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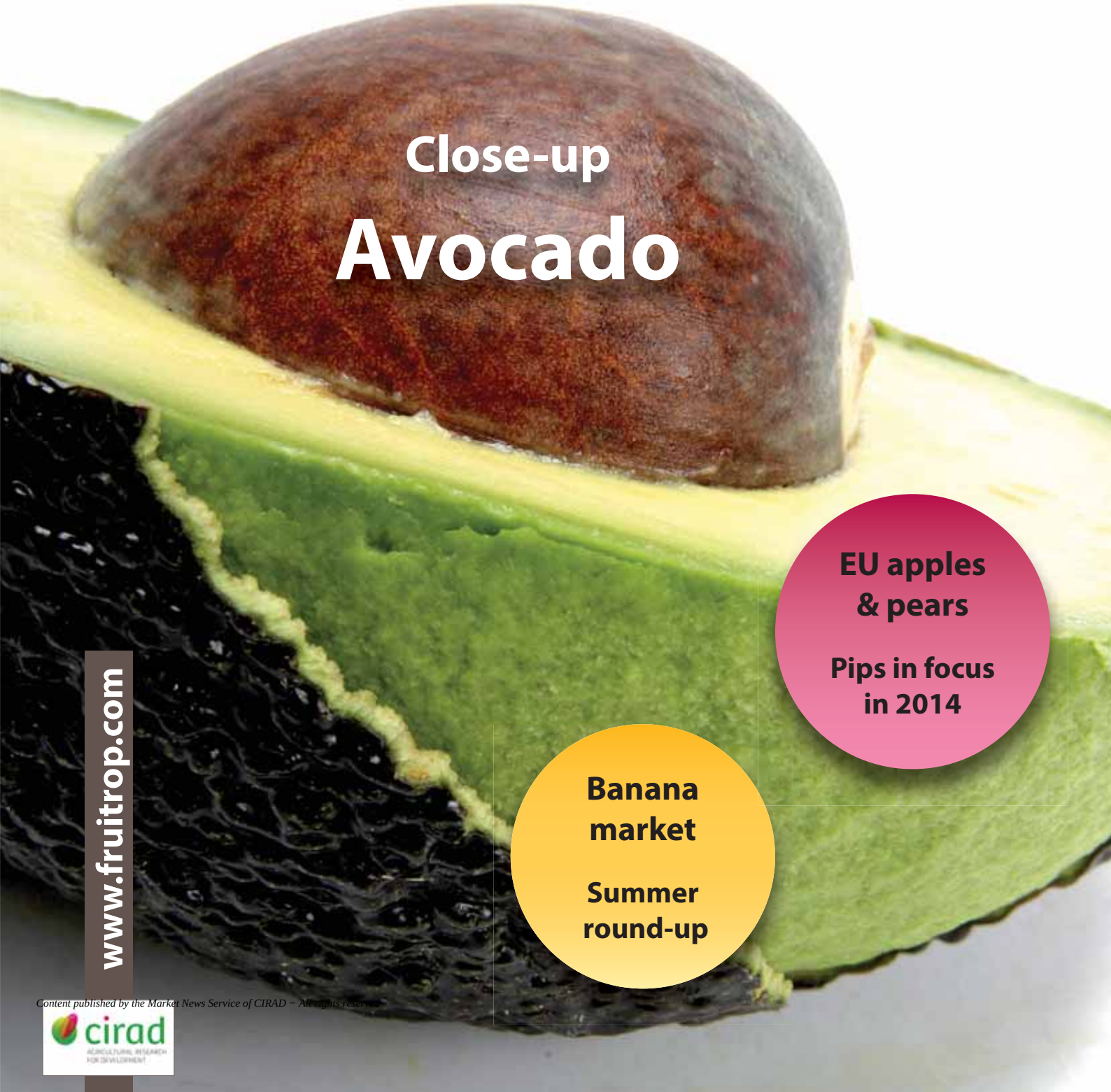

Close-up
Avocado

EU apples & pears

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Summer round-up

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AGRICULTURAL RESEARCH FOR DEVELOPMENT

Avocado

A report by
Éric Imbert

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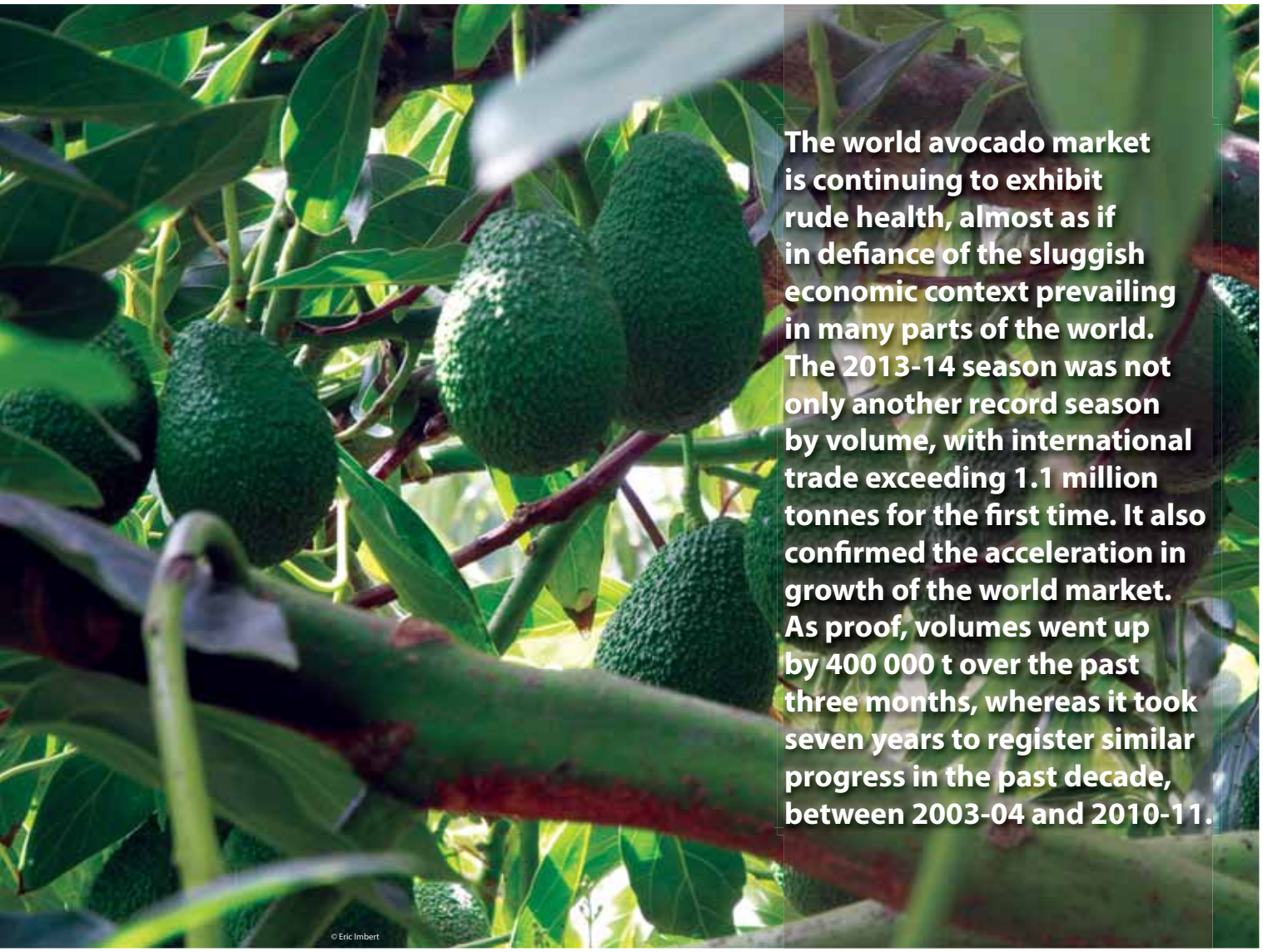
European Union stronger than the United States



The world avocado market is continuing to exhibit rude health, almost as if in defiance of the sluggish economic context prevailing in many parts of the world. The 2013-14 season was not only another record season by volume, with international trade exceeding 1.1 million tonnes for the first time. It also confirmed the acceleration in growth of the world market. As proof, volumes went up by 400 000 t over the past three months, whereas it took seven years to register similar progress in the past decade, between 2003-04 and 2010-11.

Growth down in the United States, but running on empty

The US market, still by far the world's number one, of course continued to drag international trade upward. Imports recorded between July 2013 and June 2014 rose by approximately 40 000 t from the previous season, culminating in a record level slightly in excess of 600 000 t, i.e. just over half of world trade. A performance to be hailed, although its level is considerably down on the previous two seasons, when growth was around 100 000 t. This slowdown must be put into context, and very fortunately, does not seem to indicate waning interest from US consumers in the avocado.

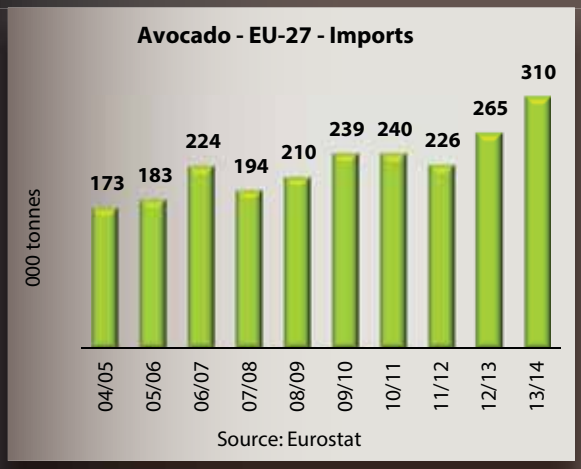
Consumption trend still as strong as it is reassuring

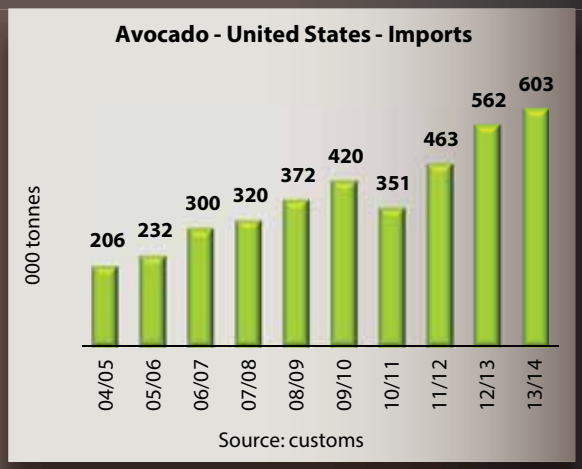
It is fuel that seems to have been in short supply to feed the insatiable appetite of the US market, with Mexican production only maintaining a stable level. Figures from the consumption boards are still very reassuring. Sales climbed 13 % between 2012 and 2013. The performance followed the same trend in Q1 2014 (+ 8.5 %), according to the latest data available. While the maturity of the Californian market seems to have been confirmed (+ 2.5 % between 2012 and 2013, and down slightly in Q1 2014), the mechanisms for growth are in place. The dynamic remains highly pronounced in other Western States and in the Mid-South States (Texas, Louisiana, Oklahoma and Alabama), markets now not far removed in size from California. Furthermore, it has been confirmed that the graft is taking in the highly populated and still low-consuming areas in the east of the country: growth remains just as explosive in regions such as the rich North-East, the Great Lakes, the Centre and South-East (up 20 to 25 % between 2012 and 2013, and around 20 % in Q1 2014, except in the Great Lakes). So the future appears assured, at least in the medium term, especially since the rise in volumes came without affecting the price levels. The indicator calculated by our Market News Service has registered a distinct rise from the tough 2012-13 season, returning to a level within the average for the past 4 years.

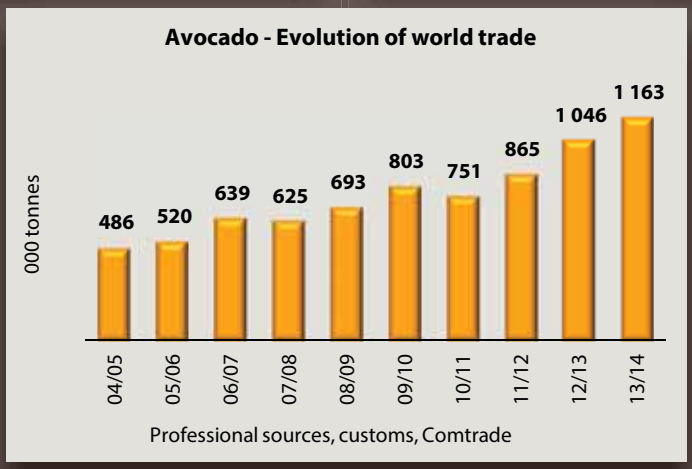
WORLD AVOCADO MARKET

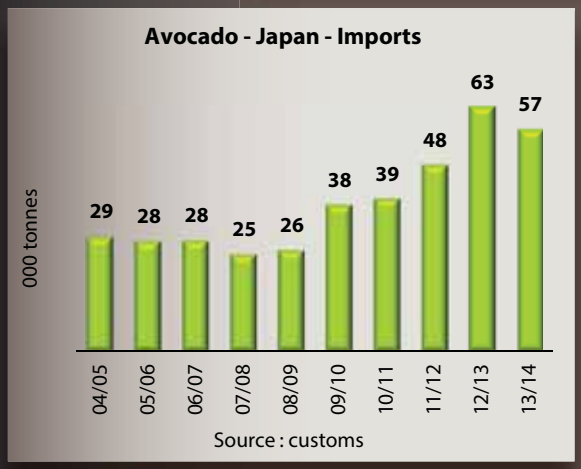
Market still seeing steep growth in 2013-14

