 15%
	Salustiana from Spain	=↗	+ 12%	Peak season. Volumes larger than average.	- 1%
	Maltese from Tunisia	=↗	- 19%	Deliveries smaller than average	- 5%

Grapefruit

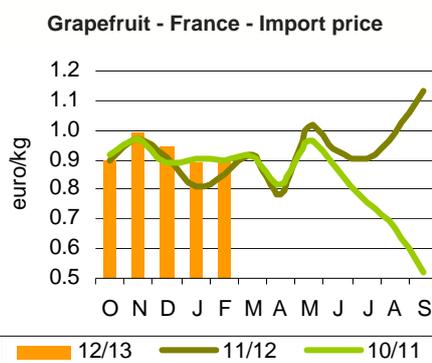
February 2013

Time passes but there is no improvement. Sales were already disappointing and then slowed with the start of the school holidays in many EU countries. Supply of Mediterranean grapefruit decreased as the seasonal increase in arrivals from Israel did not match the early slowing of the Turkish and Spanish seasons. But prices remained stable and still lower than the average. Arrivals from Florida returned to average after the dip in January. Prices lost a little ground and stocks were available at the end of the month.

■ Greening detected in Paraguay. The list of American countries concerned by this unfortunately famous bacterial disease is still growing longer. Trees testing positive have been found in three administrative departments in the south-eastern part of the country along the frontier with Brazil (Canindeyú, Alto Paraná and Itapúa) and in Cordillera east of the capital Asunción. The trees were eliminated immediately. According to the FAO, Paraguay produces some 300 000 tonnes of citrus per year. This consists mainly of oranges (230 000 t) and easy peelers (45 000 t). A large part of the area under citrus (totalling slightly over 11 000 ha according to the same source) is reported to be in the administrative departments affected.

rostat, European imports approached the 100 000-tonne mark in 2012, taking annual consumption to some 375 g per person. The market has more than tripled in ten years to the great delight of Brazil and Mexico, the sources that have practically a world monopoly of the fruit, especially as US imports are also growing. These come almost only from Mexico and approached 430 000 t in 2012, marking progress of 200 000 t in ten years.

Source: CIRAD



Source: abc.com.py

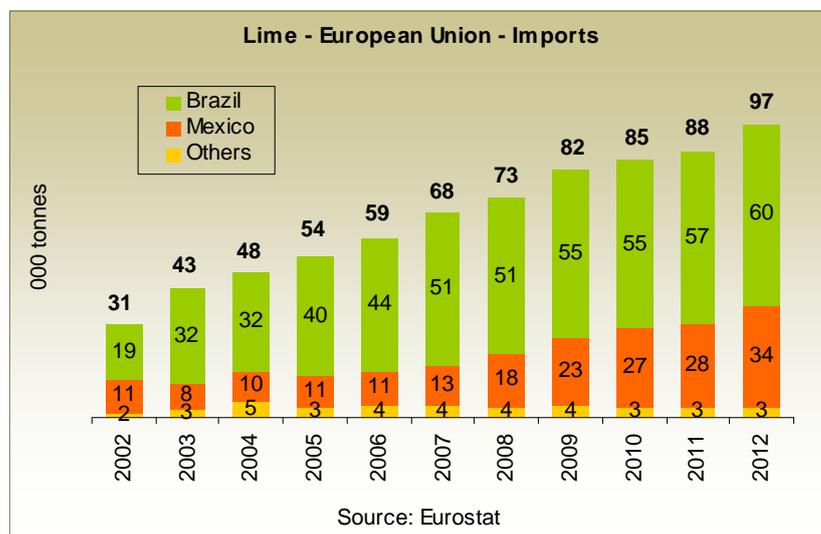
■ Lemons dull but limes shining bright! While annual lemon consumption is desperately stable at about 1.5 kg per person in Western Europe, that of lime is still growing very strongly. According to Eu-



© Régis Domergue

PRICE	Type	Average monthly price euro/box 17 kg box eq.	Comparison with average for last 2 years
	Tropical	17.50	+ 5%
Mediterranean	10.00-11.00	- 4%	

VOLUMES	Type	Comparison	
		previous month	average for last 2 years
Tropical	=↗	+ 1%	
Mediterranean	=↘	- 4%	



Source: Eurostat

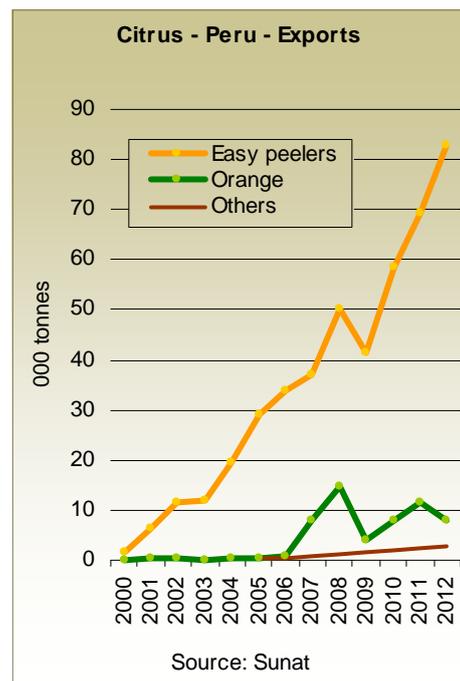
SEMI-VOLUMES	Source	Comparison		Observations	Cumulated total / cumulated average for last 2 years
		previous month	average for last 2 years		
Florida	=↗	+ 1%	EU supplies back to normal after a dip in January but shipments to Japan were still very limited.	- 6%	
Israel	↗	+ 17%	Volumes were distinctly above average after a distinct increase in the rate of shipments at the end of the month. Most of the produce consisted of large fruits.	+ 5%	
Turkey	=↘	- 27%	Early fading of shipments to all destinations in the second half of the month. Volumes in the EU were distinctly smaller than average.	- 10%	
Spain	=↘	- 23%	Volumes were limited, especially in the second part of the month.	- 7%	

Easy peelers

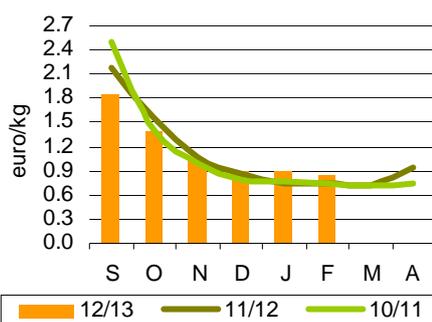
February 2013

The market was fairly satisfactory. As during this period every year, demand slowed because of school holidays and smaller sales displays and was focused on medium to top-of-the-range varieties. But supply was somewhat small. The season for late clementine and tangelo such as 'Clemenvilla' and 'Minneola' slowed early. As a result, the prices of 'Nadorcott' from Spain and 'Or' from Israel held at a good level even though available volumes were fairly substantial. In contrast, the market for 'Nadorcott' from Morocco was lacklustre and the keeping qualities of some batches were not too good. Sales of 'Ortanique' from Spain and Cyprus remained slow.

■ Peruvian citrus exports: 100 000 t is the target for 2013. One export may hide another in Peru! Asparagus, grapes, avocados, mangoes and peppers are not the only fruits and vegetables whose exports via the international market have increased considerably in recent years. After totalling less than 2 000 t at the beginning of the 2000s, citrus exports exceeded 90 000 t in 2011 and, according to Procitrus, should very probably exceed the symbolic 100 000-t threshold in 2013. Peru is now the second largest supplier of easy peelers to the United States and EU-27 in the summer, with this varietal group forming more than 90% of Peruvian citrus exports. The only dark cloud is the poor sales of 'Minneola', a variety less and less appreciated on the international market but that still



Easy peelers - France - Import price



formed nearly 40% of exports in 2011. Sergio Castillo, the managing director of Procitrus, is ringing the alarm bell and recommending that producers should stop planting this variety immediately.

Source: Agraria.pe



■ 2012-13 Spanish clementine season: better financial results than in the previous season... According to the Unio de Llaoradors professional agricultural organisation, prices paid to growers for clementines varied between 12 and 18 Euro centimes per kg in comparison with 6 to 8 centimes in 2011-12. Unio tempers this good news by making a remainder that the cost price is 24 centimes.

Source: elperiodicomediterraneo.com

PRICE	Type	Average monthly price euro/kg	Comparison with average for last 2 years
	Clementine	0.83	+ 17%
Hybrids	1.07	+ 17%	

VOLUME	Type	Comparison	
		previous month	average for last 2 years
Clementine	↘↘	- 26%	
Hybrids	↗	- 2%	

VOLUME	Varieties by source	Comparison		Observations	Cumulated total / cumulated average for last 2 years
		previous month	average for last 2 years		
Ortanique from Spain	↗↗	- 12%	The season started early but deliveries were smaller than average.	- 12%	
Nadorcott from Spain	↗	+ 80%	Volumes increased early on. Supply was distinctly larger than average as crops had increased in new orchards.	+ 36%	
Nadorcott from Morocco	↗	+ 23%	Substantial volumes until the end of the month, when the season started to decline early.	+ 31%	
Or from Israel	↗	+ 50%	Supply markedly above average. Setting up of a category 1 line after the bad weather at the beginning of the year.	+ 22%	

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Pineapple

February 2013

As could be expected, demand was weaker in February and the first fortnight was not really good for sales. The winter holidays should be added to this, and these are staggered over a three-week period in France. However, the situation was not dramatic as volumes of 'Sweet' has been forecast to increase but in fact decreased unexpectedly. Although prices did not really fall, they weakened over the month as a whole. The availability of batches at low prices on certain markets obviously did nothing to improve the price situation. At the end of the month, operators were aware that there would be a shortage of fruits for Easter but remained optimistic as regards the movement of the market.

Supply of 'Sweet Cayenne' was still very small and it remained in its niche market. The fruits displayed good colour and good keeping qualities and sold without too much difficulty in spite of the general weakening of demand.

The air pineapple market was brisk throughout the month. Supply was reduced and always smaller than demand. To this should be added the distinct improvement of the quality of fruits from Benin. Sales were stimulated by good demand and remained fluid throughout the month. Although not exceptional, prices were high. Supply of 'Sugarloaf' pineapple was sometimes small and sometimes larger and the fruits sold well as their quality was appreciated. Prices oscillated between EUR 1.90 and 2.05 per kg throughout the month.

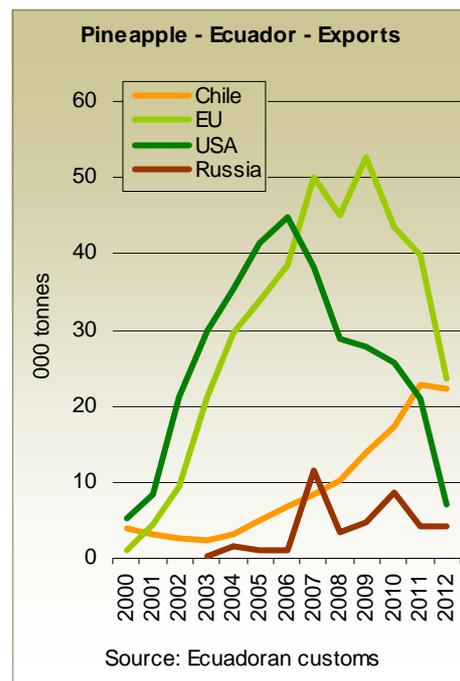
Supply of 'Victoria' was slightly smaller than demand throughout the month. Small fruit availability contributed to fluid sales and the good prices fetched. Once again, the more appreciated fruits from Réunion sold best.

■ The Ecuadorean pineapple sector is suffering. The decline is being confirmed. Asopina, the local professional organisation dedicated to the sector, reports that the area under pineapple decreased from 5 500 ha in 2003 to 1 500 ha in 2012. The reason is that profitability has plummeted in recent years for growers, concentrated mainly in the Los Rios and Santo Domingo de las Tsachilas regions. This financial worsening is related to a considerable degree to the increase in completion from Costa Rica, the best-placed source in terms of logistics for supplying the United States and Europe, the two major markets. Ecuador lost its foothold on both of these and exports fell to below 60 000 t in 2012 after approaching 100 000 t in 2009. The only cause for satisfaction is the maintaining of strong positions in Chile, a local market that, together with Europe, is one of the major destinations for Ecuadorean pineapples.

Source: Reefer Trends



© Carolina Danegon



Source: Ecuadorian customs

■ Strong ambitions for pineapple in the Dominican Republic. This is what the president Danilo Medina wants. The Dominican Republic must become a major player in the world fresh pineapple trade. The authorities have therefore earmarked USD 2 million for the regeneration and development of plantations in Sanchez Ramirez province in the centre of the country. For this, 10 million MD2 ('Sweet') suckers have been ordered in Costa Rica; this is sufficient for planting about 150 ha. The Dominican press goes a little too far perhaps when it announces that the country will soon be the world's leading producer of 'the king of fruits'. Costa Rican growers can probably wait for a while before becoming afraid.

Source: Reefer Trends

PINEAPPLE — IMPORT PRICE			
Weeks 6 to 8	Min	Max	By air (euro/kg)
			Smooth Cayenne
Victoria	3.00	4.00	
By sea (euro/box)			
Smooth Cayenne	7.00	9.50	
Sweet	7.00	10.00	

PINEAPPLE — IMPORT PRICE IN FRANCE — MAIN ORIGINS					
Weeks 2013		6	7	8	9
By air (euro/kg)					
Smooth Cayenne	Benin	1.70-1.85	1.75-1.90	1.80-1.95	1.90-1.95
	Cameroon	1.70-1.90	1.70-1.90	1.70-1.90	1.70-1.95
	Ghana	1.75-1.90	1.75-1.95	1.75-1.95	1.80-1.95
Victoria	Réunion	3.80-4.00	3.50-4.00	3.50-4.00	3.50-3.80
	Mauritius	3.30-3.50	3.30-3.50	3.30-3.70	3.00-3.30
By sea (euro/box)					
Smooth Cayenne	Côte d'Ivoire	-	8.00-9.50	7.00-8.50	7.00-8.50
Sweet	Côte d'Ivoire	8.00-9.50	7.50-9.00	7.50-9.00	7.50-9.00
	Cameroon	8.00-9.50	7.50-9.00	7.50-9.00	7.50-9.00
	Ghana	8.00-9.50	7.50-9.00	7.50-9.00	7.50-9.00
	Costa Rica	8.00-10.00	7.00-9.00	7.00-8.50	7.00-8.00

Mango

February 2013

The European mango market was supplied essentially with regular quantities from Peru in February. The volumes delivered from Brazil fell to their lowest level, consisting just of 'Tommy Atkins' and a few batches of 'Palmer'. The former were shipped mainly to the markets in northern Europe and were sold at rising prices: EUR 4.00-4.50 per box at the beginning of the month to EUR 4.50-5.50 at the end of the month depending on size and quality. The small volumes available doubtless favoured this increase in prices. The price of 'Kent' from Peru firmed markedly in the first half of February in comparison with January. A few sales at low prices were concluded at the beginning of the period but soon stopped in spite of continued quality problems from time to time. The upward price trend halted in the second half of the month because of decreased demand during the winter holidays. The small fruits that had been dominant in shipments from Peru became scarcer and were replaced by larger ones and this had a proportional effect on price. Thus in the second half of the month, the lowest prices were for large fruits while those for the smallest ones recovered.

The air mango market was difficult at the beginning of the month as many batches were very mature. Market conditions improved distinctly in the second week as a result of a decrease in supply. The switch from the Piura production region to Casma accentuated the decrease in supply, which went as far as creating a scarcity followed immediately by a sharp rise in prices, with a few sales concluded at more than EUR 5.00 per kg. This upward trend continued until the beginning of the fourth week. The arrival of larger volumes and falling demand halted the price rise. A few complementary batches of 'Palmer' and 'Maya' from Brazil were sold from time to time during the month.

Litchi

February 2013

The sales season for litchis from the Indian Ocean ends in February. The last, small batches from Madagascar sold at EUR 1.50 to 1.60 per kg at the beginning of the month. Fruits were shipped from South Africa throughout the month. During the first fortnight, fruits from the latter source still consisted of the variety 'Mauritius'. They sold at steady prices and benefited from renewed interest for the Chinese New Year. Fruit quality was uneven in the last containers of 'Mauritius' and sorting was frequently necessary. Supply of 'Mauritius' dwindled gradually to the benefit of the later 'Red McLean'. These were less appreciated as the taste is not very marked but selling prices were stable, thanks in particular to their colour and limited quantities released on the market. A few batches of 'Red McLean' were also available on the Dutch and Belgian markets at similar prices to those observed on the French market (with a few peaks at up to EUR 4.00 per kg).

The French market also received a few batches by air from Australia during the first half of February. Offered at EUR 14.00 to 15.00 per kg, these fruits were difficult to shift, especially as the last batches displayed quality problems. Deliveries soon ceased.