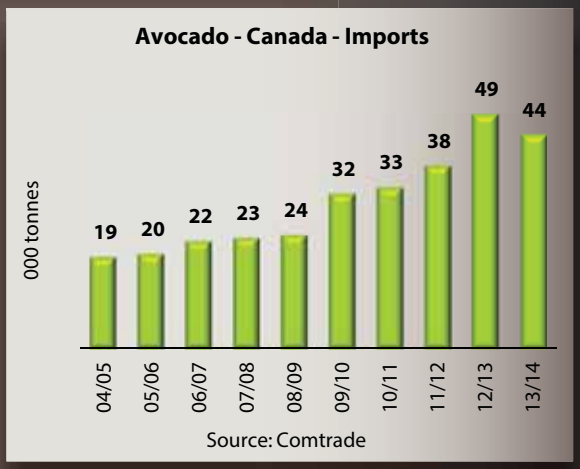
Summer season 2013, and winter season 2013-14





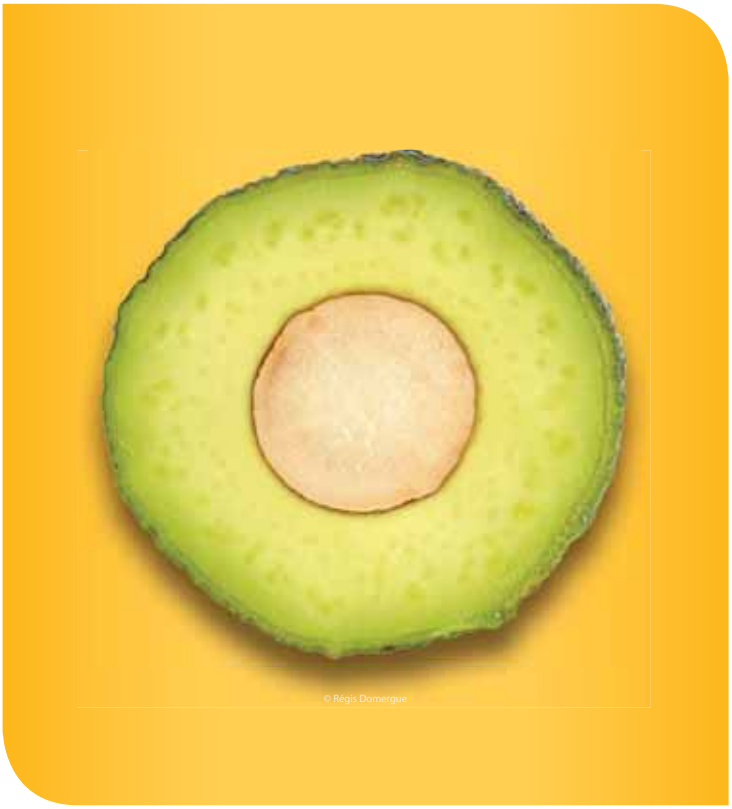


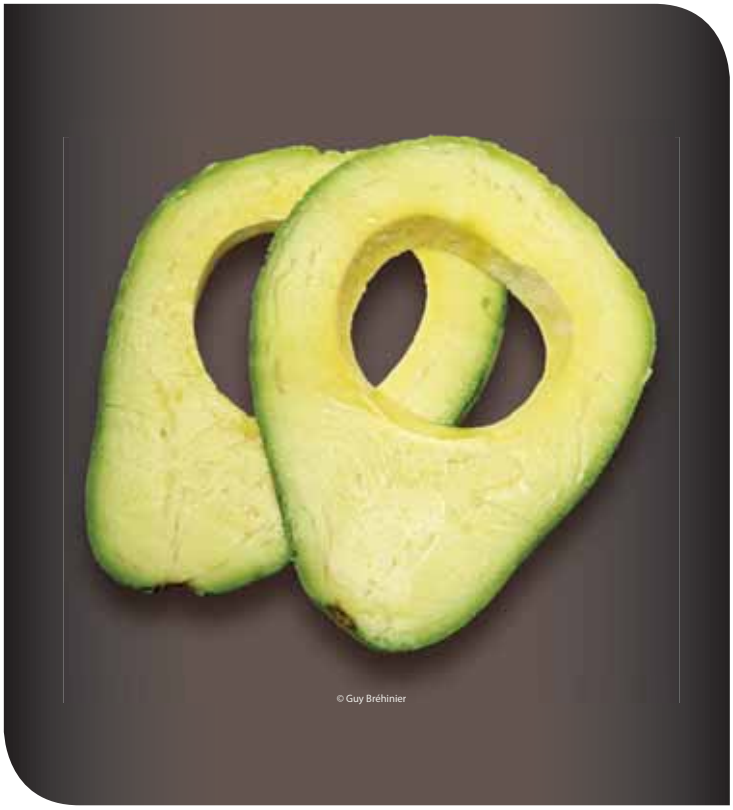




Explosive growth in the EU, confirming the market's surge

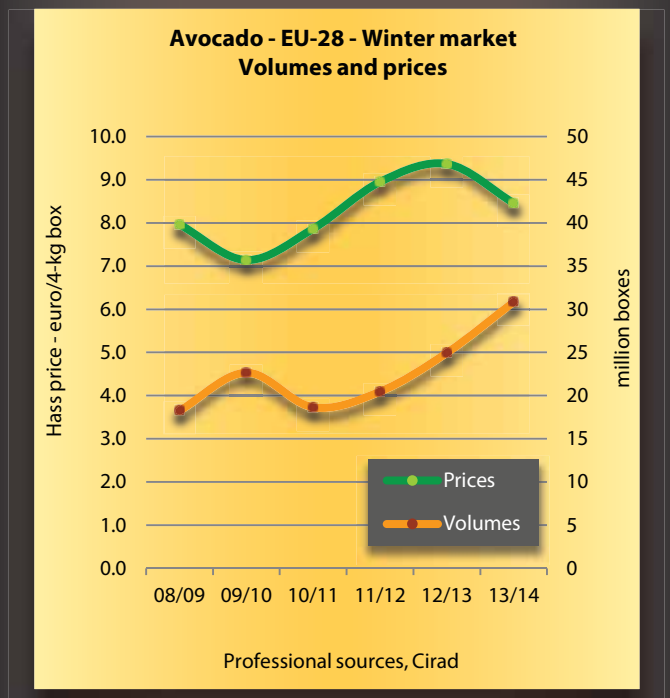
The surge of the EU-28, perceptible in 2012-13, was confirmed in the finest style. The rise in import volumes, of approximately 45 000 t, was greater than the 40 000 t registered in 2012-13 and, for the first time, exceeded the level of the US market. A symbolic success, it is true, which should soothe the spirits of the operators who have invested heavily and worked tirelessly to this end over the past few years. The rise in the summer market, which should be around 30 000 t from 2013, comes as no surprise. The growth in Peruvian imports, regular for the past ten years, and still very pronounced during the 2013 season, enabled the summer market to climb by 80 000 t between 2004 and 2014. The main factor to underline is the fine performance of the winter market. The rise in volumes in 2012-13, after a long period of quasi-stagnation, found clear confirmation. Imports went up by 30 000 t, peaking at a record level slightly above 160 000 t.

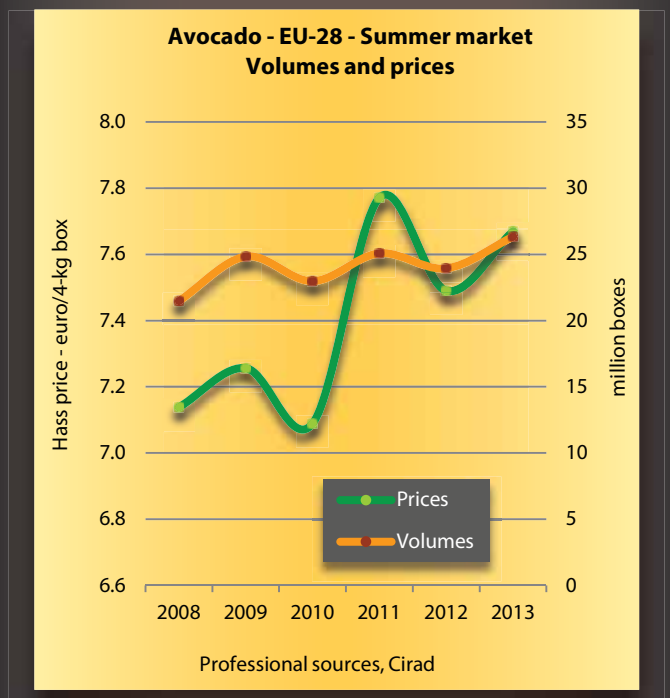




Prices at a good level, particularly thanks to the astounding first half-year!

Just as in the United States, the fine price performance during the 2013-14 winter season is demonstrating that a fundamental growth trend in consumption has set in on the Old Continent (see next article). The indicator calculated by our Market News Service for the 2013-14 season based on the size 18 was down on the past two seasons, but remains at an excellent level, 4 % above average. The first half was purely and simply astounding! Our indicator climbed from early January to be on familiar terms with the 10-euro mark in late February, despite a record supply for this period, 15 % above the supply from the previous season and approximately 1.4 million boxes per week. As the cherry on the cake, it held up at between 8.50 and 9.50 euros/box from mid-February to mid-May, despite average imports of 1.7 million boxes per week, i.e. 26 % more than during the previous season.





No fuel to feed growth of outsiders

The dynamic of the two world leaders has literally dried up the world market, and consequently, starved the other markets. Hence the slight downturn in the Japanese and Canadian markets, respectively no.3 and 4 in the world, should be interpreted as a hiatus in growth, rather than an abrupt turnaround in consumer interest in the avocado. In both cases, imports are down approximately 5 000 t because of the tension on Mexican fruits, an essential source in feeding these two markets. Imports registered 57 000 t to Japan and 44 000 t to Canada, i.e. respectively 4 and 5 % of the world market. The sole exception among the outsiders is the really fine dynamic holding up in Russia. The growth rate has been 2 000 t per year since 2010, thanks in particular to the volumes of green varieties released by the Western European markets, less and less interested in these cultivars. The volumes base nonetheless remains relatively modest, at slightly under 15 000 t.

A reassuring and above all highly promising balance

The balance for the 2013-14 season is a positive one in more than one sense. On the one hand, it unsurprisingly confirms the overall dynamic of the world market, with growth once again registering a two-digit figure.

On the other hand, with another year of strong growth in EU imports, it demonstrates that a new driving force on the world market has started up, and that it is no less powerful than the US market, if it is given fuel (see next article). Finally, the high price levels registered on the two big world markets mentioned above reassure us of the solidity of demand in the medium term, while the intermediate markets are no longer managing to find the volumes necessary to take off. Yet we shouldn't jump the gun: the summer season, which is ending on the Community market, has demonstrated that the risks of oversupply are still there (see summer review inset) ■

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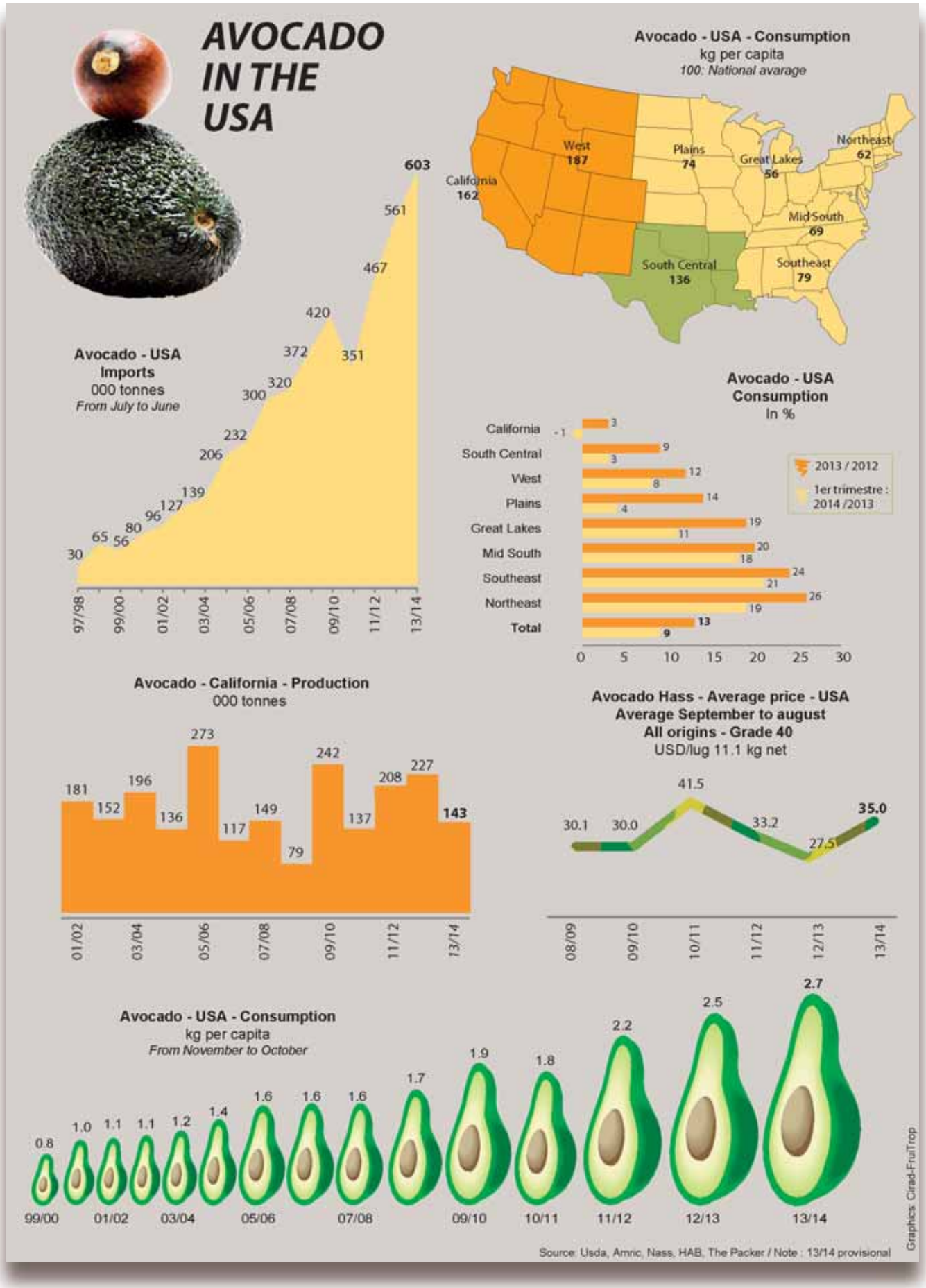
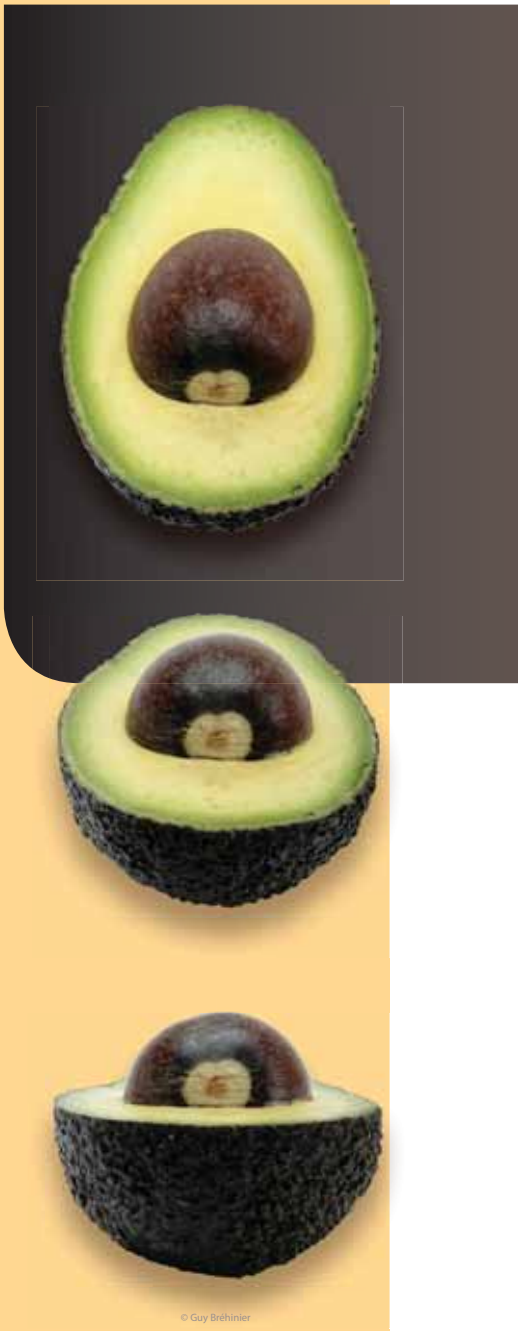