© C. Delaune

LITCHI — IMPORT PRICE ON THE FRENCH MARKET — euro/kg

Weeks 2013	6	7	8	9	Average February 2013	Average February 2012
By sea						
South Africa Mauritius	2.50-3.25	2.50-3.25	-	-	2.50-3.25	2.05-2.40
South Africa Red McLean	3.00	3.00	3.00-3.25	3.00-3.25	3.00-3.10	-

MANGO — ARRIVALS (estimates)
Tonnes

Weeks 2013	6	7	8	9
By air				
Brazil	10	5	8	-
Peru	50	50	40	80
By sea				
Brazil	480	530	900	620
Peru	3 320	3 760	3 450	3 540

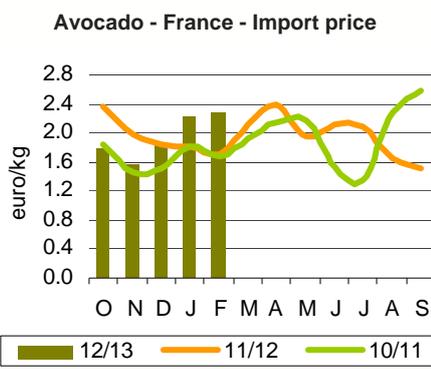
MANGO — IMPORT PRICE ON THE FRENCH MARKET — Euro

Weeks 2013	6	7	8	9	Average February 2013	Average February 2012
By air (kg)						
Peru Kent	3.00-3.80	3.00-4.20	4.00-4.50	4.20-4.80	3.55-4.30	4.30-5.00
By sea (box)						
Peru Kent	3.00-5.00	4.50-5.00	4.00-5.00	4.00-5.00	3.85-5.00	4.40-5.70

Avocado

February 2013

Performance was very satisfactory once again with prices and volumes sold distinctly higher than average. Large supplies of 'Hass'. Shipments from Spain and Israel continued to peak at higher than average levels and Chile, at the end of its season, was still strongly present in the EU as prices were still low in the United States. After an absence for the last two seasons, Mexico completed supply with moderate volumes. However, supply was well distributed among the various EU markets, with demand growing in countries where consumption had been small, such as Germany. Prices remained firm and even increased. Unlike the situation in previous months, green varieties profited from this buoyant context.



PRICES	Varieties	Average price in France euro/box	Comparison with the last 2 years
	Green	5.50-6.00	+ 17%
Hass	9.00-10.00	+ 27%	

VOLUMES	Varieties	Comparison	
		previous month	average for last 2 years
Green		↘	+ 3%
Hass		=↗	+ 40%

VOLUMES	Source	Comparison		Observations	Cumulated total / cumulated average for last 2 years
		previous month	average for last 2 years		
	Chile	=↘	+ 100%	The season ended early. Supply remained strong in the EU as it was preferred to the US market.	+ 33%
	Israel	=↗	+ 30%	Arrivals of 'Hass' peaked at a distinctly higher level than usual. 'Pinkerton' season ending but volumes were larger than average.	- 12%
	Mexico	↗	+ 1 199%	Temporary return to average of exports to the EU, contrasting with near absence in the two preceding seasons.	+ 67%
	Spain	=↘	+ 10%	The 'Hass' season continued strongly at higher than average levels. Season declining and average volumes of Fuerte.	+ 15%

■ Avocado: trouble in California. The shrinking of the area under avocado in the San Diego region has made the heart of the Californian avocado sector beat a little slower. Since 2007, the area in this zone has decreased by more than 3 000 ha in the zone, which nonetheless is still home for more than 40% of avocado in the state, with more than 7 000 ha in production in 2011. The problem is not one of outlets but that of the price of water. Farmers are now billed nearly USD 1 per cubic metre, that is to say three times the price ten years ago. The bill has increased considerably since 2009 with the end of the 20% rebate for farmers and then two successive increases in the last 18 months. The 9 000 to 12 000 m3 per ha per year required forms 54% of direct production and harvest costs, estimated at more than USD 20 000 per hectare by the University of California (and a total of about USD 32 000 per ha as the full cost including in particular depreciation, interest charges, etc.). The smallest growers are in real trouble because halting expenditure means

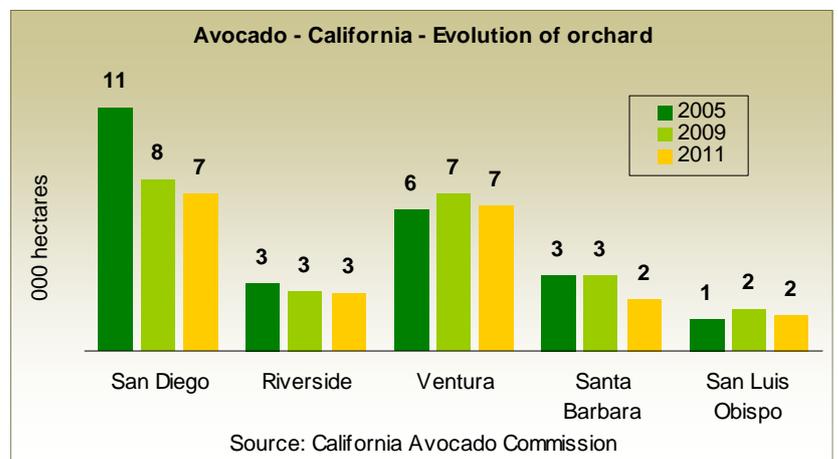
being able to invest in wells and replanting on rootstocks that are less sensitive to salinity or planting high density orchards to increase productivity.

Sources: Reefer Trends, University of California, California Avocado Commission

■ Eating avocado has proven health benefits. This is the conclusion of a study run from 2001 to 2008 and published in Nutrition Journal. In a sample of 17 600 persons, 347 regular eaters of avocado had less body weight and smaller waists, better body mass indexes and a better level of 'good' cholesterol (HDL). Their risk of metabolic syndrome (prefiguring serious affections such as type 2 diabetes, heart disease and stroke) was 50% less.



Source: Nutrition Journal



Source: California Avocado Commission

Sea freight

February 2013

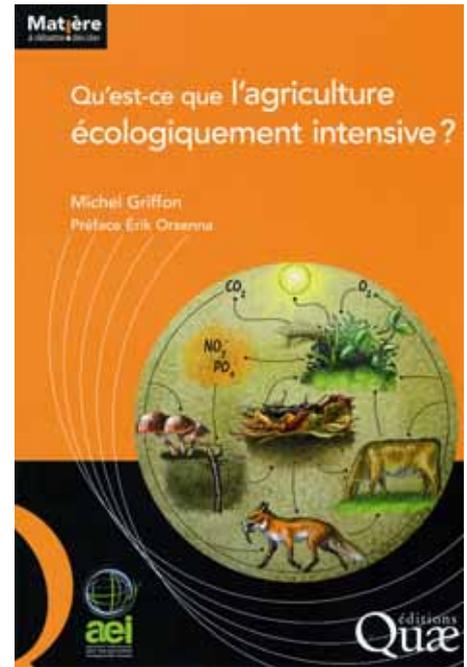
The upward momentum in activity levels established in mid January continued into February but banana box rates did not scale the heights operators had been anticipating when they met at Fruit Logistica in Berlin. This was principally due to the ongoing shortfall in banana volumes from Ecuador and a good thing, if not for the reefer operators then for charterers, as Med markets were able to clear a backlog of poor quality arrivals.

A two-tier market developed: high-end tonnage with deck-stow container capacity was fixed into Chile on TC at levels well above 100 c/cbft while banana box rates for the lesser units peaked at USD 8.75, which may have yielded 30c/cbft TCE less on certain ships. This two-tier trend looked likely to continue until the final Chilean grape shipments to the US in week 13.

Despite the absence of demand from Mauretania and the Falkland Islands, chartering activity in the small segment was brisk throughout the month and the fleet optimally utilized. The monthly TCE average was somewhere between 105-110 c/cbft, more than double the February 2010 figure, a reflection of the new equilibrium between supply and demand after the demolition of so many small units over the past 12 months. Yields to owners would also have been boosted by the reduction in lay time relative to the situation 12 months ago – apart perhaps from those vessels that were caught in or outside the Algerian port of Mostaganem for two weeks without appropriate Charter Party cover!

■ *Qu'est-ce que l'agriculture écologiquement intensive ?* by Michel Griffon.

The author shows that the combination and amplification of ecological functions can create productive synergy while reducing effects on the environment. He defines a new technical pathway for the farmers of tomorrow: that of using scientific ecology as a base for reasoning in agricultural and livestock farming. With scientific rigour and pragmatism, he describes, defines and specifies concepts and a large number of applications concern the reality of agricultural problems. But the book goes beyond techniques as ecologically intensive agriculture is also based on the principles of the viability of ecosystems and societies. Sustainable agriculture must be proposed within a framework of sustainable ecosystems for societies that are economically and socially viable. This technical revolution will lead to a new social and environmental contract between societies and their farmers.



Series: Matière à débattre et décider. In French Editions Quae, ISBN 978-2-7592-1896-7, réf. 02359, February 2013, 224 pages, 24 euros, serviceclients@quae.fr, <http://www.quae.com>



■ Michel Eddi is the new Chairman of the Board of Directors of CIRAD. He has taken over from Gérard Matheron. Michel Eddi knows CIRAD well as he was Secretary-General from 1996 to 2001 and Assistant Scientific Director from 1993 to 1996. He was Director-General Delegate for support for research at INRA from 2005 onwards.

Source: Cirad

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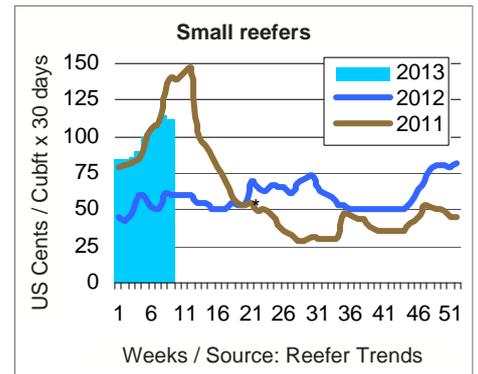
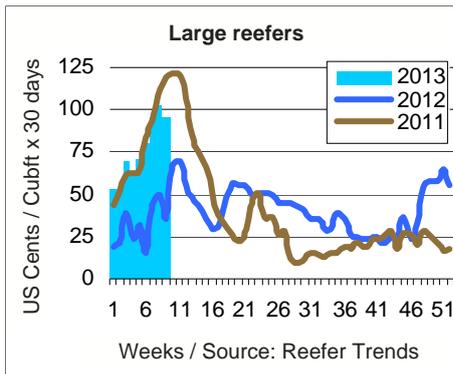
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REEFER

MONTHLY SPOT AVERAGE

USD cents/cubic foot x 30 days	Large reefers	Small reefers
February 2013	89	107
February 2012	39	55
February 2011	89	116



Soursop (*Annona muricata* L.)

Indescribable flavour... but perishable!

An amazing flavour resembling a subtle mix of strawberry and pineapple with a hint of citrus means that soursop is highly appreciated in many countries. Unfortunately, it is highly perishable at ambient temperature and can only be kept for a few days (4 or 5 at a maximum) which considerably limits trade. In spite of this, *Annona muricata* is the most commonly grown *Annona* species in the world.

The annonaceae grown for their fruits include the custard apple (*Annona squamosa*), the bullock's-heart (*A. reticulata*) and the cherimoya (*A. cherimolia*). The ylang-ylang (*Cananga odorata*) is also grown for its flowers. Although soursop originated in tropical America, it is now found as an import in many parts of the world: Africa, India and South-East Asia. It is also very common in the Caribbean islands. However, world production is concentrated in a few South American countries like Venezuela, Brazil and Colombia. Although there are no recent production or sales statistics for these countries, soursop nevertheless has a major position on the markets of Central America, the Caribbean and Asia. It is generally eaten close to production zones as its short post-harvest life and the absence of suitable packing and transport methods do not encourage trade in this fruit.



© Fabrice Le Bellec

The tree, its ecology and cultivation

The tree grows to a height of 3 to 8 metres. It has an erect habit initially and then becomes globular as it grows older. The dark green shiny, leathery leaves are elongated. They release a pleasant characteristic smell when crushed. The flowers are bell-shaped and appear either at the tip of a shoot or grow directly on an older branch. The fruits are large, elongated and covered with soft bristles. Fruit weight can attain 4.5 kg and depends mainly on pollination; poor pollination results in small, irregular fruits. When the fruit is mature it loses its shine and has a greyish hue. However, the fruits of some varieties remain completely green, even when ripe.

Soursop likes hot, humid climates. It is indifferent to soil quality as long as drainage is good. Planting density is usually about 300 trees per hectare. Training pruning is rarely necessary as the trees form well naturally. The first harvest starts three or four years after planting. Harvests are generally small and irregular for lack of good pollination. The problem of fertilisation is addressed by using artificial pollination.

Although they are hermaphroditic, the flowers of the annonaceae cannot self-fertilise. They are dichogamous and the stigma (the female part of the flower) is receptive before the stamens (the male part containing pollen) reach maturity. This floral feature, together with low attractiveness to insects, often results in very poor pollination and hence low productivity. The few pollinisers interested in these flowers include small beetles of the Nitidulidae family (*Carpophilus* and *Uroporus* spp.), ants and thrips.

In the light of all these features, different steps can be taken to improve the yields of these species:

- make natural fruit setting conditions more favourable by using sprinklers to increase the moisture of fields that are too dry;
- enhance the presence of pollinators, in particular by reducing pesticide applications;
- increasing the fruit setting rate artificially.

As regards the last point, different experiments around the world have proved to be effective. In practice, pollen is taken from the flowers at their male stage and used to pollinate flowers at the female stage. All that is needed is a brush and a small jar. The brush is used to



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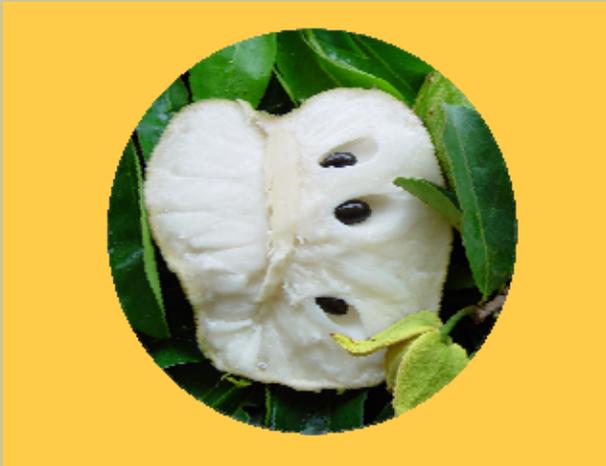


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Mealybug
on soursop



Borer damage
in soursop



© Fabrice Le Bellec

help pollen fall into the jar and also to pollinate flowers. A pollen-coated brush is inserted between the partially open flower petals to reach the stigma. This is a well-mastered technique that gives high setting rates of 80 to 100% and allows a considerable increase in yields as there are more, larger fruits. Soursop fruits twice a year in the southern hemisphere—first from April to June during the flowering period for the second fruiting, and then from October to December. Flowering and fruiting alternate practically all the year round in the tropical part of the northern hemisphere.

Pests

Soursop is attacked by various pests including two pyralids (*Nephoterix beharella* and *Spatulipalpia pectinatella*) that can wipe out the whole harvest. Preventive treatments based on *Bacillus thuringiensis* (an entomophagous bacterium specific to Lepidoptera) reduce their impact. Several species of scale, including in particular the redoubtable hibiscus scale, can also cause serious damage especially if they are not controlled naturally by beneficials. A borer (*Bephratelloides paraguayensis*) considered as one of the most serious pests of soursop is also observed on fruits and seeds in the Caribbean (especially in the Dominican Republic), Mexico and Central America. The female lays eggs on young fruits and the larvae and pupae then develop in the seeds. The adults subsequently bore a gallery to leave the fruit. Pricked fruits are unsuitable for sale. Finally, anthracnose causes damage to fruits by staining the skin, making them unattractive.

Use

Soursop pulp is fibrous, very juicy and has a sweet and acid flavour. It is particularly suitable for making juice used as a base for the preparations of cold drinks, sorbets, syrup and yogurt. It is used fresh or after freezing. The pulp has a high sugar content (18%, mainly glucose and fructose) and contains a significant amount of fibre (1%) and vitamins B1, B2 and C. Green fruits can also be roasted or sliced and fried.

Soursop is reported to have numerous medicinal virtues. The juice is considered to be tonic and have vermifuge properties. The

leaves and buds are sedative and effective against coughs and fever. A bath becomes relaxing when a handful of fresh leaves has been thrown into the water. This preparation is often recommended in the West Indies for soothing babies. The seeds and bark are toxic and should not be used internally. Powdered seeds are used in particular for preparing an insecticide. Although, overall, soursop has fairly positive effects on health, recent research conducted in the Caribbean has nonetheless demonstrated a negative impact. Indeed, consumption of the fruits and/or infused leaves and especially the annonacin that soursop contains, might potentially lead to an atypical form of Parkinson's disease.

A small ethnic market supplied mainly by the West Indies

The European soursop market is extremely limited, to the extent that it does not appear in the catalogues of a fair proportion of importers specialised in tropical fruits! Soursop supply still caters for the ethnic market. It is particularly appreciated by West Indians and also by Asians, which broadens the potential consumption base. The main source of supply for the European market is the West Indies, but other sources exist, such as Kenya and Vietnam for example. Fruits from the West Indies are often packed in boxes of the type



© Pierre Gerbaud

used for bananas. Smaller packaging (4 to 5 kg) is also used. It is purchased all the year round and in particular during the Christmas period and the Chinese New Year, when it forms part of the celebration rites.

Development slowed by many features, benefiting the other annonaceae

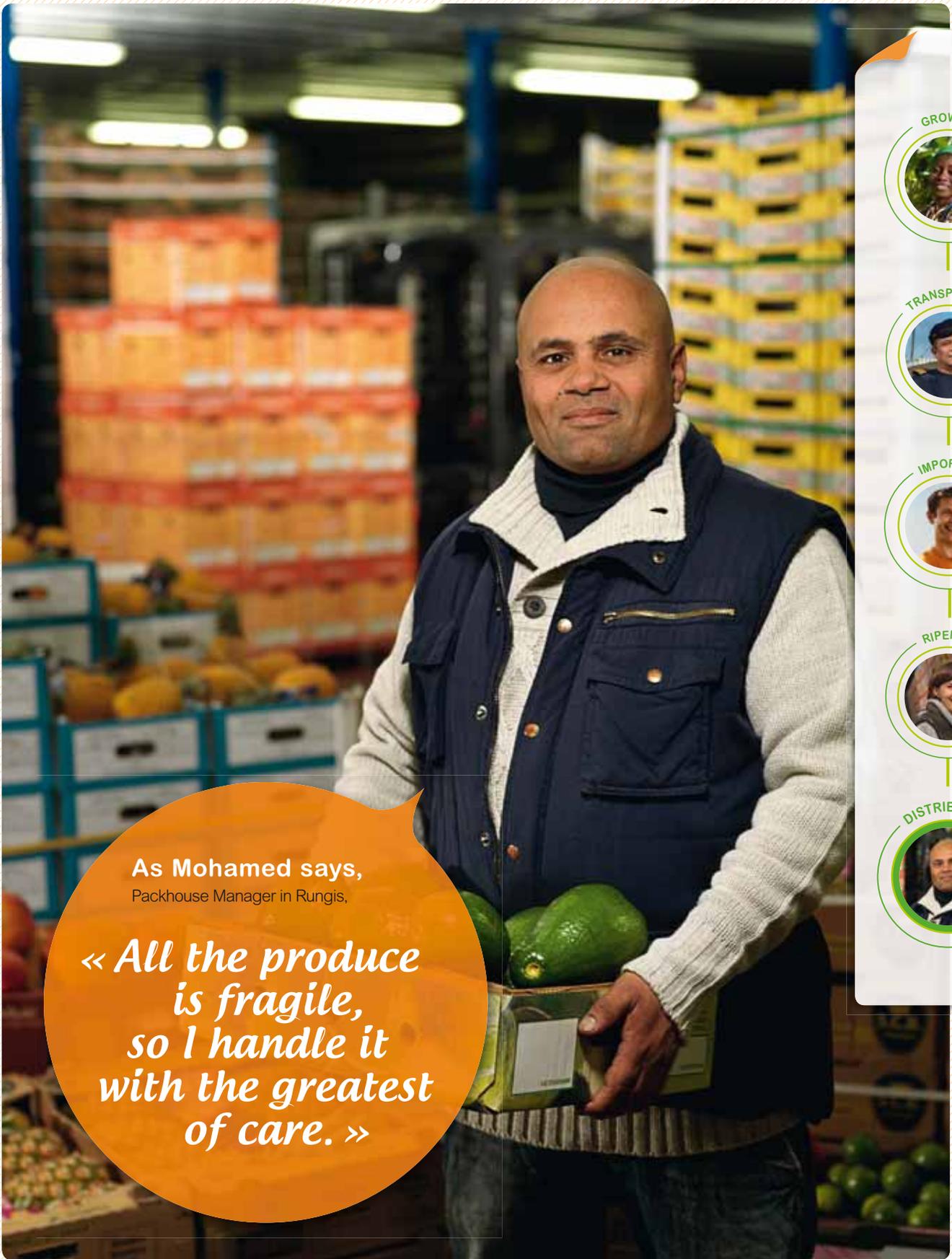
Many features slow the development of the soursop market. West Indian production is limited and sold mainly for domestic consumption, leaving only small quantities for export. In addition, the size and fragility of the fruit make it difficult to manage. Its tortured physiognomy and its often large weight and size form constraints for packing and packaging. Banana boxes do not show off the produce and increase risks of impacts and crushing. Soursop also ripens fast and can only be shipped by air on condition that the fruit is picked at a stage at which it can stand transport and handling.

Its high price also limits commercial development. It is considered that buyers avoid produce costing more than EUR 3.50 to 4.00 per kg at the wholesale stage and air freight is very costly because the fruit is heavy. This feature seems to be the reason for the small scale of imports from Kenya, the traditional supplier of soursop. As soursop is not regularly available on the European markets, consumers often buy cherimoyas instead as this substitute is more frequently available from Spain, Portugal, etc. and is cheaper (from EUR 1.80 to 2.50 per kg at the wholesale stage in France). However, there would seem to be a potential market for soursop, but development requires overcoming the obstacles mentioned above ■

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Dominique Louppe © Cirad



As Mohamed says,
Packhouse Manager in Rungis,

« All the produce
is fragile,
so I handle it
with the greatest
of care. »



Mohamed packs produce with the ultimate care. It's all part of Compagnie Fruitière's commitment to delivering the best quality fruit in perfect condition. Packing orders with this level of attention means Mohamed can ensure our fruit looks at its very best when it reaches our customers. And with more than 20,000 m2 of depots throughout Europe, Compagnie Fruitière is able to distribute 700,000 tonnes of fruit every year to wholesalers and retailers.

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Close-up by
Pierre Gerbaud

Mango

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Although it dipped slightly in 2012, the performance of the European mango market displays a positive movement that might be envied by many other fruits and vegetables. There were no great upheavals in supply other than the confirmation of trends that had already been observed, the main one being the increase in the supply of fruits from the Mediterranean basin. Although shipments from Morocco and Egypt remain modest, the performance of Israel and Spain is becoming confirmed as these sources benefit from their closeness to destination markets. Varietal diversification and ripening techniques seem to be of increasing interest to retail distributors so that they can satisfy a clientele that is ever more demanding as regards retail prices.



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We are specialists in the trade of mango. We import and export so that we can offer our customers the best product **all year round**. We work every day of the year with all these varieties: **Kent, Osteen and keitt**.



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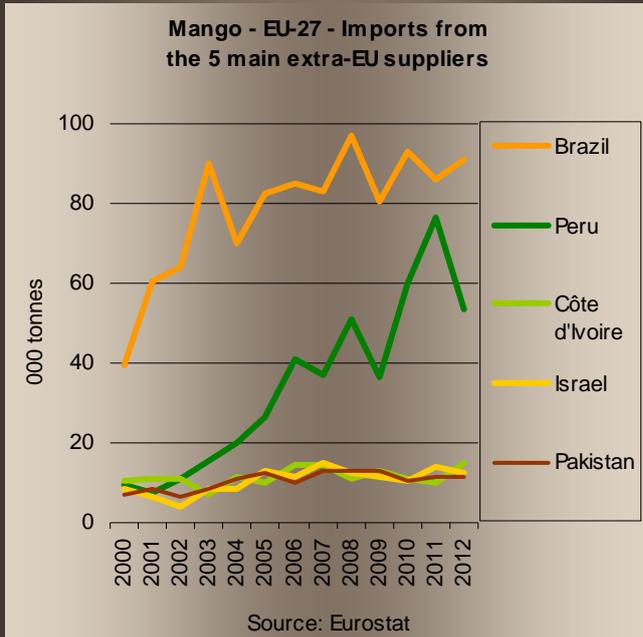
The European mango market

Ensure volumes and improve quality



© Denis Loeillet

In spite of a few incidents, the 2012 European mango sales season was satisfactory. As in previous years, the seasonal nature of the fruit caused some fluctuations in supply and hence in selling prices. With a little hindsight, it can be said that the mango market is not doing too badly, judging by the increase in the volumes sold over the last decade. But Europe is considerably out-performed by the North American markets as regards volumes imported for a much larger population. Might the presence of Latinos and trade structures and practices in the USA be the reasons for this?



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A longer or shorter season according to the source

Although the increase is slower, the movement of European mango imports is positive—a situation that many other fruit and vegetable sectors would like to enjoy. No marked changes in supply were observed in 2012 and a few noticeable trends were confirmed. There was closer regulation of flows from the main sources supplying the market rather than the little controlled and untimely fluctuations featured by Brazil and then Peru in the early 2000s. It seems that regulation mainly concerns the lengths of seasons, with a tendency for concentration for some sources and lengthening for others. Certain trade opportunities and better observation of market changes have led sources to re-adjust their exports.

Although Brazilian mangoes are on the market all the year round, an effort is being made to lengthen the shipment periods by increasing presence on the market in the spring and by starting the autumn/winter season earlier and earlier. Peru seems to be delaying the start of its season by playing on the distribution of exports between the North American and European markets. However, for a number of years it has been trying to lengthen its season until May to fill the gap between the end of its shipments and the start of the West African season. Mexico is also trying to broaden its trade slot on the European market by making earlier shipments and its vast territory and range of climates make this possible. Finally, but to a lesser extent, Spain is trying to lengthen its season until the beginning of December by substituting the later 'Keitt' for its celebrated 'Osteen'. The lengthening of the sales period for mangoes from Spain in 2012 was possibly just a one-off occurrence during an exceptional season.

In contrast, exporters in other sources tended to concentrate their shipments in a shorter period. The first example is doubtless Côte d'Ivoire, from where most of the shipments left in May, sandwiched between a recurrent late start for meteorological reasons and the risks of deterioration of fruit quality at the end of the season. But Côte d'Ivoire is not an exception. Burkina Faso also concentrated its shipments in 2012. Senegal and Israel did likewise with fairly satisfactory results.

This concentration and extension movement highlights the strategies used by each source

in the light of their own constraints to improve the quality of their shipments and returns. More attention is paid to the changing meteorology of the production zones and the evolution of markets, thus emerging from a more anarchic phase in which any mango could be exported once it had been picked.

More willing acceptance of varietal diversity

The varietal diversity available to consumers is still timid but seems to be broadening a little. It is true that the adaptation of varieties to soil and climate conditions in the producer countries has always existed but beyond the technical constraints of production there is intentional and no longer imposed diversification. A trend seems to be taking shape gradually after the historical reigns of the variety 'Amélie' in the 1980s and then 'Tommy Atkins' and finally 'Kent'. The leaders in diversification have doubtless been Israel with 'Maya', 'Aya', 'Omer', 'Shelly', etc., and Spain with the variety 'Osteen'. Other mangoes, and especially Asian types, are gradually arriving on the European markets: 'Nam Dok Mai' from Thailand and 'Chausa' and 'Sindhri' from India and Pakistan. 'Cavallini' also arrive from Costa Rica. The positioning of new sources thus naturally brings a set of varieties hitherto little seen. However, the range does not always meet endogenous criteria. We therefore sometimes see 'Ataulfo', a Mexican origin, but grown in Peru, or 'Maya' exported from Brazil. Although this is a limited trend, the number of attempts at sales is increasing. It is still marginal but could grow in the future. It doubtless matches the desires of a consumer fringe that



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is disappointed in the large quantities of mediocre quality fruits available.

Mangoes ready to eat

Similarly, better knowledge of the fruit by consumers results in a quest for better quality in retail channels in the broad sense. The mango sector is trying to do what has been done in avocado, where the ripening procedures gradually installed have resulted in an increase in consumption. The approach is only just starting but is leading to great hopes with regard to the possible effects on consumption levels. Until now, mangoes 'ready to eat' available in the shops have generally been drawn from a selection of fruits starting to 'turn' chosen among batches received by importers. In a way it helped to sell riper fruits that could not be fed into traditional retail channels. It remains effective and has been gradually formalised.

Given the complexity of the physiological ripening process, the task was difficult and still is today. However, several companies are in search of a technical procedure based on objective measurement of the degree of ripeness of fruits. The same tools as those developed for avocado and based in a fruit pulp resistance index have been used for an empirical approach to the classification of mangoes via the number of days between reception and optimum consumption date. The results are still incomplete and partially uncertain but form progress in the approach. The ripening of mangoes is complicated because of the different varieties, the production zones in which they are sources and the sales period of fruits from each source. All these factors are difficult to master. The pathway has been shown but leaves time to professionals who use artisanal ripening with purely thermal processes that are often uncertain ■

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The 2012 mango season, source by source

Compression and expansion of seasons



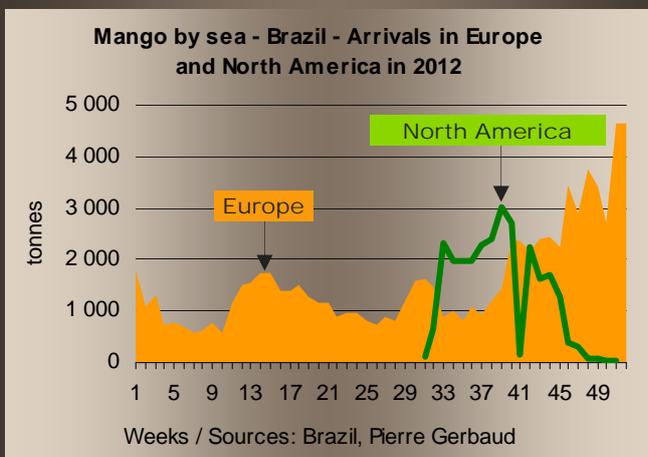
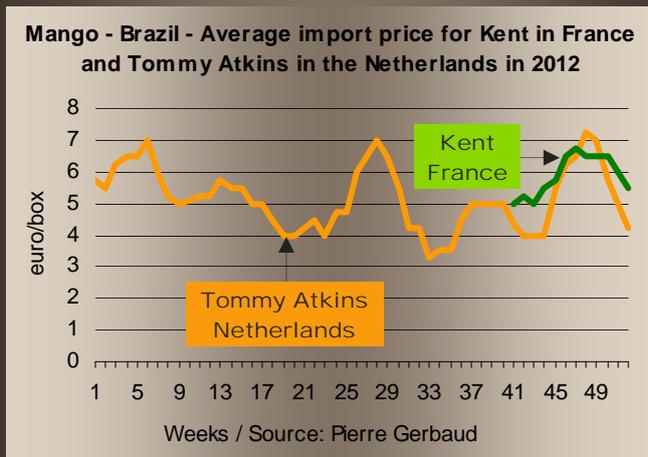
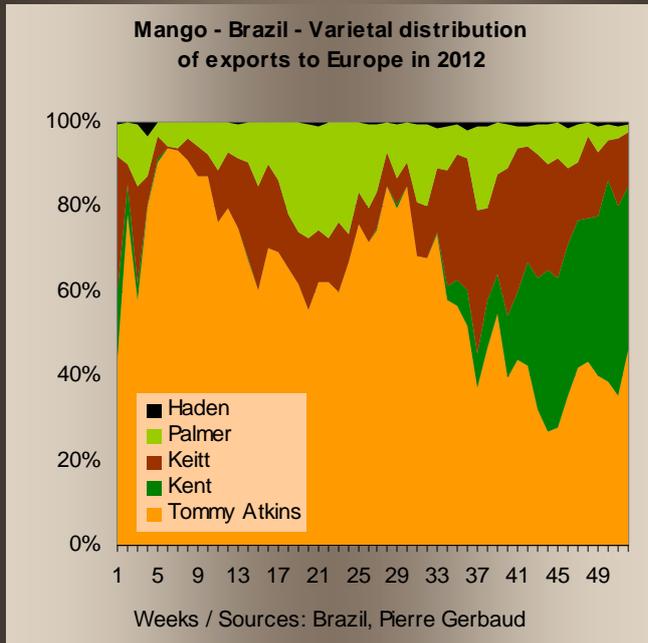
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The sources supplying the European market are always exposed to variations in production but seem to be paying more attention to their trade strategies, avoiding untimely overloading of the market that often results in falling prices. A few exceptions confirm the rule however.

Brazil The pivot of supply to Europe

Brazil has been the leading supplier of mangoes to the European market for many years. The large area under mango distributed between several regions of this vast country makes it a substantial supplier of the international mango trade. Exports are mainly divided between the North American and European markets and do not vary much from one year to the next. In 2011, exports to Europe totalled 91 500 tonnes and only 87 800 tonnes in 2012 according to the latest estimates.

There are two main seasons for Brazilian mangoes in Europe. The first runs from February to September overall, with the smallest deliveries from mid-January to mid-February and then in July and August. These quiet periods feature weekly volumes of between 500 and 1 000 tonnes. The European spring is busier with deliveries of 1 000 to 1 500 tonnes per week,



with 'Tommy Atkins' clearly dominant. Varietal diversification has been observed in the last few years, with the simultaneous shipping of 'Keitt' and 'Palmer'. Brazil thus ships mangoes for practically three-quarters of the year.

The second period runs from the end of September to mid-January and features an increase in volumes to a weekly 2 500 to 4 500 tonnes. This is accompanied by a marked change in varieties as 'Tommy Atkins' is in a minority after 'Keitt', 'Palmer' and above all 'Kent'. Brazilian exports peak to both European and the North American market (August to November). Fluctuations are at their greatest during the key September/October and December/January periods when sources such as Israel and Spain are active, followed later by Peru and, to a more moderate degree, by Ecuador.

The Brazilian varietal pattern changed slightly in 2012. 'Tommy Atkins' accounted for 62% of shipments in comparison with 60% in the preceding year. 'Keitt' remained stable at 16%. In contrast, while 'Palmer' increased from 8 to 12%, 'Kent' shipments decreased markedly from 15 to 10%. The fall is doubtless part of the reason for Brazil's good end of year season with an increase in the price of 'Kent', the most sought-after variety on European markets.