Initial review of the 2014 summer season: 6 weeks of very costly oversupply

A record winter season, followed by a record summer season. And the word is far from getting around, in view of the volumes received in the EU-28. According to an initial estimate drawn up from professional figures, the overall supply registered a rise of approximately 20 000 t, approaching 170 000 t. Practically all the supplier countries to the European market shipped out record volumes. This was clearly the case with Peru, whose shipments to the Old Continent probably grazed the symbolic 100 000-t mark. Overall, this source will have exported nearly 170 000 t of avocado this season, if we take into account the 65 000 t aimed at the US market. This makes a rise of more than 60 000 t from the 2013 season, which says a lot about the current growth dynamic.

The growth in South African surface areas is also showing through in the volumes shipped to the EU this season. Just as for Peru, an incoming shipments record was beaten, with probably more than 55 000 t. The Brazilian challenger also saw a considerable rise, reaching a high point with approximately 5 000 t. The only under-performance to report is from Kenya, with incoming shipments to Europe down by approximately 4 000 t. But can we really talk about under-performance? Since while incoming shipments of green varieties, which for a long time formed most of the Kenyan supply, have rapidly faded (barely more than 1 000 t this season), Hass shipments have held up very well, rising from 2013 to near the 2011 record.

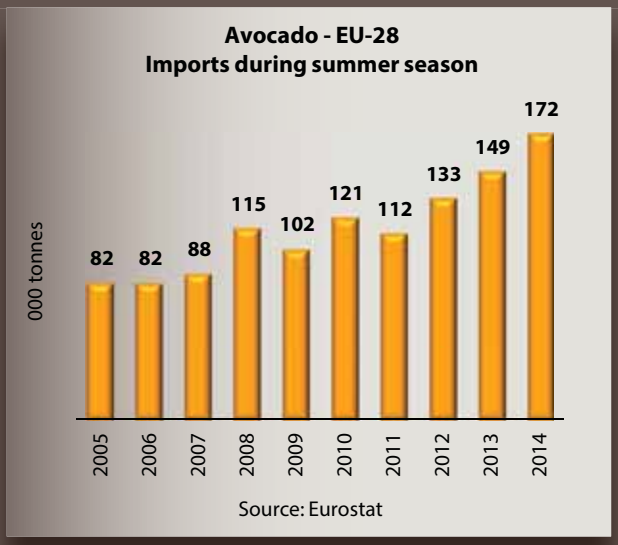
How did prices react to this rise in volumes? With a level of nearly 7.00 euros/box, our indicator based on the size 18 registered a downturn of just less than 10 % from previous seasons. The level of rates was particularly poor, at between 5.25 and 6.25 euros/box for three long months from early June to early September. This crisis was due primarily to a one-and-a-half month period of clear oversupply. From early June to mid-July, volumes reached an irrational level of between 1.8 and 2.0 million boxes per week, up 25 % from 2013, and more than 60 % from 2012. Which is a shame, since the market had demonstrated a very fine durability at the beginning of the summer season, with our price barometer continuing to fluctuate above the 9.00-euro mark, despite a very high weekly supply rate of approximately 1.7 million boxes. The additional one million boxes sold from early June to mid-July therefore cost all the links in the industry very dear, since it led to a price fall of more than 3 euros per box for three months!

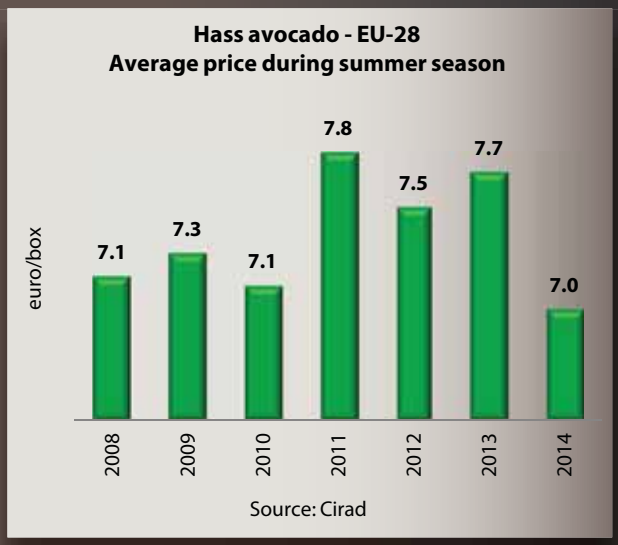


Avocado — EU-28 — Imports during summer season

tonnes	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014*
S. Hemis. total	**68 477**	**62 333**	**82 391**	**82 180**	**87 748**	**114 569**	**102 317**	**120 933**	**111 564**	**132 738**	**148 666**	**171 500**
Peru	11 266	14 590	18 096	30 508	35 857	49 829	45 661	56 345	66 155	62 618	86 260	100 000
Southern Africa**	36 404	30 528	47 906	36 589	38 445	51 109	38 821	47 800	27 375	49 083	45 165	57 000
Kenya	19 828	16 236	15 458	13 641	11 999	11 841	15 038	14 123	15 028	17 078	13 313	9 500
Brazil	979	979	931	1 442	1 447	1 790	2 797	2 665	3 006	3 959	3 928	5 000

*Estimate / **South Africa + Zimbabwe + Swaziland / Source: Eurostat

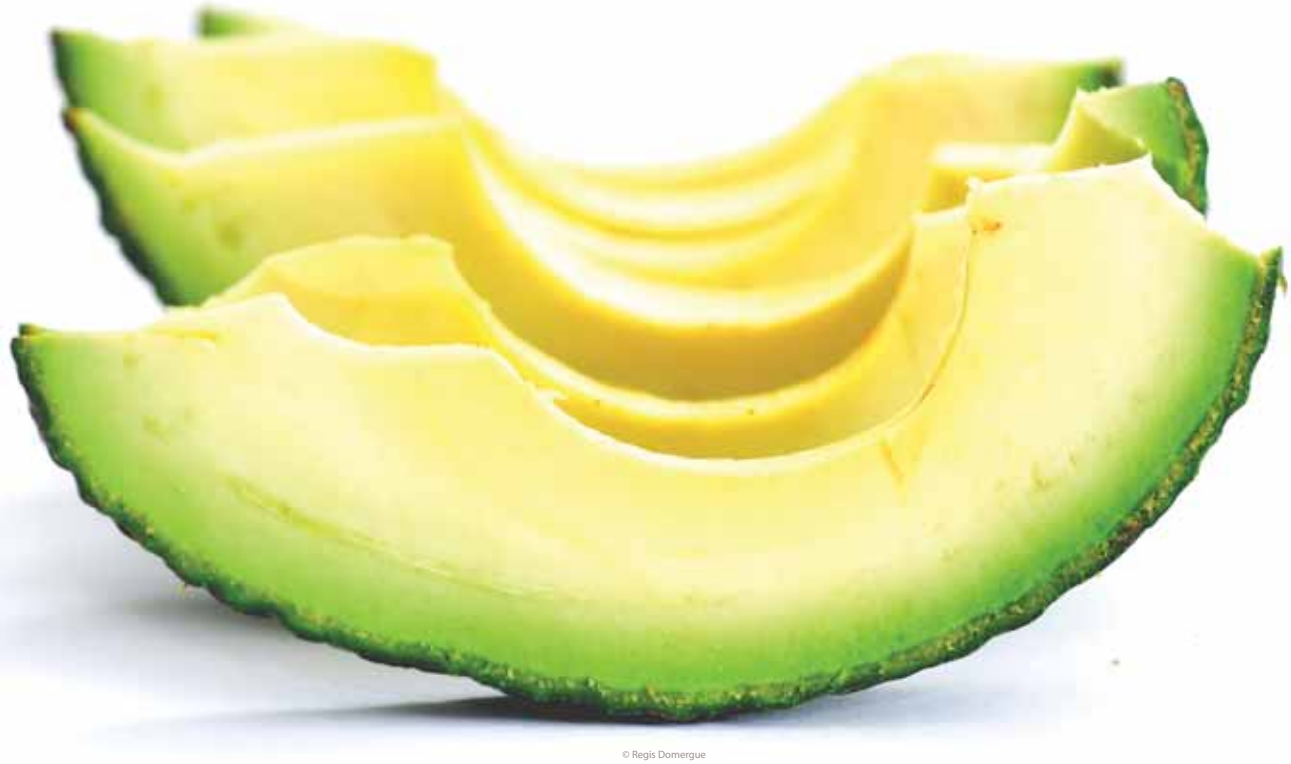




European avocado consumption

A record vintage in 2013-14… and set to usher in more

It has practically given cause to claim victory! The 2013-14 season shows that the import sector's efforts to develop consumption in Europe, striving in particular to improve the quality of fruit available to the general public, through varietal change and the ready-to-eat segment, are working. It is a real source of pride for the initiators of this approach, which are most often small or medium facilities which have had to invest heavily to dare to pick up the gauntlet thrown down by the American operators.



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Our ambitions, to offer you ripening solutions tailored to your requirements. Backed up by a structure with cutting-edge technologies, our know-how dedicated to ready-to-eat and triggered fruit, and all types of packing, is based primarily on the experience of our teams.

YOUR AVOCADO SPECIALIST FOR MORE THAN 25 YEARS.

Our commitments, providing you with a daily service from the sources Brazil, Chile, Colombia, Dominican Republic, Israel, Kenya, Mexico, Peru, South Africa, Spain, Tanzania, Zimbabwe... with optimum quality ensured all year round.

Our expertise, the ability to develop partnerships based on quality projects, and jointly anticipate new market developments.

World wide producer and French Leader in avocado distribution.