The 2012 season proceeded like the previous one and was fairly fluid, with no real period of low prices. The averages for 'Tommy Atkins' were rarely lower than EUR 4.00 per box. Only the mid-August to mid-September period was more tense with sales at between EUR 3.00 and 4.00 per box as a result of supply consisting mainly of small 'Tommy Atkins' fruits in a context of very moderate demand and slow recovery after the summer holidays. A few sales at open prices aimed at clearing the stocks available were observed during this period. The price of 'Tommy Atkins' weakened considerably in May because of the strong presence of 'Kent' from West Africa available at competitive prices.



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The surprise came at the end of the year. The announcement of a shorter 'Kent' season with smaller volumes probably kept market conditions good from early October until the Christmas period. The price of 'Kent' from Brazil increased steadily throughout October and November, climbing from EUR 5.00 per box to nearly EUR 7.00, while arrivals reached their highest level. This was even a general movement as the price of 'Tommy Atkins' displayed the same pattern. The quantity shortage in comparison with the same period of the preceding year goes towards explaining the trend. The only supplier of the European market in this sector with shipments approaching under-supply, Brazil benefited from amazingly long-lasting good market conditions. In December, prices stabilised at above EUR 6.00 per box before falling in mid-December with the arrival of the first shipments from Peru. These three months of satisfactory sales were followed by a fall in prices that was proportional to the rise seen in October. Prices fell to very low levels from the beginning of January 2013 for both 'Tommy Atkins' and 'Kent' under the combined effect of a decrease in demand and an increase in fruit quality problems in the last batches received. The decrease in the number of shippers in recent years, better matching of flows to market conditions in both Europe and North America and sales on an increasingly dynamic domestic market are in short the advantages of the source. After a series of crises in the early 2000s, a certain maturity seems to have been attained.

A complicated air shipment season overall

Brazilian deliveries formed most of supply on the air mango market at the end of the year. Problems of colour and degree of maturity were observed from the beginning of the season onwards. To these were added a few problems of

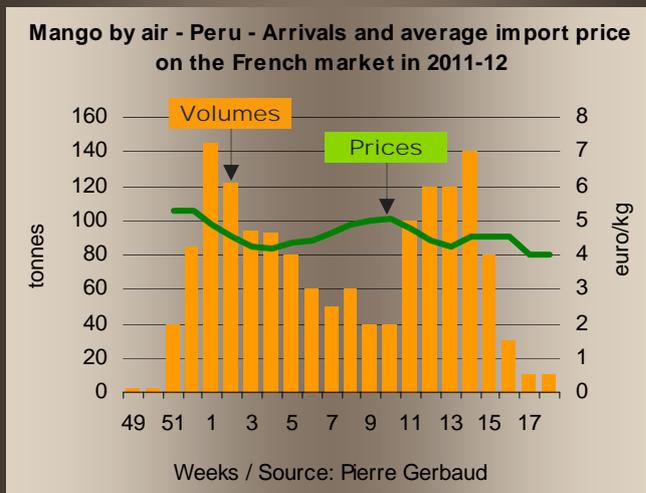
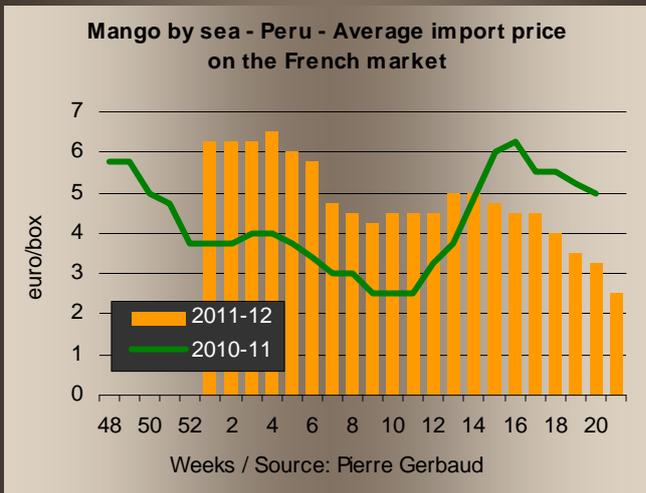
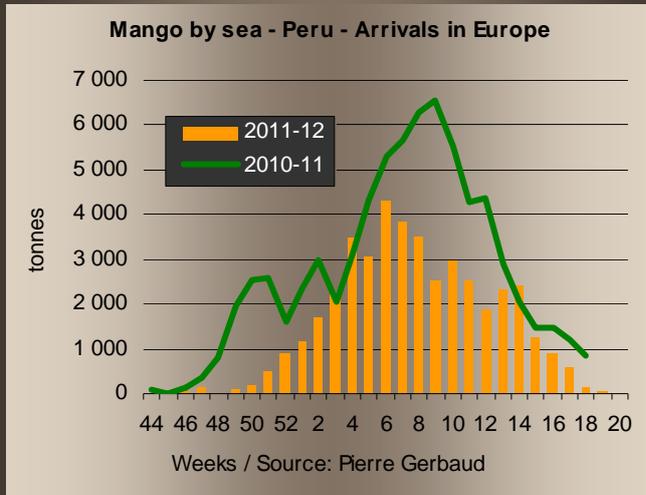
internal quality at the beginning of the period and this made it difficult to sell the fruits. Although quality and maturity then improved, lack of colour lasted for the whole season. Uneven fruit quality and occasional over-supply caused market saturation followed by cyclical clearance sales. In October, the increase in Spanish exports of 'Kent' intensified competition and price ranges broadened considerably. The end of the season for 'Kent' from Spain contributed to an increase in the price of Brazilian produce in November, with it being the only source operating on the market. The Peruvian season started in mid-November. The first deliveries displayed more attractive colour and satisfactory maturity and these features affected the prices of Brazilian mangoes, which remained lower than those of competitors until the end of the year. An increase in supply from Peru saturated the market and aggravated this trend from mid-December onwards.

Peru A mediocre season in spite of a strong decrease in volumes

With 2011-12 season exports to Europe totalling 42 000 to 44 000 tonnes, Peru displayed a substantial decrease in comparison with the 72 000 to 75 000 tonnes of 2010-11. However, this 40 to 45% deficit in volumes did not bring the hoped-for results in a context of smaller supply. The situation seems to have been the same on the North American markets where, after reaching 65 000 tonnes in 2010-11, Peruvian exports fell to 24 000 tonnes in 2011-12, with balanced distribution between the West and East coast ports of the US. The more marked decrease in shipments from Peru to North America was caused by two main factors. Peru faces strong competition from Brazil and Ecuador, which ship large volumes at often very



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competitive prices. In addition, there still seems to be a limited number (less than ten) of packing stations in Peru with equipment for the hydrothermal treatment required by the US authorities, and this slows expansion in a market that is nevertheless nearer than Europe.

It was forecast in autumn 2011 that the season would be smaller in volume and probably later. In fact, although quantities were distinctly smaller than those of the two preceding seasons, the duration was the same overall. The harvest that started at the end of October allowed the first small deliveries in Europe in mid-November. The produce sold well as Brazil was coming to the end of the 'Kent' and 'Keitt' season and competition was only moderate. Thus the switch from Brazil to Peru did not display a marked gap. The full season started in Peru in January and peaked in mid-February. Prices remained fairly stable at between EUR 5.50 and 6.50 per box during this period. The profile of the season differed to those of the two preceding ones and displayed a gradual fall in prices while deliveries dwindled. Prices generally fall during the peak delivery period and recover when deliveries and stocks decrease strongly. In 2012, prices continued to weaken until the second half of March but remained higher than in the preceding year at around EUR 4.50 per box. Prices rose markedly (EUR 5.00 per box) from Week 12 to Week 14 as demand was boosted by Easter. During this period, Peru remained the only substantial supplier of the European market because of the late start to the seasons in West Africa and it shipped its last reserves of fruits before the end of the season. However, in contrast with previous years, the recovery was short-lived as price fell substantially again to less than EUR 3.00 per box for the last deliveries at the end of April.

The Peruvian season seemed to have been successful, given the small tonnages and the good changeovers with Brazil at the beginning of the season and West Africa at the end, but it was less positive than forecast. It is true that there were no avalanches of volumes in January or February as in other years when the European markets were lastingly saturated and prices remained at very low levels (EUR 2.00-2.50 per box) for many weeks, doubtless endangering the health of numerous export operators. There was no prolonged storage either—a cause of worsening quality and loss of value. However, the condition of fruits and their poor behaviour are often put forward to explain the mixed results of the 2011-12 season. Indeed, stem rot, fungal attacks and black spoilage strongly affected shipments from Peru from mid-February onwards and this rapid worsening of quality mentioned by many consignees continued until the end of the season, explaining the falling prices while the market was still un-



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March, brisker demand as Easter approached favoured a short-lived price recovery. Competition became fiercer in the final weeks of the season, with large deliveries from Côte d'Ivoire taking over from those from Peru.

2012-13 - probably a large season

In contrast with 2011-12 and its marked decrease in volumes, supply in the 2012-13 season promises to be more ample. It started in mid-November in a strong, firm market context. Unusually high prices reached levels rarely seen at this time of the year. The first shipments consisted mainly of small fruits of medium quality in terms of colour and stage of maturity and sold well in the face of still large volumes of Brazilian fruits. However, the market started to dip in mid-December and prices lost EUR 1.00 to 1.50 per box over a period of two weeks. The trend was confirmed at the beginning of January when sales were concluded at an average EUR 4.00 per box. The Peruvian season started poorly, with a profile similar to those of 2009-10 and 2010-11.

der-supplied. The necessary sorting of arriving produce resulted in large amounts of rejects and this weighed on the cash results of sales.

The phenomenon was all the more disturbing as the requirements of European retail distributors as regards fruit maturation are increasingly strict. The quest for better quality should be a focal point for Peruvian shippers. Mango is a sensitive fruit and uneven maturity of batches is a recurrent problem in produce from all sources. However, the long transport time is doubtless an extra handicap. Although it is traditional to observe cases of immaturity at the beginning of the season and poor quality at the end, they do not call the progress of a season into question fundamentally. However, the presence of quality defects for half of a season is a major event. Perhaps it was the unfortunate result of particular weather conditions at certain times during the vegetative cycle of mangoes in Peru? If not, the strong increase in Peruvian exports in recent years could be disturbed.

Air shipments in see-saw style

The shipment of Peruvian mangoes by air started in December 2011 with good market conditions, driven by busier demand for the Christmas season. Prices remained high while deliveries consisted mainly of small fruits whose colour and maturity were uneven. In January, the large volumes released on the market exceeded demand, which had tailed off after the New Year. Stocks accumulated and led to deterioration of a large proportion of the produce available, obliging operators to run clearance sales with low prices. The decrease in deliveries in February favoured an improvement of prices. A fresh increase in arrivals in March resulted in mid-month clearance sales of frequently over-mature fruits. Peru, hitherto the exclusive supplier of the EU, was then in competition with West Africa and Costa Rica, whose seasons were starting. At the end of

West Africa

Once again, political instability marked the West African mango export period. Although Côte d'Ivoire became more stable after a decade of recurrent disturbances, it was now Mali's turn to experience a political crisis that caused serious logistic malfunctions. It has to be observed that in spite of the ups and downs of history, West African countries have always supplied mangoes to the European markets. In this context, the results of the 2012 season differ according to source and sales period.



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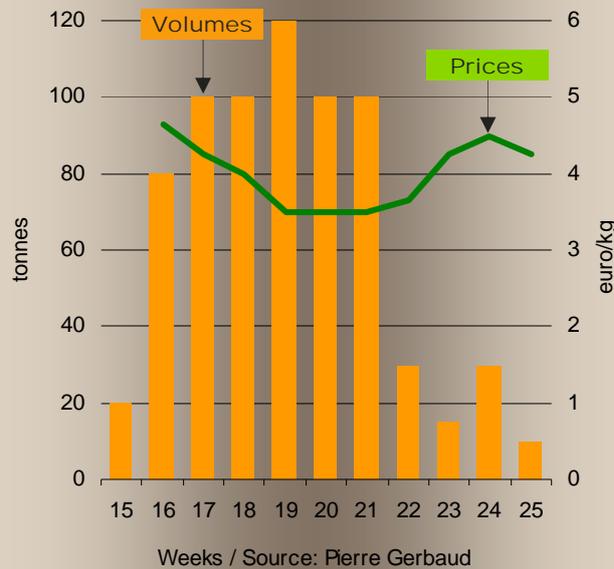
Côte d'Ivoire A concentrated season

The 2011 season was difficult because of the political crisis experienced by the country, but nearly 10 200 tonnes of mango was shipped nonetheless. The pugnacity shown during a bad period made it possible to increase exports under calmer conditions in 2012. Shipments totalled 15 250 tonnes, the highest figure of the last decade. Although this can be praised from the technical point of view as there were numerous logistic problems, the financial results do not seem to have been on the same scale.

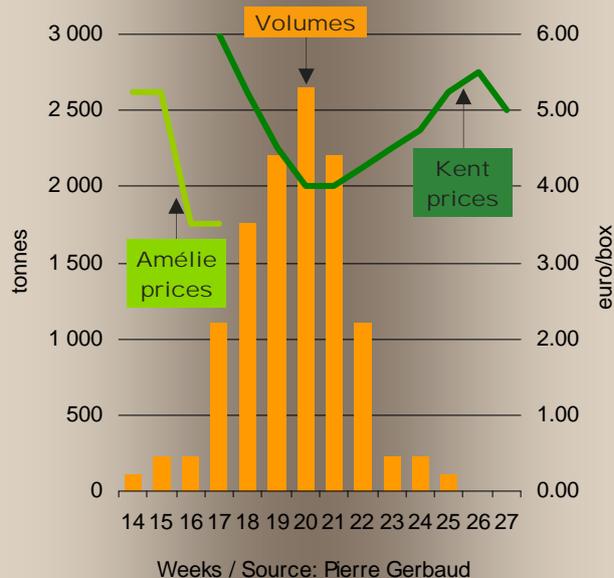
The first batches of 'Amélie' arrived in Week 14 and were on the market in Easter week. But the prices fell rapidly as the variety did not match demand on a market hitherto supplied with 'Kent' from Peru. These deliveries went on until Week 17 but prices continued to fall in the face of the last batches from Peru, mangoes from Costa Rica and the start of the season in Puerto Rico. The first 'Kent' arrived from Côte d'Ivoire in this competitive situation. Although their quality was satisfactory they sold slowly. Large stocks soon formed with massive shipments from Côte d'Ivoire (75% of the season's volumes were received in May), competition from other sources and seasonal produce and dull demand. Shipments practically stopped at the end of May for fear of quality problems resulting from rain in the production zones. Deliveries of certain containers running late by sometimes as much as a month weighed on the market in May and the beginning of June at a time when it generally clears as the volumes available are sold. Prices only began to recover in June, with good quality fruits reaching their beginning-of-season level at the end of the month. In fact, the large quantities of produce sold at low prices or discarded brought sales averages down to levels that were not very profitable.

At a price of about EUR 4.50 per kg, the first 'Kent' shipped from Côte d'Ivoire by air sold with greater difficulty than the last batches of good quality fruits from Peru that were available in Week 16. The late start of the air season ruled out once again the possibility for Côte d'Ivoire of profiting from the Easter consumption peak. As for the sea shipment season, the influx of goods over a fairly short period soon saturated the market and brought prices down. Stocks formed and the gradual deterioration of their quality led to clearance sales. Hardly three weeks into the season, prices stabilised at EUR 3.50 per kg until the end of May. The quantities shipped then decreased, favouring an increase in prices for the last batches in mid-June.

Mango Kent by air - Côte d'Ivoire - Arrivals and average import price on the French market in 2012



Mango by sea - Côte d'Ivoire - Arrivals and average import price on the French market in 2012





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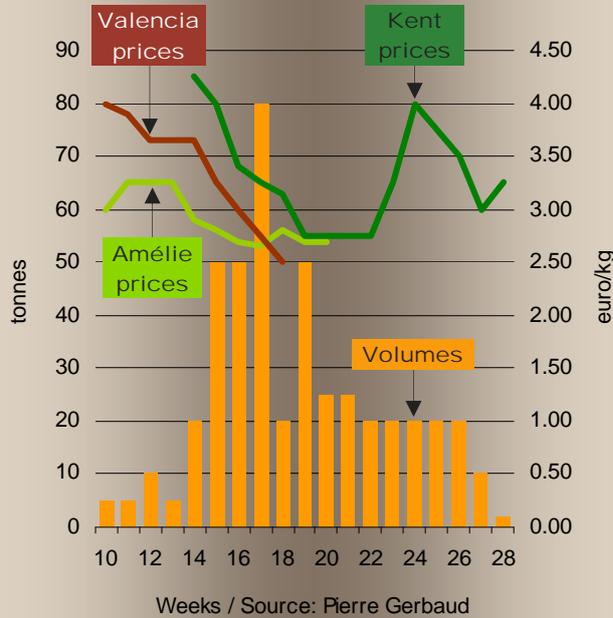
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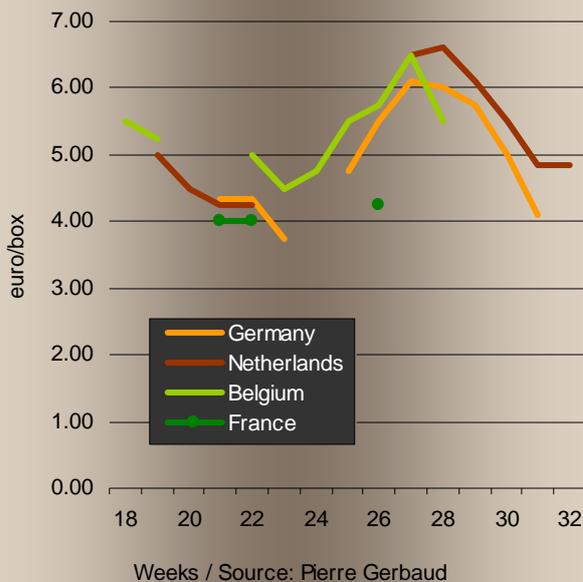
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Exotiques

Mango by air - Mali - Arrivals and average import price by variety on the French market in 2012



Mango by sea - Mali - Average import price in Europe in 2012



Côte d'Ivoire's instability for a period of several years has little by little led other sources to make up for its possible failures. Thus Peru has gradually played on the transition periods between the leading suppliers of the European market and profited from the recurrent late start to shipments from Côte d'Ivoire to profit from an end to the season that is often dotted with bad periods. Depending on the year, other sources such as the Central American countries that do not generally ship much produce to Europe display more substantial presence. Brazil has also become involved in the spring slot as its production potential is continuous. The risks of worsening quality (fungi) at the end of the Ivorian season encourage exporters to halt shipments rapidly and this often causes a gap in supply. It is also observed that this early end of shipments has gradually resulted in the disappearance of 'Kent' from the Ivorian calendar. This means that the season is extremely concentrated and does not favour good sales of produce whose intrinsic quality is nonetheless recognised.

Exports from Côte d'Ivoire are thus trapped between climatic and commercial problems and quality problems that damage their image. No practical solution seems to be implemented. It is true that it seems difficult to intervene in the weather conditions that determine the optimal harvest period and hence the start of the season. But there might be ways of ensuring good quality fruits after the end of May and continuing the season for longer, with fluidity conducive to maintaining steady prices. The relatively limited number of operators and their respective size would seem to be a positive feature for improving quality as such an operation can only be collective.

Mali A return to close to normal

The 2011 season had been particularly difficult for Mali as the troubles in Côte d'Ivoire had blocked exports via the port of Abidjan for part of the season. It was thus only possible to ship smaller volumes than before from Mali, in this case about 1 800 tonnes including 800 tonnes by air. It regained its position in 2012 with exports of nearly 3 800 tonnes to the European markets. The first shipments by sea were simultaneous with those from Côte d'Ivoire 'Kent' at the end of April/beginning of May. As in the preceding years, exporters favoured the northern European countries close to the destination ports: the Netherlands, Belgium and Germany. This strategy avoided a face to face with Ivorian produce that was destined mainly for the



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French market. However, Malian mangoes were subjected to the same constraints, with the end of the Peruvian season and pressure from large volumes of fruits from Côte d'Ivoire and Central American countries. Prices weakened throughout May when supply from West Africa was at its peak (around EUR 4.50 per box). In contrast, it recovered very markedly in June and July after large quantities of Ivorian fruits had been sold. The better keeping quality of Malian fruits was visible and formed a good opportunity for markets seeking 'Kent' and 'Keitt'. Prices reached their highest level in mid-July at between EUR 6.00 and 6.50 per box. They then fell with the appearance of quality problems and the arrival of produce from new sources such as Senegal and Mexico. When routes for goods are open, Malian fruits sell satisfactorily in spite of the higher approach costs.

The air export season was more difficult. It started at the beginning of March with 'Amélie' and 'Valencia', sold mainly in France. Selling conditions were favourable for nearly a month in a context in which Peru was still the main supplier of fruits by air but in decreasing quantities and with increasingly uneven quality. However, with the arrival of the first 'Kent', 'Amélie' and 'Valencia' lost all their advantages and their price fell to less than EUR 3.00 per kg. Loss of interest was particularly marked for 'Valencia', with fragile fruits, whereas 'Amélie' held the interest of a fringe of buyers for a longer period. The first 'Kent' sold for more than EUR 4.00 per kg at the beginning of April but prices fell until the end of May (EUR 2.50-3.00 per kg) under the pressure of shipments from Côte d'Ivoire. Prices recovered rapidly in the first half of June when shipments from Côte d'Ivoire had stopped and the fruits had practically no competition (EUR 4.00 per kg). However, this improvement was short-lived and prices weakened again to around EUR 3.00-3.50 per kg until the end of the season in the first half of July.

Recurrent failure to match demand often penalises this source: immature fruits at the beginning

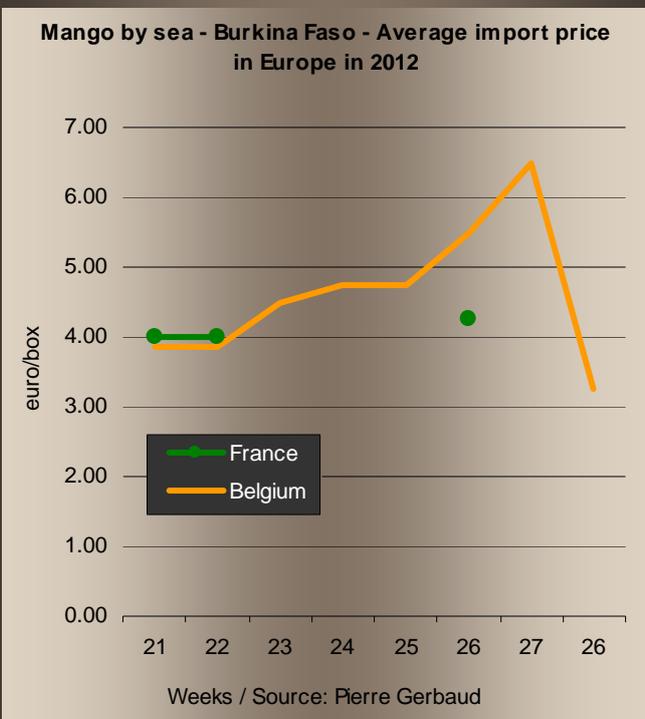
of the season, lack of colour, shipments of many unknown varieties, fruit selection and presentation sometimes lax, etc. However, in 2012 logistics was seriously disturbed after the March coup d'état that has strongly affected the collection and shipment of fruits. Movement inside the country was difficult and closures and reopening of Bamako airport were impossible to forecast. Packing stations had great difficulty in obtaining supplies and then shipments were delayed to varying degrees. The arrival at irregular intervals of sometimes large volumes of very ripe mangoes meant that they were difficult to sell on a market that was already complex because it was over-supplied. In addition to poor sales and clearance sales, the quantities shipped fell, affecting the financial results expected by Malian operators. It is estimated that about 600 tonnes was shipped by air instead of the usual 800 to 1000 tonnes. The determination of Malian operators under these difficult conditions deserves to be mentioned.

Burkina Faso Unchanged

With exports totalling some 2 000 tonnes in 2012, the scenario in Burkina Faso was the same as in 2011. The shipment by air of 300 to 400 tonne started in mid-March with 'Amélie' and continued until the end of April, with prices weakening steadily from EUR 3.00 to 2.50 per kg. The first deliveries of 'Kent' were at the beginning of April and continued steadily until the beginning of July. As for the other West African sources, the price of 'Kent' fell rapidly in April from an initial EUR 4.00 per kg to close to EUR 3.00 per kg at the end of May because of the cumulated shipments from the various sources. Prices recovered in the first half of June when supply was short and fell in the second half of the month when quality problems appeared.



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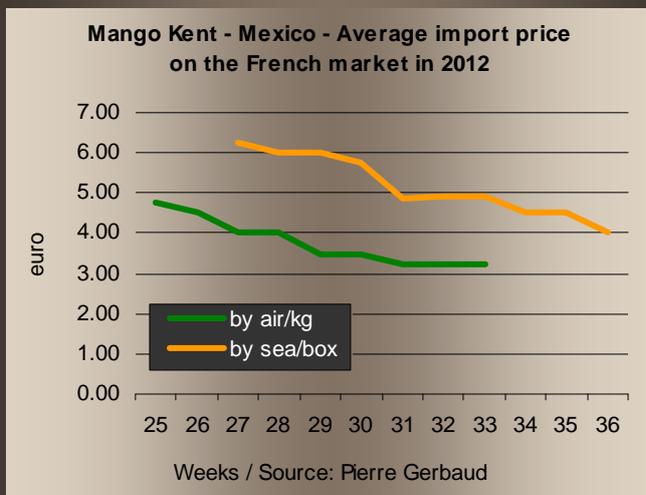
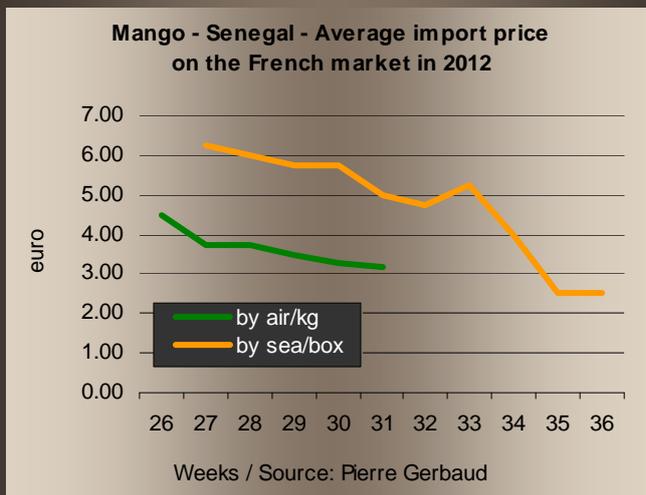
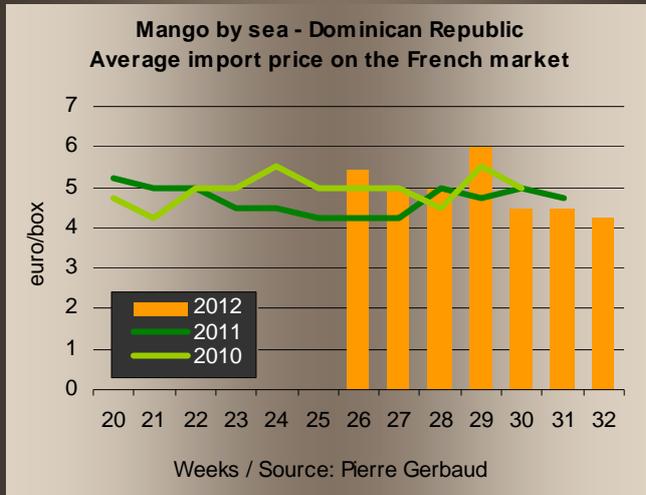


The sea export season seems to have been more profitable. Starting at the end of May, it benefited from the improvement in market conditions after the plethoric shipments from Côte d'Ivoire, thus escaping the worst period for the sale of West African mangoes. The limited tonnages and satisfactory quality resulted in steady sales at good prices. The dip in the supply of mango by sea in June was particularly favourable for fruits from Burkina Faso and their price increased until the end of the season at the beginning of July, sometimes exceeding EUR 6.00 per box. After a slightly shorter export period than in 2011 but well-positioned with regard to supply of the European market, Burkina Faso had a good season for shipments by sea. The air season was much more contrasted, with low prices resulting from competition with other West African sources.

Dominican Republic Slowing?

Mango exports from the Dominican Republic to the European markets decreased markedly in 2012 with 4 700 tonnes shipped, after 6 400 tonnes in 2011. This source seemed to be emerging in recent years, positioning itself between the West African seasons and those of the summer sources, but might it be running out of steam? Was the last season a conjunctural phenomenon or a more lasting trend? The first shipments from the Dominican Republic were practically a month and a half later than usual. This feature alone partially explains the decrease in the tonnages reaching the European markets. The start of quality problems about a fortnight after the first deliveries also highlights the fragility of the timing of the crop in the Dominican Republic. The fruits were affected by rain in the production zones, leaving the door open to fungal infections.





This source also suffers from the rigorous controls applied at both export and import and that often delay deliveries, hindering the planning of programmes with retail chains. Furthermore, sales of 'Keitt' are ever more uneven because of competition of 'Kent' from Senegal or Mexico. However, prices were fairly firm in the first part of the season at EUR 5.00-5.50 per box in July before weakening to EUR 4.00-4.50 in August as demand was smaller and quality more irregular. Only a few shipments arrived by air, with mediocre sales on the European market resulting in fairly unprofitable prices, given the costs involved. The Dominican Republic's role as a complementary source of supply remains dependent on production and also on the general conditions of supply on the European market. This configuration makes Dominican supply somewhat fragile, and it is also attracted by the American market.

Senegal Regaining a difficult position

After exports to Europe totalling 5 300 tonnes during the previous year, Senegal confirmed its return to normal with 6 200 tonnes in 2012. Exports had reached this level from 2006 to 2009 before decreasing. Like Mexico, Senegal is developing exports to the European markets in the summer, which is always a delicate period for tropical fruits as demand is smaller and competition is strong. Consisting mainly of 'Kent', mangoes from Senegal play an important role in the supplying of the European market alongside their main competitors from Mexico. In contrast with other periods of the year when a major source feeds and more or less controls market flows (the case of Brazil and Peru for example), the summer markets are supplied by several sources like Senegal, Mexico and Israel. This results in trade distortions that are frequently more marked as a result of the location of the sources and varietal range shipped.

Exports by air from Senegal started at the end of June; prices soon fell from EUR 4.00 per kg to about EUR 3.00 per kg at the end of the season (beginning of August). The overloading of the air mango market, with large shipments from Senegal and also from Mexico and Israel caused this significant, lasting decrease in prices. Moderate demand was accompanied by recurrent quality problems in Senegalese fruits, which lacked colour and maturity just at the start of the season. Recurrent fungal problems at the end of the season resulted in the halting of shipments at the beginning of August, even earlier than in previous years.



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The season for mangoes transported by sea from Senegal featured falling prices throughout July: from EUR 6.00 to 5.00 per box and even less. After a brief recovery in mid-August, prices went into a giddy downward spiral as a result of increasingly serious problems of quality. Mangoes whose quality was satisfactory still changed hands at around EUR 4.50 to 5.00 per box, but many batches developing badly were sold off at low prices (EUR 1.00 per box). Finally, a large proportion of sorting rejects sent sales averages to extremely low levels at the end of the season, in contrast with the trend observed in 2011 when the scarcity of 'Kent' resulted in higher prices. The more marked presence of Senegal in terms of volume is strengthening its position as a supplier of 'Kent' to Europe in the summer, but quality problems mean that its image is still fragile.

Mexico Summer complement

After an upward movement for two years in which Mexico exported 4 900 t and 5 300 t to the European market, 2012 displayed a slight decrease, with 4 400 t shipped by air and sea. The more abundant seasons in West Africa, Senegal and Israel doubtless limited scope for expansion for Mexican operators on a remote, competitive market where demand is weaker in the summer. This is a dilemma for a source that nonetheless possesses many strong points. Mexico has been the leading mango exporting country for years, giving it obvious know-how in production and sales. Its large territory enhances production all the year round. Since the creation of NAFTA and the concluding of phytosanitary agreements with the United States, Mexico has consolidated its trade relations with this large market and so exports naturally went to the US. However, after being absent for a while, Mexico focused on the European market again to find complementary opportunities for the sale of its large production.

The Mexican air shipment season started in the second half of June, taking over from Côte d'Ivoire whose season was ending. The 'Kent' shipped were soon in competition with fruits from other sources where the season was beginning, such as Senegal and then Israel later. The fall in demand at the start of the summer holidays and poor weather that did not encourage sales of tropical fruits soon weighed on the prices of 'Kent' from Mexico. Quality was also uneven with a marked lack of colour and little developed maturity in mangoes shipped by air. Prices were still around EUR 4.00 per kg in mid-July and then fell until the end of August when shipments ceased. Mexican fruits were affected by fungi of the anthracnose type in August.

The season for shipments from Mexico by sea started at the beginning of July in a context of comparative under-supply as a result of the rapid decrease in volumes from West Africa. Fairly rare at this time of year, 'Kent' sold at firm, high prices throughout July (EUR 6.00 per box). Prices fell to around EUR 5.00 per box at the end of the month and then to EUR 4.50 per box in the second half of August. This weakness reflected sluggish demand and also increasingly severe quality problems.

Overall, the results of the Mexican season seem to have been fairly satisfactory and confirm its trade slot from June to August. However, recurrent quality problems at the beginning and the end of the season highlight the fragility of produce that lacks reliability during a period when the market is limited and hence particularly fussy.