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Three avocados on average per year per capita

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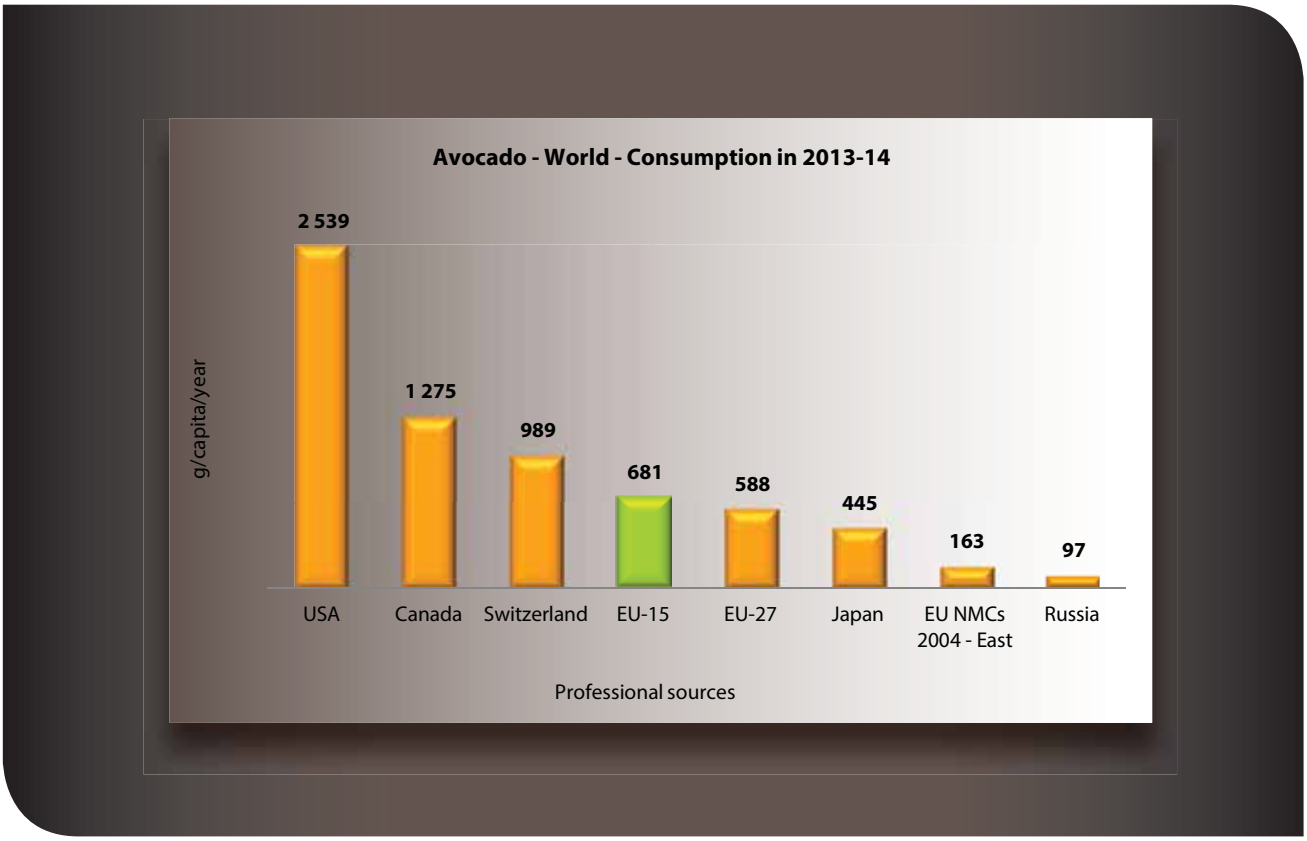
According to our estimates, European consumption amounted to approximately 290 000 t from June 2013 to May 2014. This figure takes the volumes absorbed per capita in the EU-28 to just under 600 g/year. This average level does not carry much significance, since it conceals a still very marked difference between the East and West of the Community. Despite an increasingly pronounced dynamic, the inhabitants of Eastern Europe consume just one little avocado per year (just over 160 g, i.e. one size 24 fruit). It is still the Western part of the continent which is driving the market, but again with volumes remaining restricted in comparison with other high-revenue zones. The almost 700 g consumed today per capita per year (i.e. approximately 3 size 18 fruits) is a long way from the Swiss consumption level of 1 kg, the Canadian level of nearly 1.3 kg, and even further from the US level of 2.5 kg; markets which, in addition, are far from being mature, and are continuing to exhibit a fine dynamic. In short, the European market has started to make good steps forward, but it still has a long way to go.

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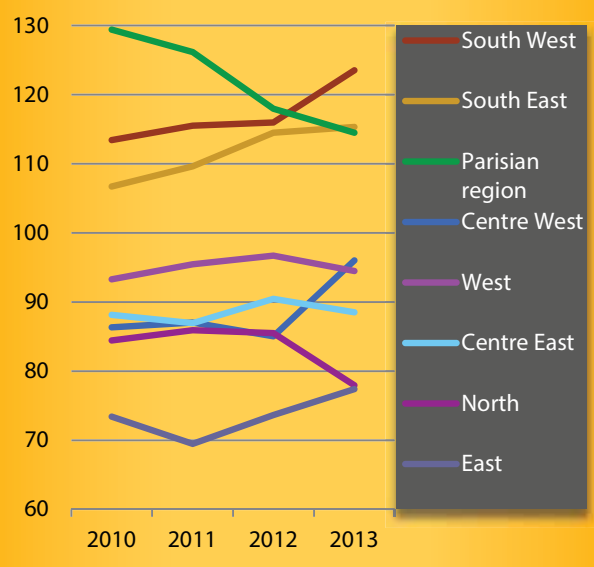
France on top!

As the old adage says, some things get better with age. France, the pioneering market where the avocado hatched in Europe, and which has ever since been number one in terms of volumes, is also the market which best rode the wave of growth of the 2013-14 season. Volumes, up 8 000 t from the previous season, approached the consumption record of 90 000 t set in 2004-05. If we believe the data of the consumption boards, this boom is mainly due to greater popularity of the avocado in under-consuming regions, which augurs well for the future! The product is increasingly breaking into Eastern France, which is nonetheless well behind despite a fine rise. A similar observation can be made for Central France, and to a lesser degree in the West. The sole exception of note is the fall in consumption in the North, probably associated with the low revenue levels in some parts of the region, the product being increasingly consumed among the better-off segment of the population. As for the big consumers, the South's infatuation with the avocado is intensifying, unlike the Paris region which is still among the aficionados of the product, but has lost more than 15 index points 3 in years! This downturn is amazing for this part of the country where average revenues are the highest in France. Another cloud on the horizon is that the avocado is highly consumed by the oldest segment of the population, while its popularity is tending to drop among young people - a trend which also seems to be linked to the rise in the retail price.

Avocado - France - Consumption by region
Index 100 = France



Source: Kantar / Processed by CTIFL

Avocado - France - Consumption by age
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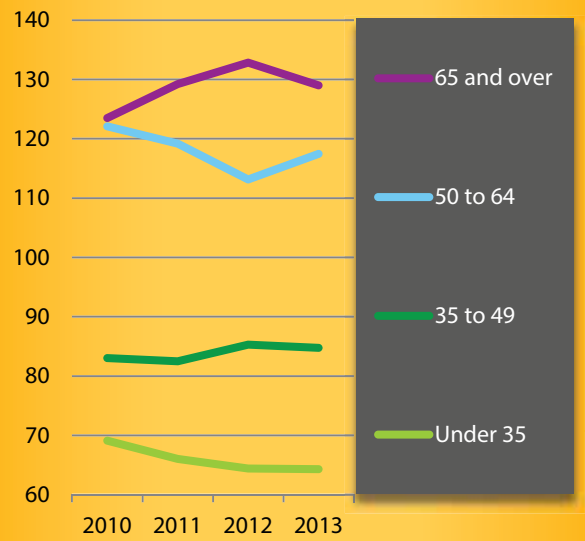

Source: Kantar / Processed by CTIFL

Avocado - France - Consumption by SPG
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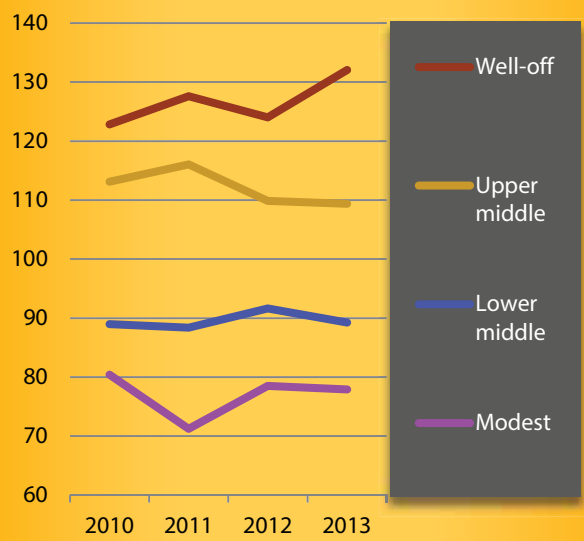
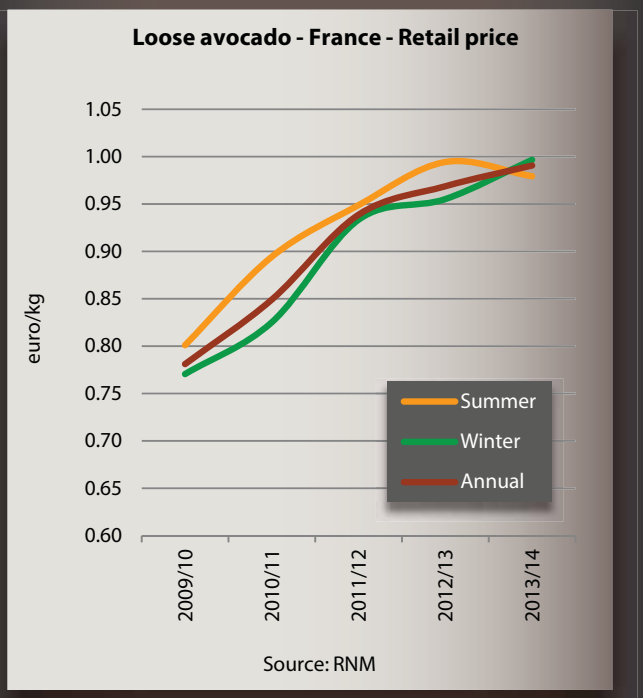
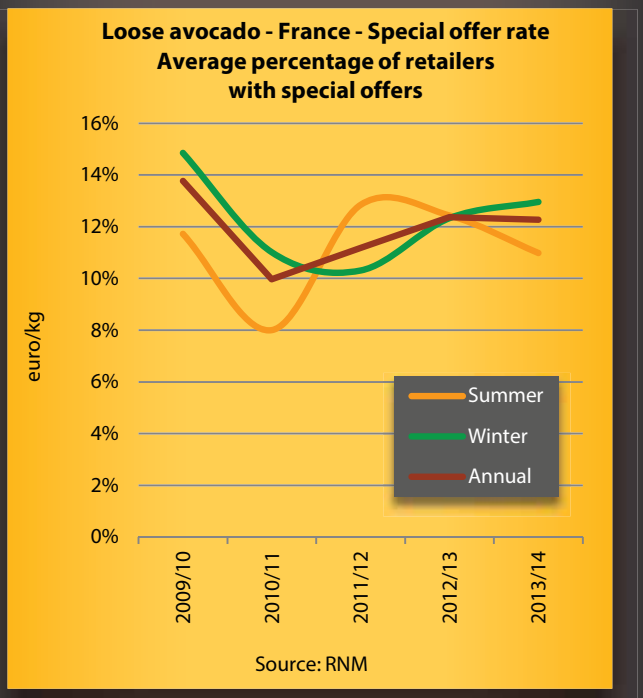


Source: Kantar / Processed by CTIFL





Quality comes at a price, but it is driving the market upward in France!

It cannot be said that the spectre of deflation, threatening the economies of the Old Continent, has hovered over the French avocado market. With practically the whole distribution sector switching to triggered fruits, retail prices have continued to rise, reaching a record level near the one-euro mark on the loose market segment. This is a dazzling demonstration that the consumer is prepared to pay a bit more — as it happens approximately 15 to 20 % — to be guaranteed a product that they can at least eat (no more avocados that never ripen), and that in most cases will meet their expectations in terms of taste. Nor have distributors needed to drive sales by increasing the promotional activity, with the number of promotions keeping to the average despite the abundance of volumes to sell. This model, which demonstrates that quality is able not only to increase consumer satisfaction, but also turnover for the benefit of all links in the industry, must be contemplated for other products and, first of all, for other climacteric fruits. We can only encourage the efforts made in this respect also by the imports sector to develop a similar approach with the mango. The same could apply to the grapefruit for example, where more relevant segmentation would make it possible to demarcate fruit from tropical regions.

An excellent balance in the United Kingdom

The results are lukewarm in Europe's two other big consumption centres. The United Kingdom has recorded a very fine performance, doing more than confirming its little leap made in 2012-13 after a long flat period, registering a spectacular increase of 15 %. This long-term success relies on two pillars. On the one hand, the communication campaigns conducted for the past few years have made it possible to persuade a good proportion of consumers that the avocado is a health fruit, emphasising in particular the qualities of its fatty acids. Furthermore, banking on quality, in the form of developing clear segmentation, seems to be bearing fruit. The vast majority of distribution sector sales now comprise ready-to-eat fruits (pack of 2 fruits, generally size 20 to 22, or even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24). The remainder of sales (generally in loose form, from sizes 14 to 16, or even 12 more recently, a baby pack of 3 small fruits of size 28 to 32) comprise triggered fruits. Hence the British market is now hot on the heels of Scandinavia, with its consumption in excess of 43 000 t.

Mixed fortunes for Scandinavia

The balance is much more qualified in this northern part of the continent. The maturity of the two main markets has been confirmed. Consumption stabilised in Sweden, where volumes per capita are slightly above the 2 kg/year mark. In Denmark, they actually saw a considerable decline. Conversely, the growth trend which had established itself on the Finnish and Norwegian markets two or three seasons ago seems to be consolidating. The annual consumption per capita is now approaching the one-kilo mark in Finland, and the (fateful?) 2-kg mark in Norway.

Germany corroborated and into overdrive!

The 2013-14 season confirmed that the German market was among the most promising. Consumption beat a new record of 27 000 t, up by approximately 2 000 t from the previous season. Hence it has climbed more than 10 000 t since the market's first steps at the end of last decade, and the tempo should pick up considerably over the coming years. The switch from green varieties to triggered Hass, the main factor behind the awakening of the market, has now spread practically across the board. Aldi Nord took the plunge approximately one year ago, and Lidl last season, following the trail blazed by the pioneering Aldi Sud at the end of the previous decade. Hence approximately 90 % of the German distribution sector has now opted for quality, and has been rewarded by sales quadrupling in certain stores. Another important factor for the development of consumption on this highly price-responsive market: size range tailored to consumer revenue. Indeed, the distribution sector is mainly working with big fruits in the urban areas, and more modestly sized avocados in rural areas. Similarly, the discount stores are offering smaller fruits (16-18 for example) than the conventional supermarkets (14).