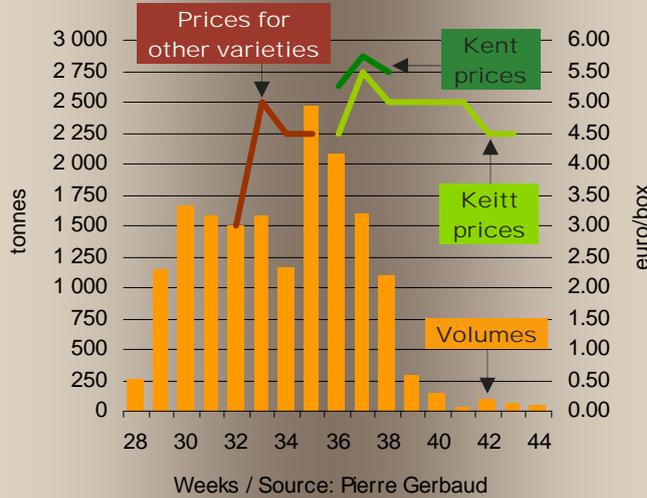
Given the early ending of shipments by air from Côte d'Ivoire observed for a number of seasons, Mexican operators are examining the possibility of starting shipments about a fortnight earlier. Although the production zones hitherto used for fruits exported to Europe cannot give fruits that are physiologically ripe and sufficiently well coloured, other earlier production regions could be called upon in the future.



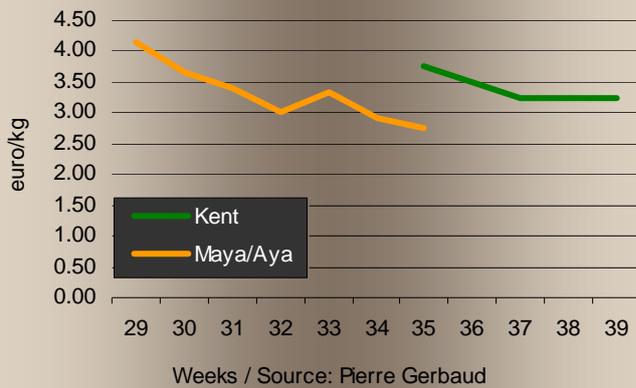
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Israel A large, concentrated season

Mango by sea - Israel - Arrivals in Europe and average import price by variety on the French market in 2012



Mango by air - Israel - Average import price by variety on the French market in 2012



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With 16 800 tonnes exported in 2012, Israel broke its own records and confirmed the growth observed in 2011 (14 000 tonnes). The European market was the main destination and took 12 500 tonnes, an increase of 1 800 tonnes in comparison with the preceding season. The Israeli season ran from mid-July to the end of September, with very limited quantities shipped in October. Perceptible as a trend in 2011, the Israeli season became more concentrated.

The air shipment season started in mid-July for the varieties 'Maya' and 'Aya', characteristic of the source. Almost completely absent in 2011, in 2012 they were featured for the longest period of sales as the last batches were released on the market at the end of August. 'Kent' took over until the end of September. In contrast with 2011, 'Haden', 'Shelly' and 'Kasturi' ('Omer') were hardly present at all in France but were seen frequently on other European markets (Belgium, Netherlands). Prices of 'Maya' and 'Aya' lost ground as the season proceeded as demand was limited during the summer. Available from the end of August, 'Kent' sold at slightly higher prices but had to compete with the first shipments from Brazil and Spanish fruits available at attractive prices.

The sea shipment season was longer. Starting in the second week of July as in 2011, it continued until the end of September with markedly decreasing volumes and small tonnages arrived throughout October. In July and August, Israeli supply featured mainly 'Shelly', 'Tommy Atkins' and 'Kasturi'. 'Kent' was available for only a short period in the first half of September and was soon replaced by 'Keitt'. The prices of Israeli fruits firmed distinctly in the second half of August; they seemed to be a good alternative to produce from Mexico and Senegal whose seasons were ending with fruits with fragile quality. The switch to the variety 'Kent' and then to 'Keitt' strengthened this trend in spite of a recurrent lack of colour that sometimes made sales difficult. The closeness of the production zones to the destination markets and hence the short transport times made it possible to sell fruits whose ripeness matched demand but whose external appearance was not very attractive. Consumers tend to favour strongly coloured fruits and Israeli supply did not feature this in 2012.



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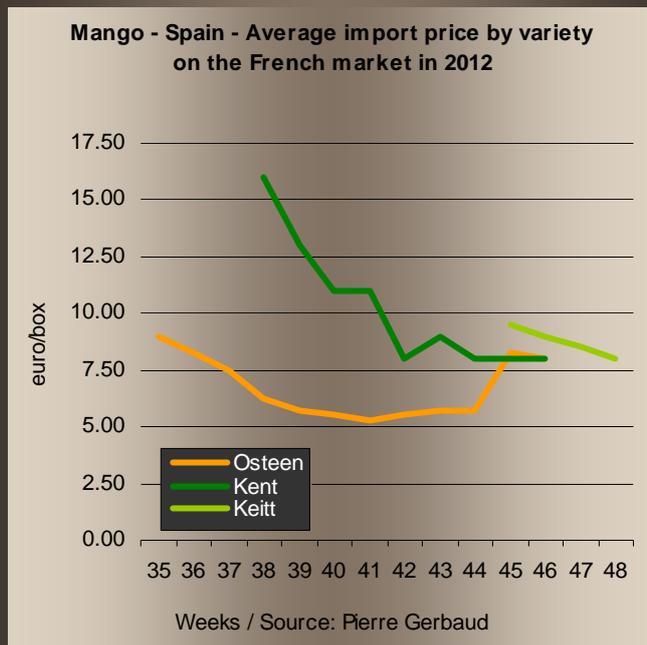
Nature at it's best



Mango | Avocado | Sunrise | Medjol Dates | Orri | Sharon

Contenu publié par l'Observatoire des Marchés du CIRAD - Toute reproduction interdite





Spain 2012, an explosion

With an estimated 14 000 tonnes exported in 2012, Spain did very much better than in 2010, which had already been a good year with shipments of between 7 000 and 8 000 tonnes. The 2011 season was smaller with about 6 000 tonnes. Thus the only European source producing and exporting mangoes has joined the group of leading suppliers of the EU. It is equalling or doing better than Côte d'Ivoire and Israel, both key sources on the supply calendar. The boom seems to be based on two major features, one being structural and the other conjunctural. The first concerns the extension of the area under mango in recent years. Full production is being attained and even exceeds the previous estimate of some 10 000 tonnes, forming a substantial 'reservoir' for exports and the domestic market. The second feature is the particularly favourable weather conditions during flowering and then fruit formation. Close attention must be paid to the seasons to come to see which factor is the most important and whether the position of Spain is firmly held.

Although Spanish supply is hinged on the variety 'Osteen', of which it has a near monopoly as only small quantities are shipped from Morocco, the varietal range is greater. A few batches of 'Tommy Atkins' were sold at the beginning of the season (end of August/beginning of September) and benefited from a trade opportunity at a moment when the market was little supplied with mangoes. This variety is sold more readily on the domestic

market than for export. Sales of 'Kent' in limited quantities ran from mid-September to mid-November. The price worsened gradually as the fruits were often fragile and faced competition with those from Brazil. This variety does not seem to be that best suited to the natural conditions in Spain and periodically displays pulp deterioration. Finally, the later 'Keitt' has enabled Spanish exporters to continue the season until the end of November, thus occupying the market for three months.

As in previous years, Spain took the lion's share thanks to the variety 'Osteen'. In parallel with Brazil, it supplied the European market from the end of August to mid-November, first with moderate quantities in September and then an increase going as far as disturbing the market. The quantities released throughout October, the main production period sent prices down. To prevent total market saturation, Spanish operators favoured the setting up of supermarket promotion operations that stimulated demand each week, making it possible to shift the quantities available and to stimulate sales for each weekend. The strategy seems to have paid off. It is true that 'Osteen' prices lost ground overall but the volumes sold seem to have made up for this. Spain passed a threshold during the season, becoming a central source rather than a complement. The pressure of the volumes to be sold has changed the way retail distributors consider Spanish mangoes as they previously hesitated to sell this produce that was more expensive than competing fruits from Brazil. In 2012, prices of fruits from the two sources were closer and the availability of medium-sized 'Osteen' fruits and their good taste quality also played in their favour. Better known by European consumers through wider distribution and easier access, the 'Osteen' mango 2012 sales season was accompanied by a large-scale promotion campaign. It remains to be seen whether this configuration is repeated in the future.



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30

years together



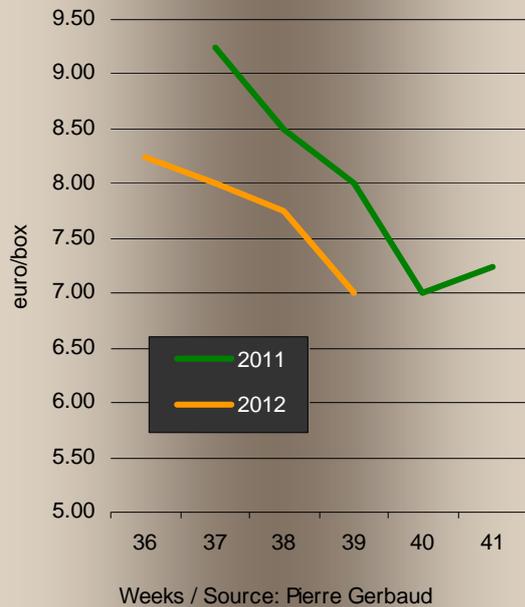
MANGO & AVOCADO SPECIALISTS



When the specialist...
...is Unique

Our delicious fruits are the result of a traditional and careful harvesting, 100% natural and coming from our own fields – an exclusive product from farm to fork.

Mango Osteen - Morocco - Average import price on the French market in 2012



Morocco A low-key season

Morocco emerged as a supplier of mangoes to the European market in 2011. But the 2012 season went practically unnoticed. The first deliveries at the beginning of September were earlier than in 2011 and continued until the end of the month, limiting the season to a single month. Morocco does not yet have large enough quantities to affect the world mango trade. It ships complementary supply and because of this and depending on the season fits in more or less successfully on a market already structured by larger export sources. Thus 2012 was not very favourable because of the large Spanish harvest forecast. The price of 'Osteen' from Morocco soon adjusted to that of the competition. Large imports from Spain soon sent prices down and this was difficult to accept for Moroccan produce and it disappeared after a short season. A few batches of 'Irwin' were also shipped from Morocco and sold better overall but quantities were not large enough to ensure continuous supply. Lack of export profitability nevertheless allowed Moroccan mangoes to conquer the domestic market, a significant outlet with trade development potential for the years to come ■

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Quality control



The 2012 European mango market month by month

Steadier supply,
but disturbed in the spring



© Eric Imbert

January - early February
A strongly marked
switch from
Brazil to Peru

The slow increase in shipments from Peru, consisting mainly of small fruits that were difficult to sell, did not counter-balance the rapid decrease of deliveries from Brazil. In early 2012, the drop in Peruvian production strongly affected the scale and rate of shipping. Overall supply scarcity resulted in continued satisfactory market conditions. Natural demand was not fully covered, explaining the high prices. The quantities shipped from Peru to the North American market were also slightly greater than those for Europe. The European market approached a balance state in Week 5.

February - March
Peruvian fruit
omnipresent
and a splitting
of the market

Although demand remained stable, a change in trend was seen in Europe as a result of several simultaneous factors: accumulation of deliveries from Peru, high prices, heavy rain in Peruvian production zones (resulting in fruits that were fragile on arrival) and winter holidays in several European countries. The influx exceeded market capacity in Week 8, causing a momentary build-up of stocks. In Week 10,

© Denis Loeffler



sales were at rock bottom prices for batches from stocks or whose quality was deteriorating and higher for better fruits. Numerous batches from Peru displaying serious quality problems cluttered the market even though the latter was clearing a little and weighed on sales. The sorting of Peruvian fruits became more frequent in March.

The seasons started late in Côte d'Ivoire (late ripening) and Mali (political events).

April - May Towards diversification in the dull market

Arrivals from Peru recovered slightly in Week 14 before Easter. Overall volumes increased as a result of simultaneous arrivals from Brazil and to a lesser extent from Costa Rica. Demand accelerated by prices were very varied according to the quality of the produce. In Week 16, Europe entered the hinge phase between supply mainly from Peru and the starting of the seasons in West Africa and Central America. The increase in the number of sources and suppliers made it more difficult to 'read' the market as the quality and varietal range of the goods received increased. The arrival of fruits by air from Côte d'Ivoire increased very strongly in Week 17. In May, fairly substantial volumes remained with arrivals from Brazil, West Africa and Central America and the remaining stocks of fruits from Peru. These quantities amply covered what appeared to be shrinking demand. Market conditions worsened. The air mango market was hardly any better, featuring large arrivals of fruits at various stages of maturity.

June A distinct decrease in quantities in another transition phase

Prices moved upwards again in Week 23 but erratically according to the market and the quality of the produce concerned. The air market recovered as a result of a dip in supply and the gradual ending of arrivals of Ivorian fruits. The overall decrease in volumes gradually resulted in a rise in prices. June supply was dominated by Brazil with 'Tommy Atkins' and 'Palmer' and the last batches arrived from Côte d'Ivoire. Fruits from Puerto Rico were an alternative, especially on the northern European markets. Deliveries from Mali and Burkina Faso continued, with dwindling quantities. The export season started with limited quantities in the Dominican Republic, Senegal and Mexico. European supply thus featured the arrival of fruits from many sources with a broad quality range, depending on whether the fruits were beginning of season or end of season shipments.

July - August A sluggish summer season

Demand remained very moderate as a result of the much-changing weather conditions in Western European countries, increasing competition from the season's fruits and summer holidays. The sea market remained healthy as arrivals were limited. A large proportion of supply was from Brazil ('Tommy Atkins', 'Keitt' and 'Palmer') and Puerto Rico, with produced generally destined for supermarket chains. Demand was at its lowest for the year from Week 31 onwards. Market conditions were all the more difficult as supply was from numerous sources with much



© Henri Vannière

variation in size, variety and above all quality. This was the context for the getting under way of Israeli exports. Meanwhile the seasons ended gradually in Senegal and Mexico with fruits of increasingly uneven quality that were difficult to sell as demand was small and competing produce from Israel was of better quality.

September - October Recovery, but a delicate balance

At the beginning of September, most of European market supply was from Brazil although deliveries were down on those of 2011, and Israel. Exports from Brazil were shared between the North American and European markets, with shipments being greater to the United States and Canada. In contrast with preceding years when shipments at this time of the year consisted mainly of 'Tommy Atkins', quantities of the latter decreased in favour of 'Keitt', 'Palmer' and 'Kent'.

Shipments of 'Osteen' from Spain increased a little but initially sold with difficulty. It was difficult for them to find their trade slot because of competition of fruits shipped by sea from other sources. The Israeli season began to wane in Week 38. Shipments from Spain increased, with goods supplied to all the European markets.

However, the remaining summer fruits (peaches, nectarines, plums, etc.) and autumn fruits (grapes) competed with tropical fruits including mango because their prices were attractive. The market dipped again in October. Demand was small in Week 40 and sales were difficult. The increase in shipments from Brazil, the strong presence of Spain and remaining Israeli stocks amply exceeded demand and accentuated the downward movement of the market. As a result, competition between sources became fiercer and caused a fall in prices.



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November - December An exceptional rise in prices

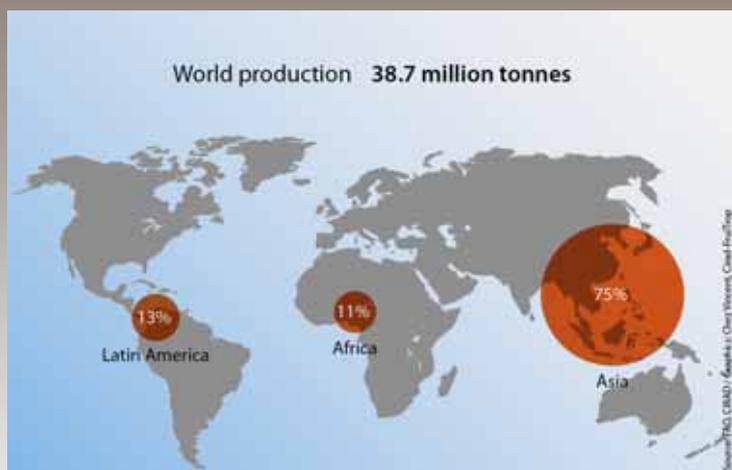
The gradual ending of shipments from Spain and increased demand caused a marked increase in prices from Week 45 onwards. Brazil became practically the only supplier of the European market. The price of 'Kent' and 'Keitt' firmed and that of 'Tommy Atkins' reached its highest level since the end of the summer. The European market remained very healthy in Week 47. Operators reported the shortage of produce that caused a strong rise in prices while deliveries from Brazil increased (Brazil displayed an export deficit of some 15 to 20% in comparison with the same period in 2011). This favourable trend resulted from an increase in demand. The only small volumes of autumn fruits (apples and pears) partially explained the transfer of attention to available fruits such as mango. However, the continuation of these high prices would seem to be partly artificial as most of the produce put on the market was covered by long-term contracts with retail distributors.