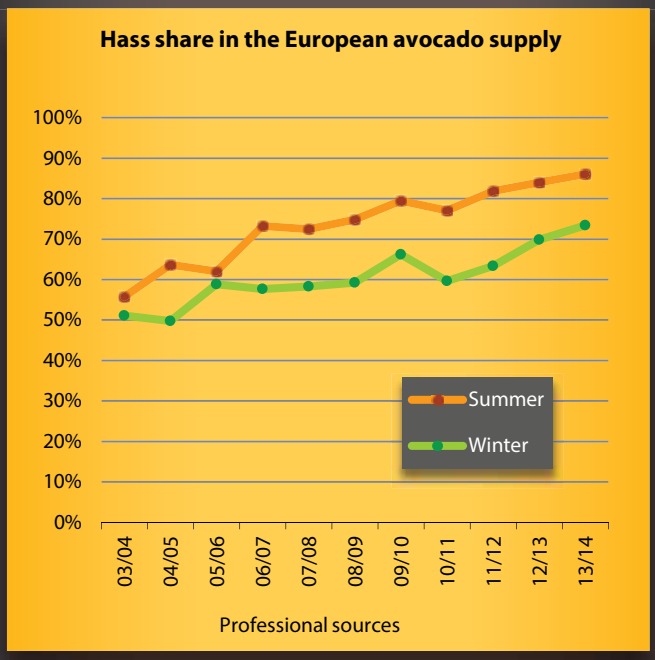
"Little markets" taking off, but will they gain altitude?

Goods news too from Western Europe's "little markets", which weigh in at under 10 000 t. Italy, hitherto among the non-subscribers in terms of the avocado, seems to be showing some initial signs of awakening. For the first time, consumption took off from 4 000 to 5 000 t per year. Nonetheless, the prospects seem modest for the medium term. While the avocado is now present on supermarket shelves (green varieties of size 10, or even 12), it is still very much an exotic fruit. Hass is very scarce and little known (except for some ready-to-eat fruit packs available from certain supermarkets), and gaining public approval is a challenge calling for heavy investment that no professionals seem to want to take on at present.

The same observation can be made in Austria, where an initial leap was observed, with volumes taking off from 2 000 to 2 500 t/year. Conversely, the Irish market remained completely static.

Eastern Europe: markets which now matter

The East European markets registered another brilliant performance in 2013-14. Just as between 2011-12 and 2012-13, the rise was approximately 4 000 t, taking overall consumption to nearly 16 000 t. Practically all the markets in the zone registered spectacular increases, of around 45 % on average from last season. Poland and the Baltic States remain the regional



champions, with consumption levels nudging the 5 000-mark t in 2013-14. Romania, Hungary and the Czech Republic come next, with volumes of between 1 000 and 2 000 t. This dynamic is very good news in more than one respect. On the one hand, it is an opportunity to familiarise consumers from these regions with the avocado, hitherto very little known, thanks to the accessible introductory prices of the green varieties. On the other hand, it is reassuring as to the future of the green varieties. These cultivars, which continue to represent a significant proportion of production for certain supplier countries (approximately one quarter of the Spanish supply, two thirds of the Israeli supply and one third of the South African supply), now have only a very restricted outlet in Western Europe. During this last season, they represented just one quarter of volumes consumed during the winter period, and under 15 % of volumes during the summer period.

Big growth margins

The growth trend which has taken hold on the Community market seems to be solid, provided that the fuel is there (see next article). While there are clearly margins for growth, how big are they? We should seek some answers to this difficult question in the analysis of the markets where consumption is tending to stabilise, a probable sign of approaching maturity. Are the volumes absorbed by the big Scandinavian markets, such as Sweden or Denmark, which seemed to stall once they passed the 2 kg/capita/year mark, good gauges for the markets of non-producer countries? True, competition from local produce on the same segment is less than in Southern Europe, but the climate is also less favourable for consumption of raw vegetable salads. If we can believe the Freshfel estimate of overall fruit consumption in the various Community countries, Sweden is actually slightly under-consuming in relation to France or Germany. Although this consumption level might represent only a very rough marker, the big European markets are still a very long way from it: more than 600 g/capita for France, more than 1.3 kg for the United Kingdom and more than 1.7 kg for Germany. Hence even if we take only these three driving markets, which together represent a population of more than 200 million, the growth margins are enormous! ■

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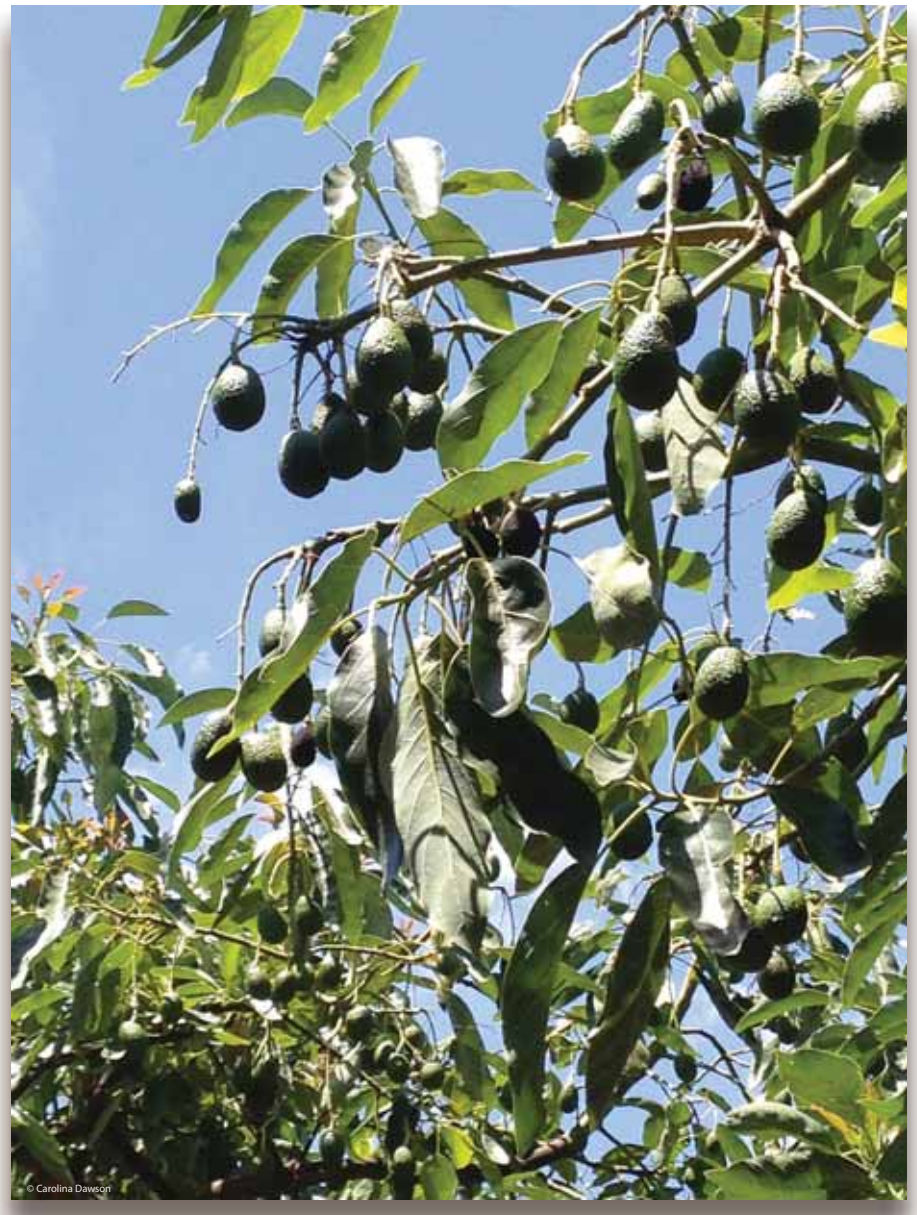
Avocado — Consumption in Europe (EU-27 + Norway)						
	Estimated marketed volume in 2013-14 (tonnes)	Population in millions	Consumption per capita (grams)	2013-14 compared to		GNP-PPS (index)
				2012-13	average 2009-10 to 2012-13	
EU-27 + Norway	**289 357**	**495.0**	**585**	**+ 18 %**	**+ 23 %**	**100**
EU-15 + Norway	**273 103**	**401.2**	**681**	**+ 16 %**	**+ 21 %**	**111**
France	88 656	65.9	1 345	+ 10 %	+ 14 %	108
Scandinavia	43 709	25.8	1 694	+ 16 %	+ 24 %	136
Sweden	19 924	9.6	2 075	+ 2 %	+ 25 %	127
Denmark	8 719	5.6	1 557	- 30 %	- 20 %	125
Norway	9 877	5.1	1 937	+ 33 %	+ 69 %	191
Finland	5 189	5.5	943	+ 62 %	+ 147 %	112
United Kingdom	43 182	64.3	672	+ 16 %	+ 24 %	106
Germany	27 109	80.8	336	+ 6 %	+ 22 %	124
Netherlands	27 117	16.8	1 614	+ 124 %	+ 34 %	127
Spain	21 413	46.5	460	+ 42 %	+ 19 %	95
Italy	6 425	60.8	106	+ 29 %	+ 36 %	98
Belgium	5 180	11.2	463	- 15 %	+ 18 %	119
Austria	3 428	8.5	403	+ 47 %	+ 38 %	129
Portugal	2 431	10.4	234	- 18 %	- 12 %	75
Ireland	2 219	4.6	482	+ 8 %	+ 4 %	126
Greece	1 967	11.0	179	- 1 %	+ 11 %	75
Luxemburg	267	0.6	485	+ 31 %	+ 25 %	264
Eastern Europe NMCs	**16 254**	**99.7**	**163**	**+ 45 %**	**+ 107 %**	**68**
Poland	4 724	38.5	123	+ 58 %	+ 99 %	68
Baltic states	4 823	6.2	778	+ 35 %	+ 78 %	71
Czech Republic	1 373	10.5	131	+ 43 %	+ 113 %	80
Slovakia	601	5.4	111	+ 5 %	+ 46 %	76
Hungary	1 311	9.9	132	+ 101 %	+ 158 %	67
Slovenia	773	2.1	368	- 17 %	+ 183 %	83
Romania	1 852	19.9	93	+ 78 %	+ 223 %	54
Bulgaria	541	7.2	75	+ 61 %	+ 122 %	47
Croatia	256	4.2	61	+ 85 %	nd	61

From June 2013 to May 2014 / Import-export+production / Sources: Eurostat, FAO, professionals

European avocado market Forecast for the 2014-15 winter season

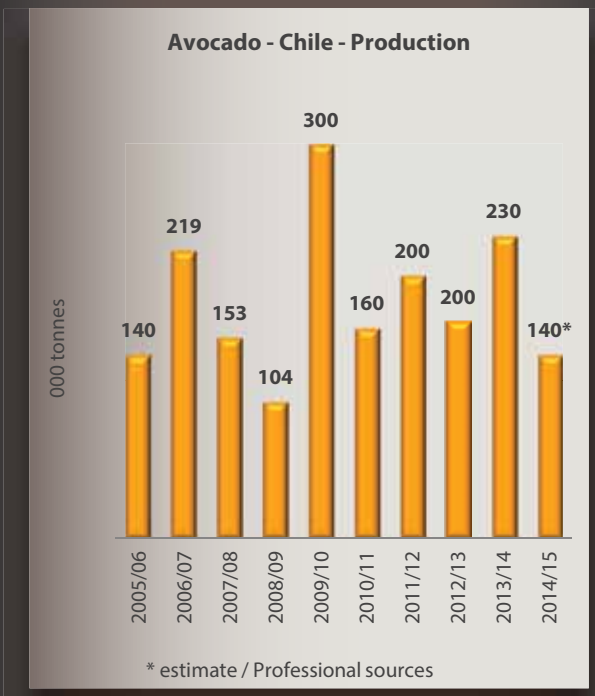
A season under tension



Each year follows the last, but they bear little resemblance! After a 2013-14 season when the supply level was sufficiently abundant to quench the thirst of the European market for the avocado, the 2014-15 season is now set to be under tension.

Chile dried up...

Indisputably, the major pendulum effect of Chilean volumes is the main point to take away from the start of this season. According to the latest information gathered, production should not exceed 140 000 tonnes, as opposed to nearly 230 000 t last season. This drastic fall puts the 2014-15 harvest among the lowest in recent years. It can be explained not only by the well-known alternating effect in production, but also by the persistent drought in certain parts of the country, and by the resulting abandonments of orchards. In this context overall exports should not exceed the 65 000-70 000 t mark, given the local consumption level, i.e. barely more than the volumes bound for the European Union alone in 2013-14. So Europe should receive between 30 000 and 40 000 t, if we assume a market share of between 40 and 60 % since Chile's strategic focus shift to the Old Continent implemented in 2012-13. The upper hypothesis of 40 000 t, based on the 2012-13 figures when the Chilean season was curtailed like this season, and the very high prices in Europe, is perhaps the most credible. In either scenario, there is a major supply shortfall in relation to the 63 000 t in 2013-14.