End of December The artificial effect of the Christmas period

Market fluidity in Week 50 resulted from a slight increase in demand caused by the run-up to Christmas. The market was amply supplied in spite of late deliveries resulting from logistic problems. Market conditions deteriorated strongly with the New Year. The European market became congested after a substantial increase in supply from Brazil and Peru and Ecuador too. The fall in prices was still cushioned by the artificial demand of the Christmas period. Stocks accumulated ■

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MANGO — Production



Mango — The 10 leading producer countries	
million tonnes	2010
India	16.3
China	4.4
Thailand	2.6
Pakistan	1.8
Mexico	1.6
Indonesia	1.3
Brazil	1.2
Bangladesh	1.0
Philippines	0.8
Nigeria	0.8

Source: FAO

MANGO — Imports



Mango — The 6 leading importing countries	
tonnes	2011
United States	379 803
China	203 184
Netherlands	156 277
Saudi Arabia	63 497
Germany	57 798
United Kingdom	50 143

Sources: national customs, COMTRADE

MANGO — Exports



Mango — The 6 leading exporting countries	
tonnes	2011
Mexico	273 122
Thailand	152 285
Brazil	140 910
Peru	124 048
Pakistan	105 130
India	63 441

Source: COMTRADE

USA — Imports — Main supplier countries						
tonnes	2006	2007	2008	2009	2010	2011
Mexico	181 163	185 279	182 754	186 807	221 945	241 468
Peru	33 614	29 193	38 323	17 316	32 175	45 223
Ecuador	31 070	31 250	24 682	35 304	25 650	30 364
Brazil	23 088	24 679	25 774	23 193	24 407	24 810
Guatemala	9 131	12 881	14 919	14 706	12 679	17 875
Haiti	10 266	8 681	8 274	9 014	6 502	9 241
Philippines	2 974	3 545	3 268	2 996	2 815	3 989
Others	6 782	8 053	7 964	6 318	5 922	6 833
Total	298 088	303 562	305 958	295 653	332 095	379 803

Source: US customs

Canada — Imports — Main supplier countries						
tonnes	2006	2007	2008	2009	2010	2011
Mexico	27 312	28 643	25 768	27 843	29 501	35 923
Peru	3 159	4 808	4 766	1 627	4 704	6 195
Brazil	3 911	5 182	4 722	3 563	3 529	4 310
Ecuador	2 947	3 254	3 236	3 445	3 568	4 083
Total	42 192	46 736	42 459	41 544	46 649	56 375

Source: COMTRADE

South America — Imports — Main markets						
tonnes	2006	2007	2008	2009	2010	2011
Colombia	5 524	2 722	5 078	7 277	9 675	13 132
Chile	328	453	690	766	2 344	6 567
Mexico	2 004	2 161	2 007	2 982	2 300	1 976
Argentina	654	517	729	873	1 024	1 353
Honduras	810	973	843	970	1 000	1 000
Salvador	1 812	930	987	1 582	665	569
Costa Rica	68	64	190	110	406	391
Panama	52	74	111	137	173	374
Ecuador	150	150	155	4	784	317
Guatemala	263	219	147	155	201	228
Paraguay	63	29	142	50	112	128
Bolivia	32	41	84	77	105	79
Total	11 759	8 334	11 163	14 982	18 787	26 113

Italics: estimates / Source: COMTRADE

EU-27 — Imports — Main supplier countries						
tonnes	2006	2007	2008	2009	2010	2011
Extra EU + Spain	225 013	226 292	244 256	213 796	244 480	275 749
Extra EU	212 713	211 944	231 628	198 878	224 995	252 521
Brazil	84 858	83 025	96 870	80 670	92 256	91 490
Peru	41 027	36 854	50 756	36 270	60 386	72 350
Israel	11 349	15 006	12 743	12 998	10 700	14 016
Pakistan	10 120	13 225	12 941	12 916	10 596	11 745
Côte d'Ivoire	14 428	14 706	11 250	11 680	11 323	10 177
USA	5 971	7 404	7 516	5 535	4 744	8 475
Costa Rica	7 545	4 664	5 360	5 685	3 429	6 873
Dom. Rep.	1 618	2 767	4 307	4 186	4 303	6 357
Senegal	7 088	4 702	6 034	6 240	2 758	5 341
Mexico	1 764	2 680	1 674	1 596	4 938	5 255
India	2 472	2 428	2 577	2 472	3 201	3 016
Burkina Faso	2 152	3 191	2 406	1 988	3 302	2 129
Mali	3 477	4 317	4 902	3 480	3 672	1 795
Ecuador	5 681	3 718	2 313	2 011	1 406	1 523
Gambia	785	857	696	1 246	776	1 503
Thailand	893	1 281	1 055	1 021	1 178	1 101
Guatemala	4 614	1 827	634	1 587	845	1 033
Nicaragua	203	940	249	933	435	947
South Africa	1 576	3 011	1 780	1 876	1 040	507
Venezuela	1 464	1 486	1 286	1 008	729	332
Ghana	295	983	1 098	880	428	227
Intra EU	110 602	126 768	131 314	112 843	145 480	148 512
Netherlands	63 529	74 018	81 516	64 279	80 214	95 239
Spain	12 301	14 348	12 628	14 918	19 485	23 228
Germany	7 539	7 053	10 031	7 605	9 299	9 807
France	16 039	17 499	14 419	10 162	21 006	7 581
Belgium	6 597	9 344	7 683	6 776	7 898	6 950
UK	1 883	1 275	804	1 588	1 394	1 535
Italy	749	1 023	1 034	5 139	2 780	569

Source: EUROSTAT

Other western European countries — Main markets						
tonnes	2006	2007	2008	2009	2010	2011
Switzerland	5 624	5 933	7 039	7 154	8 849	9 730
Norway	2 298	3 593	4 174	3 264	4 249	4 657
Iceland	181	262	295	253	300	344
Total	8 103	9 787	11 508	10 671	13 398	14 731

Source: COMTRADE

Russia — Imports — Main markets						
tonnes	2006	2007	2008	2009	2010	2011
Brazil	2 510	3 444	4 388	3 201	4 893	4 967
Peru	71	115	546	152	922	876
Thailand	151	267	332	295	393	452
China	155	235	67	200	437	418
Ecuador	91	137	319	195	415	254
Total	3 254	4 517	6 123	4 480	7 416	7 488

Source: COMTRADE

Other eastern European countries — Main markets						
tonnes	2006	2007	2008	2009	2010	2011
Ukraine	538	584	681	400	534	694
Croatia	66	86	73	136	260	256
Belarus	57	70	87	88	106	114
Total	662	740	840	624	899	1 064

Source: COMTRADE

Mediterranean — Imports — Main markets						
tonnes	2006	2007	2008	2009	2010	2011
Palestine	-	21	14	4	2 318	3 735
Lebanon	387	558	721	843	817	1 344
Morocco	582	482	715	1 174	993	1 000
Jordan	1 726	5 633	3 944	2 518	1 765	966
Turkey	180	130	151	183	271	260
Total	2 914	6 877	5 640	4 819	6 294	7 515

Italics: estimates / Source: COMTRADE

Japan — Imports — Main supplier countries						
tonnes	2006	2007	2008	2009	2010	2011
Mexico	4 329	5 386	5 260	5 050	3 974	3 446
Philippines	5 443	3 797	3 070	2 720	2 834	2 197
Thailand	1 099	1 566	1 482	1 407	1 520	1 514
Taiwan	444	781	851	990	995	1 155
Brazil	403	445	316	395	571	551
USA	317	57	285	286	277	172
Australia	338	268	233	187	124	38
India	9	88	73	27	10	11
Total	12 383	12 389	11 589	11 103	10 391	10 055

Source: Japanese customs

Other Asian countries — Imports — Main markets						
tonnes	2006	2007	2008	2009	2010	2011
China	67 376	109 837	125 576	252 705	240 710	203 184
Malaysia	23 521	23 433	29 767	40 676	42 015	50 960
Singapore	16 027	19 406	18 415	21 485	18 232	20 920
Nepal	-	-	-	1 696	1 964	5 740
Cambodia	210	935	2 392	2 441	3 401	3 287
Korea	1 235	1 784	1 666	904	1 351	2 270
Thailand	262	753	156	257	69	1 311
Indonesia	1 103	1 193	1 097	877	1 206	1 064
Bangladesh	925	958	697	461	500	500
Total	111 625	159 170	180 755	322 542	310 449	290 234

Source: COMTRADE

Oceania — Imports — Main markets						
tonnes	2006	2007	2008	2009	2010	2011
New Zealand	2 263	2 706	2 496	1 742	1 993	2 614
Australia	810	973	843	969	665	1 206
Total	3 073	3 679	3 339	2 711	2 658	3 820

Italics: estimates / Source: COMTRADE

Persian Gulf — Imports — Main markets						
tonnes	2006	2007	2008	2009	2010	2011
Saudi Arabia	48 330	45 660	35 643	38 583	58 250	63 497
Oman	16 438	16 992	15 015	19 407	18 338	19 794
Iran	990	4 500	8 000	13 000	15 670	18 073
Bahrain	3 617	2 622	2 459	2 515	2 801	5 581
Qatar	3 238	3 448	2 756	3 500	4 184	4 500
Kuwait	582	482	715	1 174	1 200	1 200
Total	73 849	74 222	65 317	79 053	101 344	113 645

Italics: estimates / Source: COMTRADE

Africa — Imports — Main markets						
tonnes	2006	2007	2008	2009	2010	2011
Tanzania	0	1	1 802	2 866	2 020	4 649
Niger	5 448	2 001	3 474	3 300	4 223	3 274
Botswana	746	1 082	1 531	1 230	1 956	1 369
Rwanda	-	163	218	624	1 000	1 360
Swaziland	387	558	721	843	850	850
Mauritania	320	38	40	41	549	774
South Africa	807	823	514	500	305	467
Namibia	565	544	826	568	600	461
Total	8 275	5 277	9 213	10 063	11 613	13 314

Italics: estimates / Source: COMTRADE

Mango quality defects



Immaturity and spotting



Natural discoloration of the epidermis



Misshapen fruit



Scarred-over insect pricking



Mechanical wounds after picking



Mechanical wounds after picking



Stalk too long



Spotting on epidermis



Anthracoze type fungal infection



Fruitfly larvae



Sun scorch



Misshapen fruit



Discoloration caused by scales



Wounding with wind-caused rubbing



Postharvest sap burn



Postharvest soiling by sap



Stalk rot



Fungal infection



Overripeness



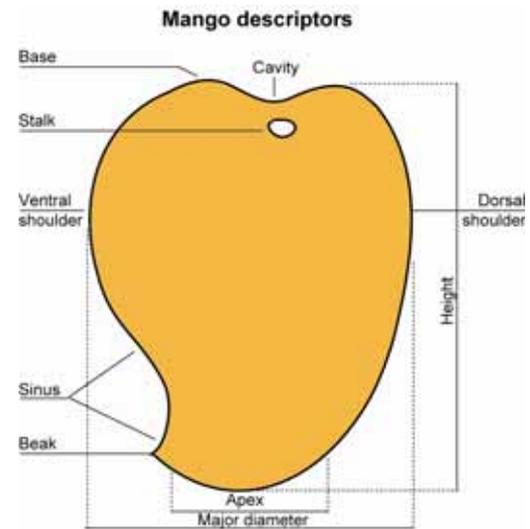
Internal breakdown caused by excessive nitrogen (high calcium and boron contents too)

Photos © Pierre Gerbaud



The main varieties of mango

Mango, *Mangifera indica*, probably originated in a region on the frontier between India and Burma. Today, there are certainly more than a thousand different varieties around the world. Mango plays an important role as a foodstuff in many countries. Distinction was originally made between two main families of mango with clearly different features that came from two diversification zones—the Indian sub-region and tropical Asia. A great many of the commercial varieties grown today were bred in Florida at the beginning of the twentieth century from multiple crosses between parents from these two families. Exported fruit are generally from budded plants.



After 'Le manguier' by F. de Laroussilhe, Maisonneuve et Larose

Requirements of mango

Mango is suited to a broad tropical climate range from humid to dry. It is found in regions with very different annual precipitation. In the tropics, the halting of vegetation caused by a dry or cool season lasting for a few weeks or months is a condition for good flowering intensity and hence high productivity. Production is often small and irregular in equatorial humid zones as a result of the absence of a halt to vegetation. The optimum temperature range for tree development and fruit growth is 24° to 30°C. Temperatures lower than 10°C can cause physiological damage. Water supply to the tree must be optimum throughout the fruit growth period and then during the growth of new shoots. Rainfall distribution over the year is more important than cumulated annual precipitation, especially for the production of high-quality fruits. The lower limit for precipitation for commercial mango growing seems to be 750 mm. Mango can grow in a very varied range of soil types if the underlying horizons are sufficiently loose and well-drained. However, the tree prefers deep, fairly light soils with average structure. It can suffer from shortage of water in sandy soil and produce small, insipid fruits. It is sensitive to salts in the soil and in irrigation water. Wind can cause damage of varying seriousness and cause imbalance in the water supply. Windbreaks should therefore be grown in windy areas before mango trees are planted.

Characteristics of the two mango families		
	India	Tropical Asia
Diversification zone	India, Pakistan	Burma, Malaysia, Philippines
Seed	Mono-embryonic	Polyembryonic
Shape	Round to ovoid	Elongated with cylindrical or flattened cross section
Skin colour	Yellow to orange, sometimes with purple flushes	Green to yellowish green, no purple
Taste	Marked, hint of turpentine	Less marked
Observations	Susceptible to anthracnose	

Tommy Atkins

Shape: ovoid, sometimes slightly oblong. Sloping dorsal shoulder. Ventral shoulder above the stalk zone. Round apex, small lateral beak.

Peel: thick. Yellow orange and bright red. Dark purple bloom. Numerous large greenish-yellow lenticels.

Flesh: strong orange colour. Good quality but slightly fibrous.

Average weight: 450 to 710 g

Bred in Florida in 1922, it was soon chosen by growers for its productivity, robustness when handled and good resistance to anthracnose, in spite of its medium fibre content. Flesh quality deteriorates markedly if too much fertiliser or water is supplied. This is the most widespread variety in Brazil, where it forms the greater proportion of exports. It is particularly well-liked in northern Europe for its bright colour. Most exports consist of medium-sized fruits (8 to 10 fruits per 4 kg box); this matches the requirements of supermarket chains.



Kent

Shape: ovoid, rounded dorsal shoulder and apex. Full ventral shoulder. No beak.

Peel: thick and strong, light adherence. Main colour greenish-yellow with red or even crimson surface in the parts most exposed to light. Slight greyish bloom.

Flesh: strong yellow to orangey-yellow, rich flavour with melting, fibreless texture.

Stone: 9% of total fruit weight.

Average weight: 600 to 750 g

Bred in 1932 in Florida from sown 'Brooks', it bears comparatively large fruits, ranging from 440 g to more than 1 kg on young trees. Much appreciated by both the upstream and downstream ends of the sector, yields are medium but with a high proportion of export quality fruits. Fruit colour is attractive and the tasty flesh is firm and ripens very gradually. It is grown in most of the countries supplying Europe, where it is considered to be the yardstick for mango. However, considerable variations in colour and size according to the production zone can lead to sales problems.



Keitt

Shape: oval, abruptly falling dorsal shoulder. Full and rounded ventral shoulder. Rounded, obtuse apex with no beak.

Peel: thick and strong, fairly high adherence. Orangey yellow to crimson yellow on the side exposed to the sun, with numerous small pale yellow to russet lenticels. Fairly strong lavender-coloured bloom.

Flesh: orange to deep yellow. Rich and fruity flavour. Melting texture with many fibres that are not particularly unpleasant as they are fine.

Stone: 7 to 8% of total fruit weight.

Average weight: 510 g to 2 kg

Bred in 1939 in Florida from sown 'Mulgoba', it has high, regular yields. The reddish colour appears very early before the fruit is ripe and can lead to problems of evaluation of maturity; the latter can be enhanced by time in a ripening chamber. An end-of-season variety in most provenances that makes it possible to prolong the export season. Less appreciated than 'Kent', it is nevertheless of increasing importance during periods of gaps between supply origins.



Osteen

Shape: oblong with a rounded base. Rounded apex, sometimes with a small beak.

Peel: thick, not very clinging. Main colour violet/purple with some lavender lights. White lenticels.

Flesh: lemon yellow, firm and juicy. Very high quality and not fibrous.

Stone: long and flat.

Average weight: 500 to 800 g

'Osteen' is from Florida, where it was bred from sown 'Haden' in 1935. It is little grown at the world scale in spite of its good commercial features. It has become more common on the EU market since 2000 as it forms most of Spanish production.



Haden

Shape: oval to rounded cordate. The ventral shoulder is broader and slightly higher than the dorsal shoulder. Well-rounded apex.

Peel: mostly dark red with numerous whitish-yellow lenticels.

Flesh: orangey yellow, almost fibreless. Pleasant, slightly acidulated taste.

Average weight: 510 to 680 g

Variety bred from a sowing of 'Mulgoba' in 1902. Shipped almost only by air, this variety completes supplies of 'Kent' when these are too small to meet demand. The fruit has a fine appearance and a reputation for fragility, requiring rapid sale.



Valencia Pride

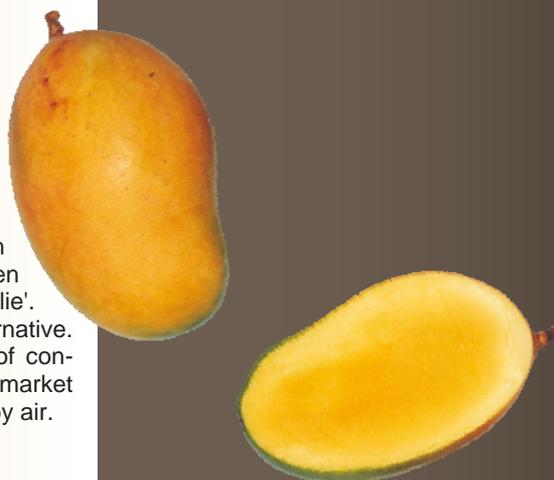
Shape: elliptic. Rounded apex, large apical beak.

Peel: comparatively thin but detaches fairly well. Basic colour greenish-yellow with a large red to purple area. Yellow lenticels.

Flesh: deep yellow. Aromatic and practically fibreless.

Average weight: 600 to 900 g

Variety bred from sown 'Haden' in Florida in 1941. Very elongated, fairly large fruits with attractive colour and shape. Good productivity. Grown mainly in West Africa, it long enabled varietal diversification at the beginning of the season when shipments consisted mainly of 'Amélie'. Its attractive colour formed an alternative. Gradually chosen by a proportion of consumers, it is now consolidating its market share in the range of fruits shipped by air.



Fruit quality and conservation

Post-harvest deterioration

Picked fruits gradually move towards senescence (ageing combined with slow deterioration). Conservation techniques are used to slow senescence and maintain fruit integrity as best as possible, but they obviously have their limits. Factors other than senescence can accelerate deterioration: physical damage, deterioration caused by parasites and physiological features. The latter are without doubt the most complex and are often related to conservation techniques. The main causes of deterioration are covered here.

Physical damage

This may have natural causes (a fruit rubbing against a branch because of wind, fruit drop), but focus here is on that caused by post-harvest procedures.

Harvest wounds

These are inevitable in some cases. Fruit stalks often have a natural abscission zone that becomes differentiated at the end of growth as maturation approaches. This zone minimises wounding at harvest or results in a small wound area in the case of a cut. In banana, the crown connected to the stem of the inflorescence must be cut, causing a fairly broad wound. Another classic case is that of pineapple: the stalk is the prolongation of the stem bearing the fruit and must be severed at harvesting. These zones are always gateways for deterioration flora (fungi and microbes).

Wounds caused by handling

These can occur at any point in the chain. Care during harvesting and on packing lines has been much improved to reduce these risks of wounding. Packing fruits in cavity trays prevents impacts and the rubbing of fruits but before this final packaging, intermediate packing in

box pallets and field boxes can cause:

- clear wounds caused by the stalks of other fruits;
- bruising caused by compression: the fruits in the lower layers bear the weight of the upper layers and this can cause internal wounding in the contact zones;
- abrasion caused for example by rubbing on the edges of packaging that can cause skin damage.



Mould (*Penicillium*) on peduncle

Some of the most widespread biological pests that can affect the presentation and sanitary quality of tropical fruits

Fungi <i>Alternaria</i> <i>Aspergillus</i> <i>Colletotrichum</i> <i>Fusarium</i> <i>Lasiodiplodia</i> <i>Penicillium</i> <i>Phomopsis</i> <i>Phytophthora</i> <i>Rhizopus</i>	Bacteria <i>Erwinia</i> <i>Pseudomonas</i> <i>Xanthomonas</i>
Yeasts <i>Saccharomyces</i>	Arthropods Thrips Mites Fruit flies Weevils

It is noted that rough handling when fruits are set out in shops (emptying a cavity tray or a box directly on the shelf or on other fruits) can cause further impacts that cancel out the efforts made upstream in the chain to conserve fruit quality.

Fruits with visible wounds or bruises can be discarded when batches are prepared. But the absence of visible symptoms should not lead to forgetting that any wound is traumatic by definition and that the secondary effects are more serious than it would seem: in 'climacteric' fruits (**Fruitrop** 198), the partial or marked deterioration of several cells in the fruit will accelerate the maturation of the zone concerned and hence that of the fruit. These lesions are sometimes visible in fruits that are already ripe. In fruits harvested at the 'green-mature' stage, the lesion only become truly visible after maturation. The wounds result in loss of firmness and sub-surface browning, depending on the intensity of the wounds, in both climacteric and non climacteric fruits. As the surface cells of the wound zones are damaged, any wound becomes a zone liable to contamination.



Bruising caused by impact during packing

Damage caused by parasites

The aim here is not to describe all pathogens and control methods (**Fruitrop** 203) but to make a reminder of several aspects of this type of damage and explain the difficulty in regulating it. Pests are varied—bacteria, fungi (deterioration flora), insects (biopests) such as fruit flies, moths, whose larvae colonise the fruits, and weevils, whose larvae can colonise the fruit (plum) or the stone (mango). Contamination by bacteria and fungi can take place in the field or after harvesting.

Latent contamination in the field is particularly difficult to manage. Once a fungus has entered it waits until the physico-chemical features of the fruit allow it to develop. The immune defences of the fruit gradually disappear during maturation (waxes, phytoalexins at the surface of the pericarp), the pulp gains sugar, cell walls become weaker and the contaminant fungus ceases its latency period and starts to develop. The great difficulty involved in this type of contamination is that the fungus is undetectable in the early stages (green or green mature fruits). This sometimes leads to harvesting fruits at an early stage to limit these risks of development. But this alternative is not a good tactic if harvesting is carried out too early as it will have other effects such as doubtful fruit keeping properties with marked loss of moisture (risk of wrinkling), possible reduced ripening capacity in climacteric fruits and poor final quality of the produce (**Fruitrop** 198) and, in addition, greater susceptibility to postharvest contamination.

Postharvest contamination is linked naturally to the presence of microorganisms in the environment, on walls, and equipment. The attention paid to the hygiene of premises, the cleanliness of the tools used (clean knives, crates, etc.) is determinant in controlling the risks of contamination present at all stages in the distribution channel.

Deterioration with physiological causes

This type of deterioration is generally a response to stress or constraint. Mineral imbalances in crop management can cause physiological disorders (soft pulp zones, glassiness, translucence, browning), with different features according to species. For example, calcium deficiency is one of the recognised causes of bitter pit of apples and soft nose of mangoes. Furthermore, the conditions of constitution of a

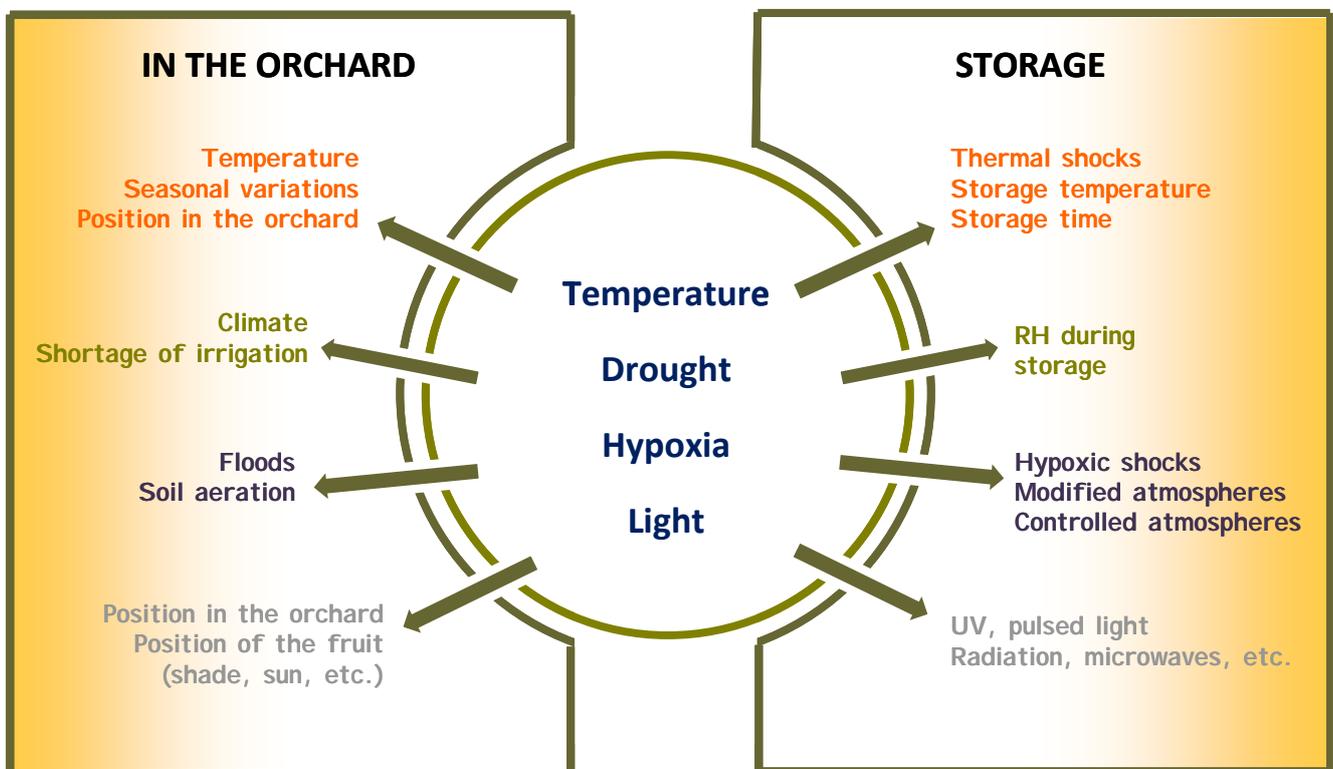


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fruit, that is to say development and growth on the plant from flowering to harvest predefine post-harvest behaviour. These constitution conditions include nutrition of course, but also other 'abiotic' environmental factors with no reference to living organisms. These factors can cause constraints—abiotic stresses that can make a fruit weaker or stronger. This results in levels of susceptibility, variability, frequency or intensity of different symptoms in the appearance of physiological deterioration linked with post-harvest conditions. Tolerance thresholds to conservation conditions are partially defined before harvesting, with preacclimation or presensibilisation effects. There is a certain logic in this as storage techniques are based on the management of the environmental conditions of the fruit but under controlled conditions, as is shown in the figure below.

Poor management of storage conditions (cold, dryness, hypoxia, etc.) then causes physiological disorders, as at the cultural level. A fruit under conditions of constraint will

ABIOTIC FACTORS



A few similarities between pre- and post-harvest



set up systems of defence to the extent of its natural capacity for reaction. These systems are no longer fully effective when a constraint is too strong and deterioration occurs. The degree of deterioration is generally proportional to the level of the constraint, with graduated symptoms ranging from more or less marked surface damage (spots on skin, lenticel suberisation, fruit colour) to major metabolic problems (loss of ripening capacity, internal browning, fermentation). These physiological disorders accelerate senescence which also invites parasite damage.

Chilling injury (CI)

This results from prolonged exposure to a temperature lower than the fruit can withstand without reacting. The threshold depends on species and varieties. Temperate species have lower minimum temperature thresholds than tropical species and can therefore be stored at lower temperatures (Fruitrop 203). For the same species, there are also different thresholds for different varieties. All temperature references are merely indications as other factors (as mentioned above) can increase or decrease susceptibility to chilling injury: cultural (altitude of the zone, fertilisers used), the stage of maturity at harvesting and the management of chilling itself. Finally, as for different species, the degree of susceptibility to chilling injury depends on varieties. Evaluation of the storage temperature alone is insufficient for the management of cold storage. It is preferable to cross-reference temperature and duration of stor-

age to identify the best conditions without the appearance of CI.

Tropical fruits are generally shipped from production zones in refrigerated containers or holds set at a suitable temperature (10 to 14°C according to the type of fruit). But for release on the market, distribution channels often have only one storage temperature of between 4 and 7°C and this considerably increases the risk of damage. In addition, CI is not necessarily observable during cold storage but more generally once the fruits have returned to ambient temperature. It is then difficult to make a precise evaluation of the degree of disorder related to CI and the impact on fruit quality at the level of the consumer. However, variable, random quality can affect sales.

Post-harvest chilling damage can be classified as follows (from weakest to strongest):

- surface lesions,
- spongy zones in the pulp, gelification,
- accelerated senescence ,
- loss of normal ripening capacity.

These disorders obviously accumulate with the severity of the attack. For example, surface lesions result in greyish colouring of the skin, as in banana, or surface spotting, as in mango, avocado and papaya. In pineapple, internal disorders cause browning around the heart of the fruit when it has returned to ambient temperature. In avocado, internal damage results in spotting of the mesocarp (pulp), with grey or brown patches close to the stone. The appearance of mango pulp is generally satisfactory but proper ripening is affected (carotenoid synthesis and aromas, little flavour).





Deterioration associated with modified or controlled atmospheres

Controlled atmosphere (CA) is used mainly for long storage lasting from several weeks to several months. Deterioration related to the use of CA has been studied above all for temperate fruits such as apples and pears. However, the use of CA for shorter periods forms potential for transport and additional storage time (up to 6 weeks for mango and avocado). In this case, possible deterioration is similar to that observed in fruits kept under modified atmospheres (film, coating).

As for chilling injury, the deterioration resulting from controlled atmospheres affects peel or pulp. The most classic peel damage is apple scald (a surface scald). The symptoms are similar to those of other forms of scald such as senescence scald. Damage may be in the form of diffuse browning of skin zones, which can become rough. Deterioration becomes rapid when the fruits are returned to ambient conditions.

Internal deterioration is mainly in the form of tissue degradation after long periods of storage under CA. They result as much from the effect of conservation treatment as from fruit senescence and maturity. The best known in apples are brown core and mealy breakdown in overripe fruits.

Deterioration associated with modified atmosphere results from a balancing of O₂ et CO₂ levels that does not match the requirements of the fruit (Fruitrop 203). This poor balance may result from bad choice of film, a break in storage temperature (which modifies the O₂:CO₂ ratio) or poor evaluation of the ratio film surface:mass of stored fruits. Whatever the cause, this deterioration reveals the effects of hypoxia that can lead to the beginnings of pulp fermentation, and sometimes internal browning. It also results in non-characteristic aromas and the fruits will be acid and short on aroma. Some kinds of skin deterioration are attributed to a high CO₂ content, but it is not easy to differentiate between the respective roles of excess carbon dioxide and insufficient oxygen.

Whatever the cause, this physiological deterioration involves cell degradation with a change in cell wall permeability, oxidation of phenolic compounds (and hence browning) and finally overall disturbance to the metabolism (maturation disturbed in climacteric fruits, accelerated senescence).



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Conclusion

Present trends in farming systems are aimed at regulating biological attacks (by pathogens or pests) by using appropriate crop management and hence limiting risks of contamination. Upstream/downstream interaction will enable increasingly better designed post-harvest treatments to be applied according to the real risks of pest damage. Such better allowing for upstream conditions in post-harvest storage capacities in relation with the physiology of the fruit is also a future pathway for the implementation of storage techniques, especially as the latter change continuously. For example, films with selective permeability allow practically à la carte choice of the atmosphere desired. The regulation and management of CA facilities is increasingly accurate. It is possible to enhance fruit conservation potential, as in the case of thermal shocks before storage for better resistance to cold. Although some of these techniques are still at the experimental stage, there is real scope for better control of risks and degrees of physiological deterioration and a reduction of their impact on final quality ■

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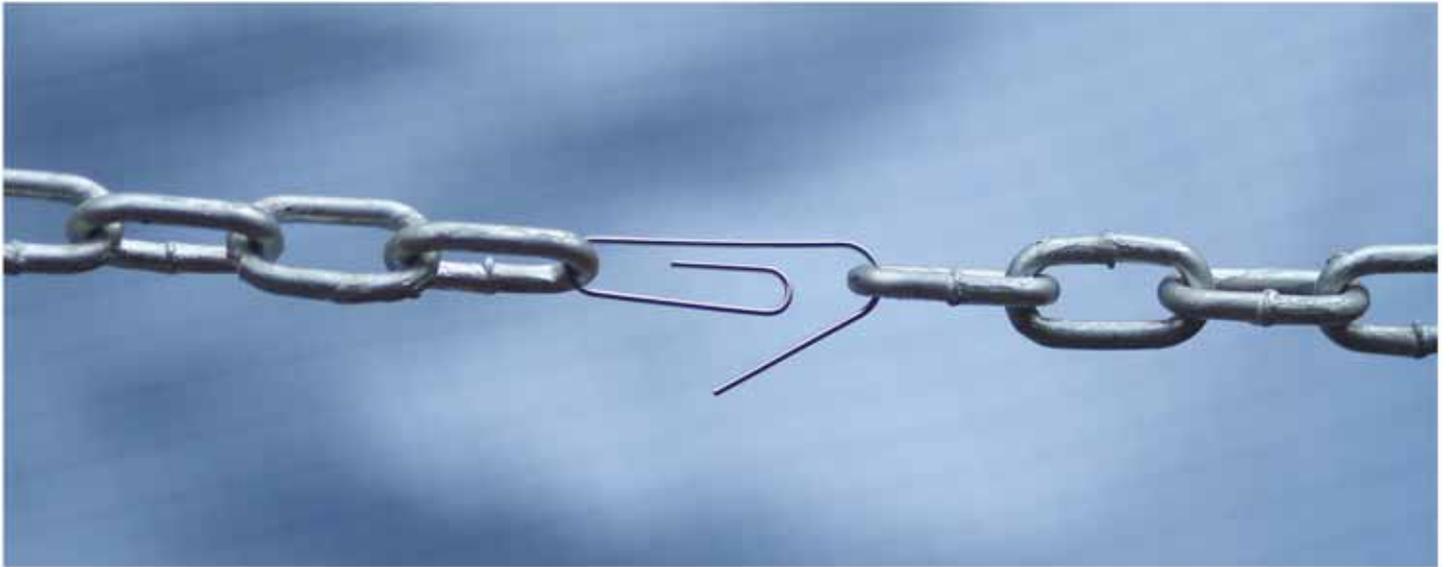


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