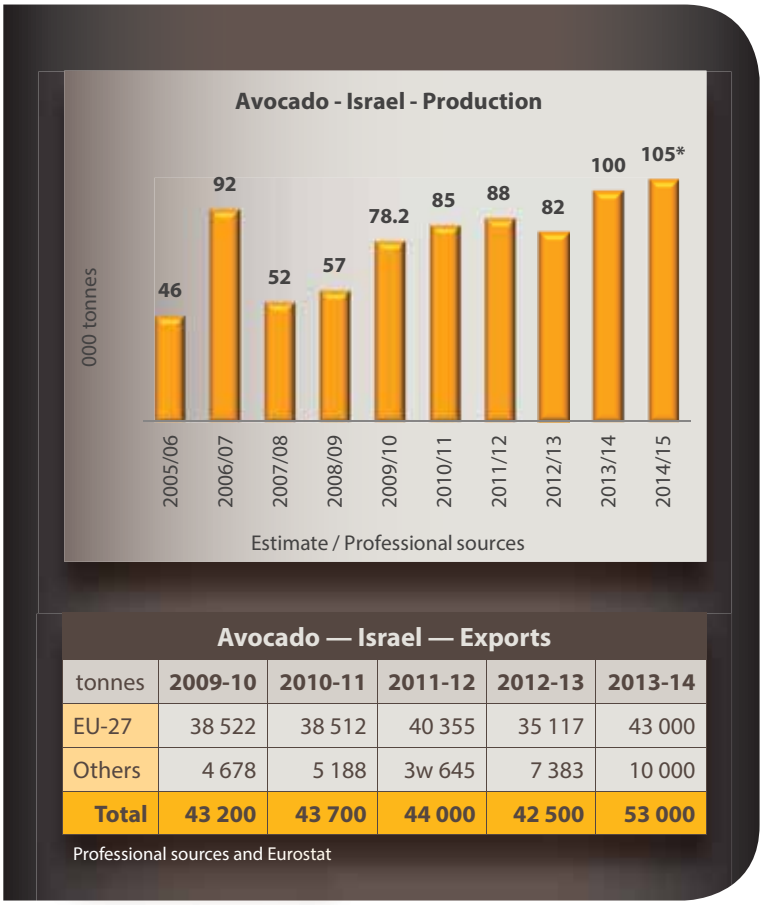
Avocado — Chile — Exports

tonnes	2009-10	2010-11	2011-12	2012-13	2013-14
Europe	52 174	25 762	32 929	42 571	64 247
USA	134 596	54 383	73 795	14 710	53 297
Central and South America	5 971	5 900	7 342	8 888	11 735
Japan and Asia	1 703	393	1 638	1 283	1 978
Total	**194 444**	**86 439**	**115 703**	**67 452**	**131 257**

Source: Chilean Customs

Production practically stable in Israel, though volumes earmarked for export up slightly?

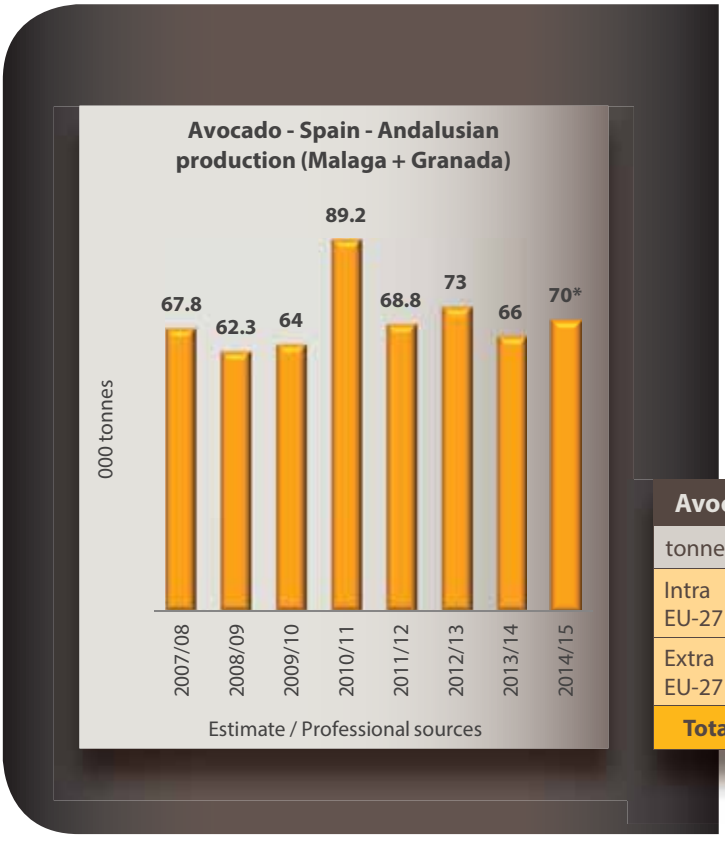
The Mediterranean sources will clearly not be able to make up for the lack of Chilean Hass, despite a probable small rise in their exports. The climatic conditions were good throughout the cropping cycle in Israel. Hence production should at least maintain last season's high level, i.e. approximately 100 000 t. Certain sources even believe that a slight growth of 10 % is probable. The Hass volumes earmarked for export should register slight growth, with this variety representing an increasing proportion of production. Shipments of green varieties will depend on the market. While nearly all of the Pinkerton should be exported, the local market will come into competition with the international market for varieties such as Ettinger, Fuerte, Ardith and Arad. If, as we might assume, the tension on Hass is favourable for the green variety prices holding up, volumes earmarked for export could also be slightly up on last season.



Avocado — Israel — Exports

tonnes	2009-10	2010-11	2011-12	2012-13	2013-14
EU-27	38 522	38 512	40 355	35 117	43 000
Others	4 678	5 188	3w 645	7 383	10 000
Total	**43 200**	**43 700**	**44 000**	**42 500**	**53 000**

Professional sources and Eurostat



A little more in Spain? Yes, but...

The Spanish harvest is also slightly bigger than last season. There seems to be a considerable increase among the green varieties, which represent approximately 25 % of production. However, this should be put into perspective given the scarcity of volumes seen in 2013-14. The increase in Hass could be around 10 to 15 %. However, this should not be taken as certain, because of high temperatures during the latter part of summer. Physiological dropping is still a possibility to fear. In addition, the size range now seems to be on the medium to small side.

Avocado — Spain — Exports (October to May or April)

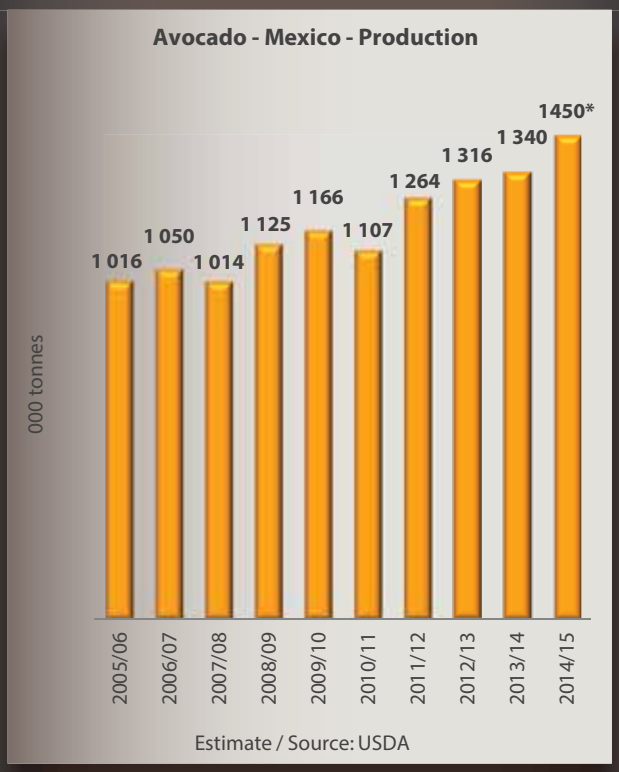
tonnes	2009-10	2010-11	2011-12	2012-13	2013-14
Intra EU-27	31 420	44 461	33 272	42 039	41 292
Extra EU-27	4 980	1 804	4 750	7 717	3 148
Total	**36 401**	**46 265**	**38 022**	**49 756**	**44 440**

Source: Eurostat

Top-up Moroccan volumes shrinking, though Colombia continuing its rise to the fore

So what about the outsiders? A downturn in the harvest is taking shape in Morocco, despite the cultivation area still seeing considerable growth. Exports achieved an exceptional level of 4 500 t in 2013-14, after a steep upswing in production due to the frost which hit the previous season. They should be between 2 000 and 3 000 t in 2014-15. Conversely, shipments will primarily comprise big fruits, with the small ones being shifted toward the increasingly hungry local market. Morocco also imports increasingly significant volumes, which culminated at more than 9 000 t in 2013.

Unlike Morocco, Colombia will continue to increase its shipments. However, they will remain relatively moderate. According to professional sources, they should come close to 3 000 t, as opposed to just over 1 000 t in 2013-14. The acceleration will be much more significant by a few years' time, with the large surfaces areas set up recently entering into production.



A very open market for Mexico, though with conditions

The downturn in Chilean imports, combined with near-stability in Mediterranean volumes, should lead in a fall in the supply to the Community market, which might be estimated at 15 to 20 % from last season. So the context appears favourable for a decent level of top-up volumes from Mexico. The exporters will get what they need. Unsurprisingly, given the growth in surface areas over recent years, production should be greater than in 2013-14, where it already registered a colossal level of 1.3 million tonnes. The magnitude of the increase is still difficult to ascertain, and depending on the sources, ranges from moderate to + 20 %. It remains to be seen whether the conditions offered by exporters will be compatible with the requirements of the European market. Prices should be more attractive in October, with the harvest of fruits from the main flowering period coming to the fore. Conversely, the "prepaid" contract mode and the qualitative heterogeneity of certain brands could still be serious impediments. Mexican shipments into Europe have not exceeded the 10 000-t mark since 2008-09.

Avocado — Mexico — Exports

tonnes	2009-10	2010-11	2011-12	2012-13	2013-14
United States	274 329	283 814	359 262	522 488	512 000
Japan	34 473	35 159	42 354	55 883	50 600
Canada	25 435	22 687	27 431	35 044	33 700
European Union	10 807	3 155	4 153	9 137	6 300
Others	25 883	19 642	29 537	34 893	34 700
Total	**370 927**	**364 457**	**462 737**	**657 445**	**637 300**

Source: Mexican Customs

A market under tension, especially for the Easter promotions

Prices promise to be high overall, not only because of the downturn in supply mentioned above, but also because of the demand dynamic, which has been in excess of 15 % for the past two seasons. The 2012-13 season can probably be used as a reference (moderate Chilean supply, and similar Mediterranean exports). The market could be particularly tight at the start of 2015. In view of the volumes available, the Chilean season will not be able to extend over the record period seen in 2013-14 (last incoming shipments in early May!), although exporters too are seeking to tap into a market probably very buoyant at this time of year. The final batches were delivered in late February/early March, if we take previous seasons as a reference, when volumes were similar. So the supply should be small after this period, until Peruvian volumes take off in around early May. There should be high tension for the Easter promotions (early April in 2015). Will this context enable the green varieties to claw back more space on the shelves? We might think so, although specialists in these cultivars saw no auguries in September.

Beginning of the summer season under pressure?

Thereafter the market could have a turnaround in store for us, but it is giving nothing away. Unless there are major climatic problems, Peruvian production should again see very steep growth, with the entry into production of considerable new surface areas combining with the young orchards reaching their prime. Furthermore, the US market could be distinctly less open than in 2014, because of the upswing in Californian production. However, this scenario should still be taken as conditional, with the recurrent drought ravaging the south-west of the United States and the abnormally high temperature levels in Q2 potentially compromising this rise in volumes ■

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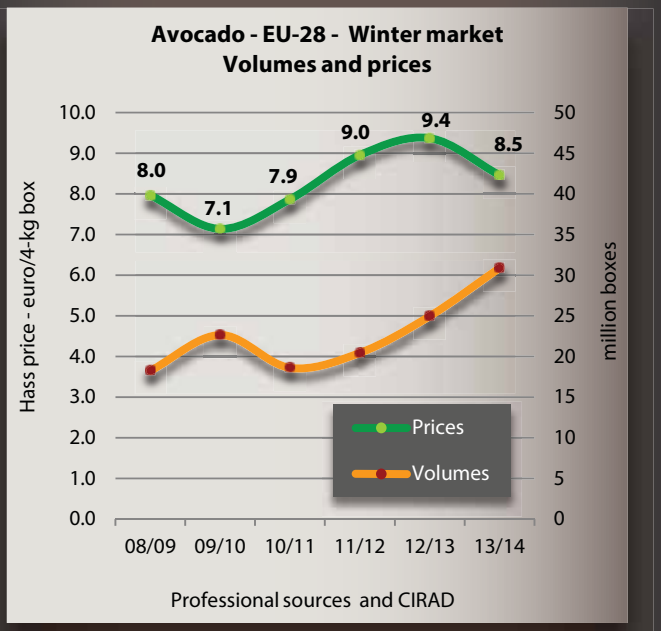

Avocado — Main exporting countries

tonnes	Production 2013-14	2014-15 trend vs. 2013-14	Exports 2013-14
Mexico	1 340 000	+ 5 % to + 20 %	637 000
Chile	230 000	- 40 %	131 000
Israel	100 000	0 % to + 10 %	53 000
Spain	66 000	0 % to + 15 %	44 400

Professional sources

Prospects for the European avocado market

Towards a winter market under tension over the forthcoming seasons?

The last two seasons have shown that a consumption growth dynamic is now established in the EU, a seemingly solid trend given the growth margins of most of the markets in this part of the Old Continent (see previous article). Nonetheless, we can ask the question, which is not so common in the world of fruits and vegetables, where oversupply is generally the rule: where to find the fuel to feed this momentum?

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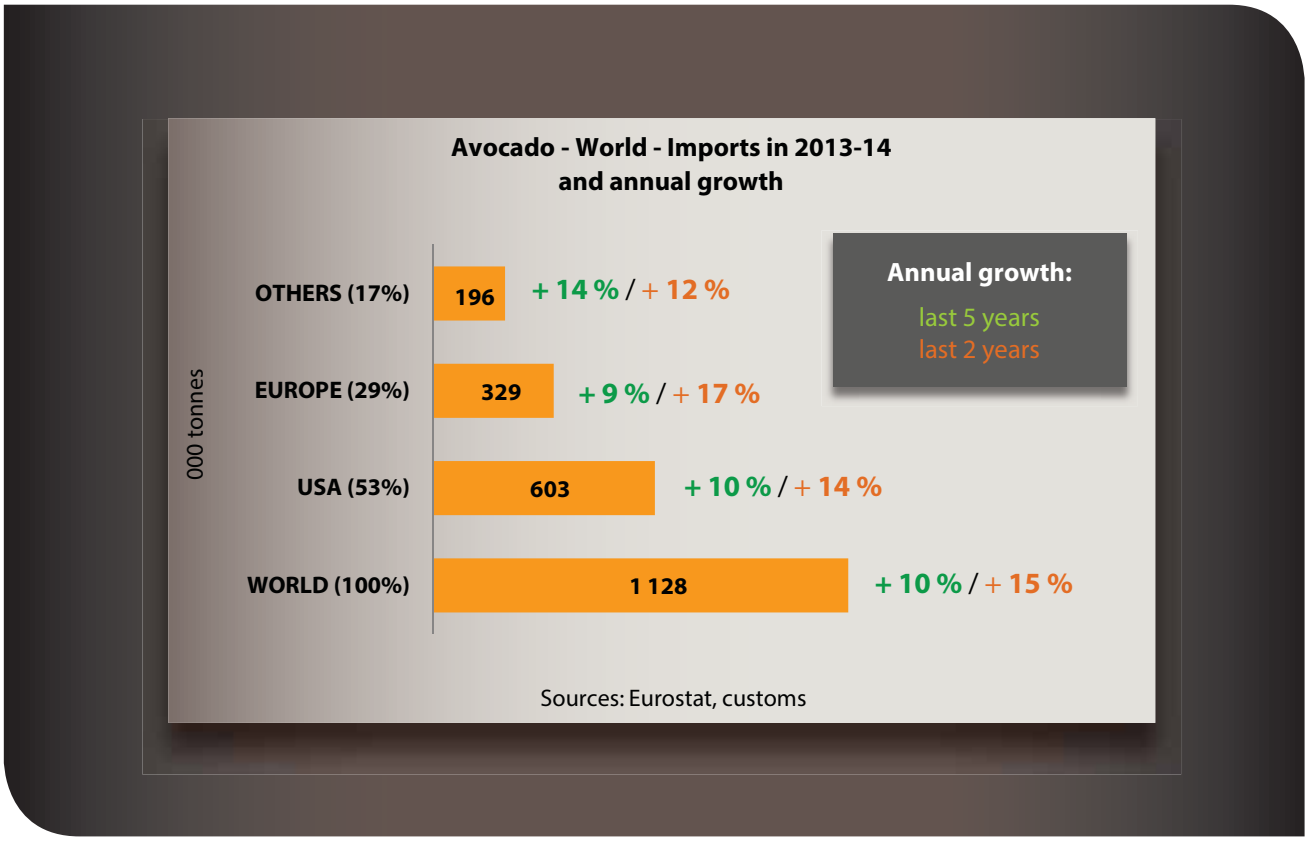
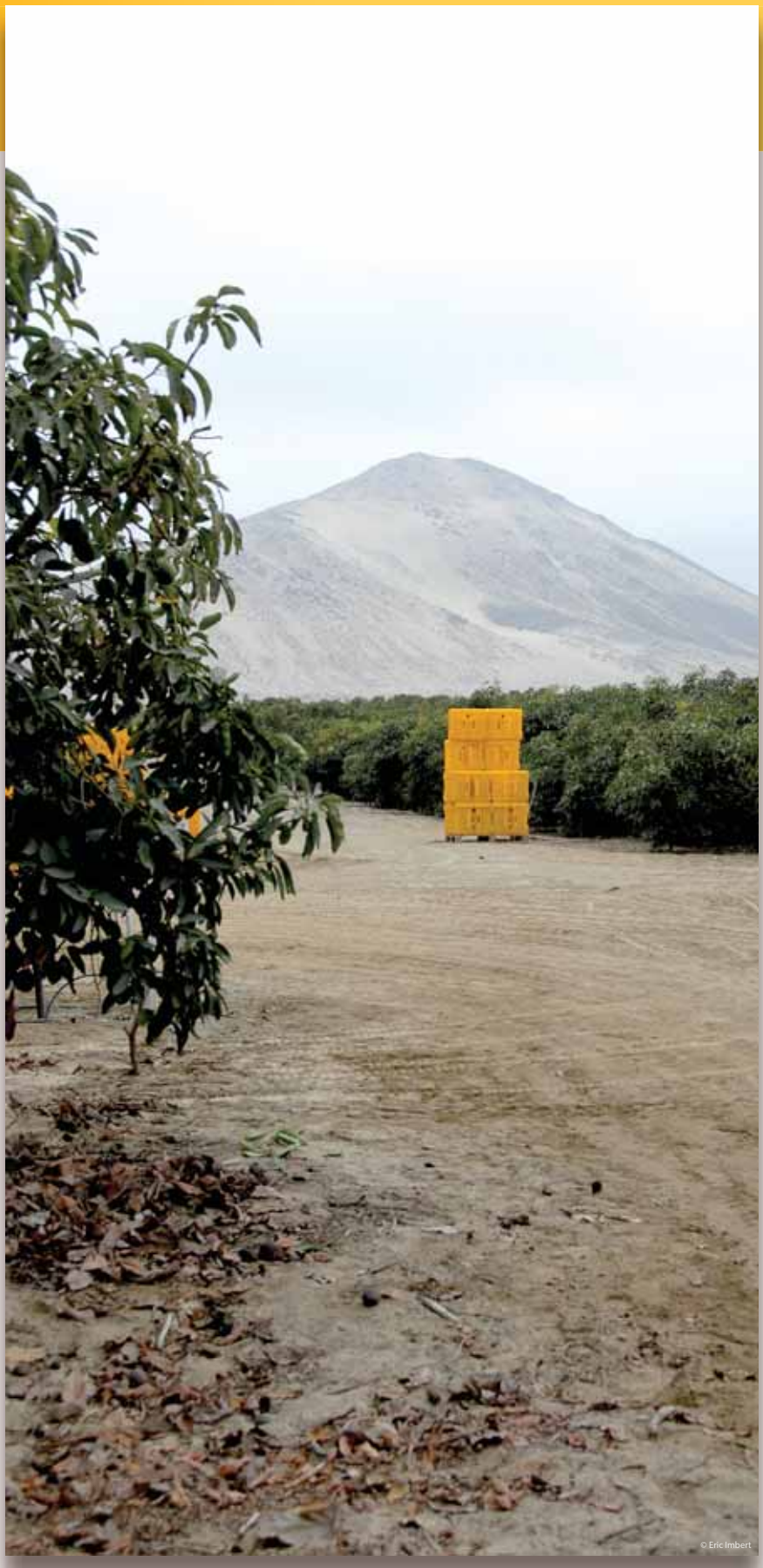
Supply is a sensitive subject, in view of the risks of the upstream segment racing out of control, but approaching it by gauging demand will probably help avoid the even more perilous pitfall of unguided and completely disproportionate growth of production. To ensure the Community market a growth of approximately 10 %, a conservative figure in view of the 17 % of the past two seasons, an additional 30 000 t per year will need to be found during the coming seasons (i.e. approximately 2 000 ha with a high productivity level), of course without counting competition from other world markets (see graphs). Is the planting dynamic in place upstream sufficient to meet this demand?





Peru able to continue its driving role in Europe

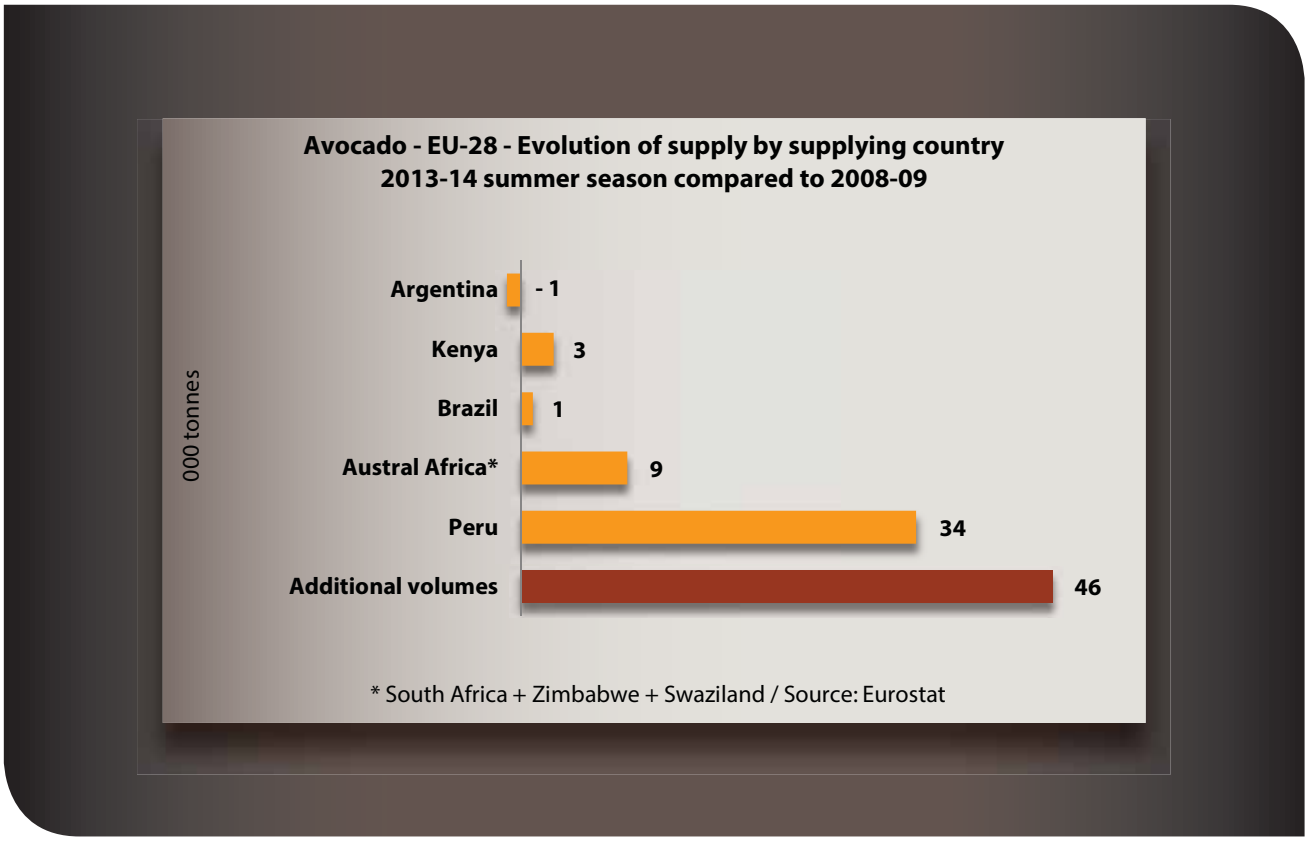
The issue of the supply prospects to the European market during the summer season does not seem to be the most difficult to deal with. Peru, which has been by far the main force behind the summer market for around ten years, should continue to play a driving role in Europe. On the one hand, the period of very steep growth in production recorded since 2013 is only starting to be expressed. Enormous surface areas will continue to enter into production or come into their prime during the forthcoming seasons, with the planting rate having been between 1 000 and 2 000 ha per year since 2009. We must also recall that the average yields in this country are among the highest in the world, thanks to the particularities of the production conditions (see **FruiTrop** no.179).

On the other hand, Peruvian exporters should still need the European market, at least in the medium term, although the United States and even more so Chile, which has just opened up, are more natural markets. The window of opportunity remains relatively tight in the United States. Mexico holds a strong hand, since its production culminates from early October to late May, whereas California remains an essential source, although the recurrent destructive drought is raising questions as to the future.

The season now ending seems to be demonstrating that Peru is able to feed the growth of the European market and at the same time meet demand from the US market, even when it is largely open, as was the case in 2013-14, due to the Californian production shortage. An initial review drawn up based on the professional figures leads us to believe that shipments to the EU should rise by more than 10 000 t in 2014, to approach or exceed 100 000 t, with the United States registering a simultaneous increase of at least 40 000 t, to probably exceed 65 000 t.

Significant expansion of surface areas in South Africa

South Africa, which currently provides between 30 and 35 % of the European summer market supply, is also able to contribute to growth. Production there too is on the rise, as is demonstrated by the record volumes exported to the EU in 2014, which should approach 60 000 t for the first time. The annual planting rate is a long way from equalling the Peruvian rate, but it has picked up, going from approximately 350 ha until 2012 to 500 ha in 2013. Kenya should also be in on the action, although on a smaller scale. The downturn in imports observed the past two seasons is due to the near-total abandonment of Fuerte for export, and switching the focus to Hass; and planting is still slightly up for this variety. Furthermore, we should also count on slightly bigger top-up volumes from outsiders such as Brazil or Tanzania.



Chilean rise not to be overestimated

The case of the winter season seems to be rather more complex. The rise by nearly 50 000 t of the overall supply to the European market recorded in two seasons, of which Chile is the main architect, must not be over-interpreted. Unlike Peru, this increase is not due to production growth, but to a strategic turn imposed by increasingly tough Mexican competition in the United States, which is hard to counter. Hence although Chile's trend of refocusing on Europe seems sustainable, that does not mean volume growth will be seen over the coming years. The persistence of a devastating drought in certain zones of the country (La Ligua and Petorca valleys, Coquimbo region), frosty spells and falling economic profitability have forced the abandonment of many plots. Indeed, the Chilean cultivation area has reportedly shrunk by 7 500 ha over the past few years, and now amounts to approximately 28 000 ha. With these surface areas, the top production level should barely be different from 2013-14, when just over 62 000 t of fruits were shipped to Europe. Hence, while Chile is in a position to remain the leading Hass supplier to the Community market during the winter season, it does not seem able to support its growth, at least in the medium term.

No major change in Spain

What about the Mediterranean suppliers? Surface areas are expanding in Spain, especially for Hass, which now represents the bulk of planting. The mango, less water-intensive than the avocado and hitherto highly profitable, is now deemed risky by certain producers because of the large surface areas planted over the past few seasons. Nonetheless, the avocado cultivation area does not seem to be expanding by more than one hundred hectares per year. Water is now a limiting factor in certain zones, with demand for human consumption having risen steeply with the population growth, especially in the Marbella region. Major infrastructural work should be carried out, in order to irrigate new areas so that avocado growing really takes on a new magnitude in Axarquia. These new large-scale and costly developments are at present only under study.

Modest growth in Israel

The dynamic is livelier in Israel, though without being explosive. According to professional sources, the cultivation area is growing by approximately 200 to 300 ha per year, especially in the centre and north of the coastal zone and in the south of the country. Projections show that production should rise by 30 000 to 50 000 t by 2020, of which 20 000 to 35 000 t for Hass, which currently represents approximately 70 % of planting. Nonetheless, these additional volumes will not be earmarked solely for export. The local market, still under development mainly thanks to a growing population (+ 1.5 million inhabitants during the past decade), should its take its share, especially in green varieties such as Ettinger, Fuerte, Ardith, Arad and Reed.

Context more favourable for growth of the Moroccan cultivation area

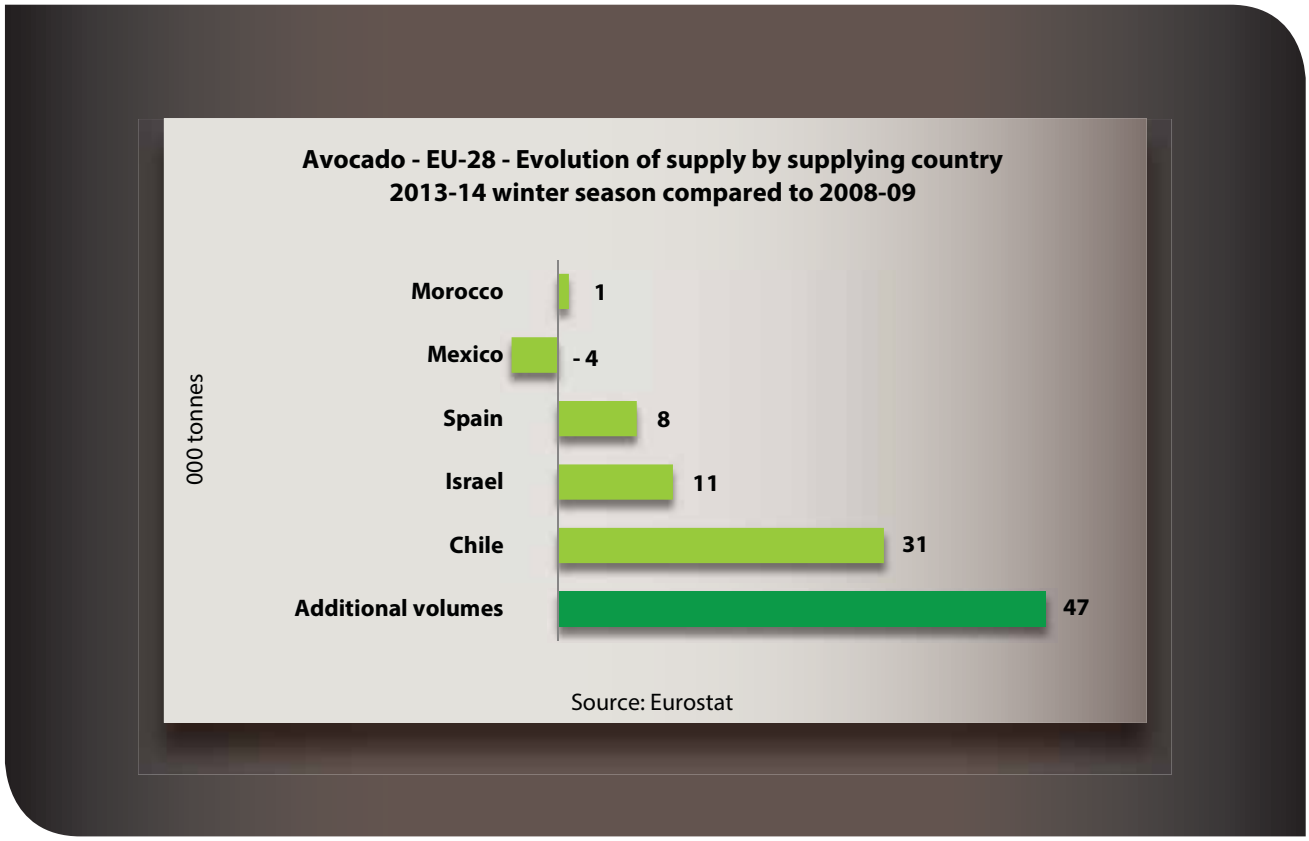
Growth is also continuing in Morocco. The record level of exports, which for the first time exceeded 4 500 t in 2013-14, is tangible proof of this. The planting rate has picked up, reportedly amounting to around 300 to 500 ha/year in recent seasons. The problem of real estate remains very significant (high cost of land, with common law always posing an impediment to regrouping of plots). However, the measures implemented to prevent or mitigate the climatic problems have reassured producers, who had been burnt by the frosts of 2012-13 (subsidy for purchasing wind machines, insurance against climatic catastrophes). In addition, the succession of poor citrus growing seasons has encouraged certain citrus growers to convert their plantations to the avocado. So production growth should be expected, though within the current 5 000 ha Hass cultivation area. Nonetheless, the growing appetite of the local market for the avocado will need to be taken into account, which could take its toll on the exportable volumes (especially for small fruits).

Is the return of Mexico credible?

Could Mexico, in the medium term, once again become one of the supply pillars of the Community market, as was the case in the early 2000s? The question is really being asked, and the hypothesis is serious, although the level of exports to Europe might leave some doubt: they have never exceeded the 10 000-t mark for the past five seasons. Mexican production already represents 30 % of world harvests, with more than 1.3 million tonnes — an industry in the literal sense of the term, since the country's 11 500 producers and 37 packing stations (counting only the APEAM affiliates) generate 100 000 direct jobs and 200 000 indirect jobs. This production will take on massive proportions over the years to come: 50 000 ha have been planted since 2007-08, of which 34 000 ha over the past three years. True, the appetite of the US market should remain immense. Maintaining the 10 % annual growth recorded by this market over recent seasons corresponds to approximately an additional 80 000 t per year, to be shared between the various suppliers! However, the expansion of the Mexican cultivation area represents considerably greater quantities, and in any case exceeds the growth in surface areas approved for export to the United States, which are up on average by 4 500 to 5 000 ha/year. What outlets are there for these additional volumes? The local Mexican market, where demand is highly flexible in relation to price, is able to absorb a large part of them. Nonetheless, a bigger outlet to diversification export markets will be clearly desirable, or even very necessary. In this context, the Community market, which has become just as lucrative in recent seasons as Japan or Canada, will probably become a useful alternative once more.

A future challenger: Colombia

Colombia is also a serious avenue to explore in this volumes race. True, its presence is currently very small (barely more than 1 000 tonnes exported to the EU in 2013-14), but its volumes should be on a whole new level by two or three years' time. According to the latest statistics from *Consejo Nacional del Aguacate*, the Hass cultivation area amounted to 9 300 ha in 2012. The planting rate, already high, has reportedly climbed to more than 1 000 ha per year. Anoth-



Avocado — Main exporting countries orchards — Situation and evolution (estimate)			
	Hass and export varieties cultivation area in 2013-14 (ha)	Annual estimated growth (ha/year)	Hass and export varieties production 2012-2014 average (tonnes)
Mexico	168 000	> 10 000	1 300 000
Chile	27 000	- 1 750***	184 000
California	21 800	- 300***	185 000
Spain	9 400	100	70 000
Colombia	9 300*	> 1 000	35 000*
Israel	7 000	200 - 300	100 000
Morocco	5 000	300 - 500	9 000
New Zealand	4 200	300 - 500	21 000
Winter season total	**251 700**	**> 10 000**	**1 904 000**
Peru	13 000 - 15 000	1 000 - 2 000	150 000
South Africa	14 500 -15 000	500	110 000 - 120 000
Kenya	10 000 - 11 000**	500	na
Brazil	1 000	150	na
Summer season total	**40 250**	**2 650**	**-**

* 2012 / ** FAO / *** average for last 3 years / Professional sources

er important point is that it is no longer small producers who are investing, but mainly big local agro-industrial groups which have resources and good technical mastery of the crop. Many world leaders in avocado production or importers based in the big consumption markets and specialising in the product also seem to be casting longing glances at Colombia.

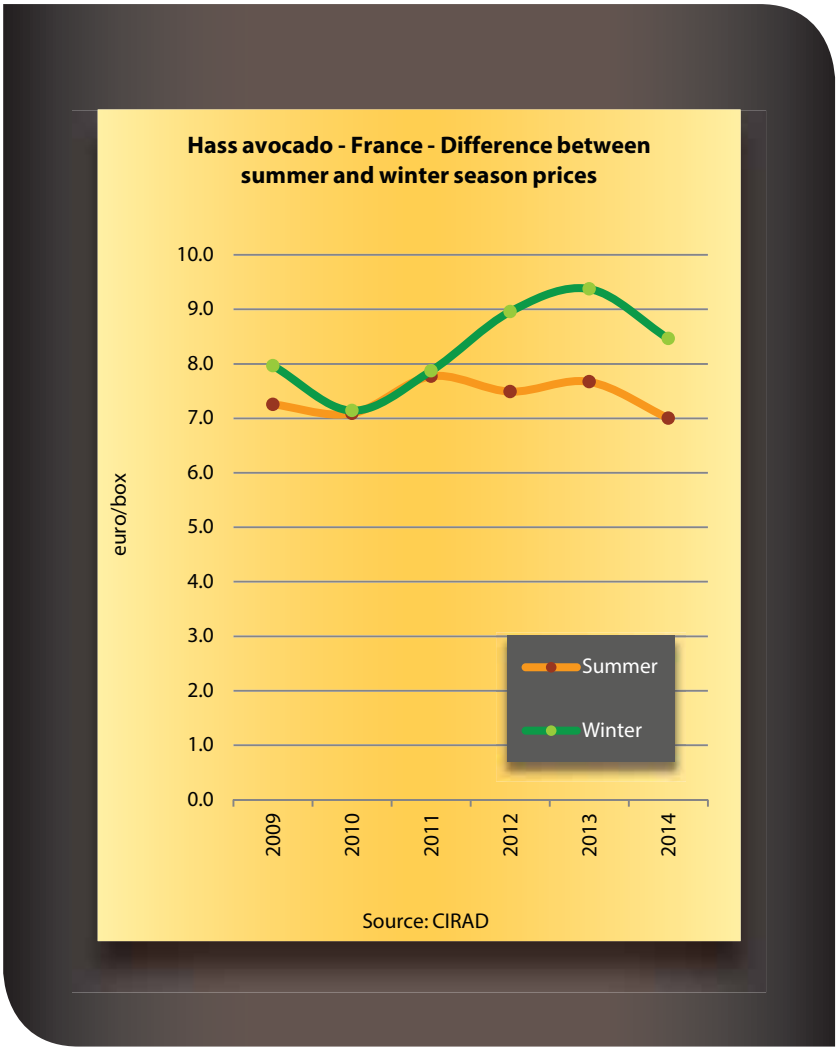
It is true that the country has no shortage of assets in terms of production calendar, logistics (10 to 12 days to serve Europe) and cost prices (see **FruiTrop** no.214). So the Colombian giant is not sleeping: it is awakening! Four packing stations are currently in service: two in the Medellin region (Hass Colombia in El Retiro and Westfalia in Guarne), one in Valle del Cauca (Frutales Las Lajas) and one in Quindio (Wolf & Wolf between Armenia and Pereira). True, a large part of its volumes should eventually be sent to the US market, 5 days away by sea. Its borders could open up in around 2016 (opening protocol entered into with APHIS). However, the European market should remain a choice outlet for Colombian exports.

Tension on the winter market, at least for the next few seasons

The 2014-15 winter season should be emblematic of the tension which could prevail during the forthcoming winter seasons (see forecasts article). Yet things could change in the medium term. On the one hand, a massive growth trend is in progress in certain countries (Colombia, Mexico), which should produce its effects by the end of the decade. On the other hand, the supply calendars of certain summer suppliers, such as Peru, are increasingly flexible, and tend to overlap with the winter season supplies (weekly Peruvian imports to Europe in excess of 800 000 boxes throughout September). For all these reasons, the growth margin due to growth of consumption during the winter season in Europe must not be overestimated.

Beware the summer season!

The findings are different regarding the summer season, as is shown by the Hass average price differential, now constantly widening between these two periods (see graph). Caution must be the watchword. The season which has just finished shows that oversupply is still a big risk, and that brings painful consequences: two months of incoming shipments approximately 10 % above the market's absorption capacity caused a three-month crisis, during which prices were between 5.25 and 6.25 euros/box for the good sizes. The supply expected for the coming years seems not only able to support the market growth, but to be of such a level that other episodes of this type are highly probable. Hence the period from June/July seems eminently perilous, given the Peruvian volumes set to emerge between mid-May and late June. So this is another opportunity to reiterate that the communication efforts to boost consumption in the Old Continent must be stepped up.



It may not be irrelevant to highlight once more the example of the US market: the growth in consumption, which is now on average in excess of 2.5 kg/capita/year, is largely due to the continuous promotion efforts led by the Hass Avocado Board (HAB) for around fifteen years, with a budget in excess of 40 million USD for 2013 alone. This project is still up in the air in Europe, but it may have every chance of rapidly coming to fruition, if we want to finish on a note more tinged with irony than optimism! Europe may be 15 years behind the United States (which is more or less confirmed in terms of development of the ready-to-eat segment). Paradoxically, this could be good news, since the large-scale promotion efforts orchestrated by HAB were implemented back in 2002 on the other side of the Atlantic! ■

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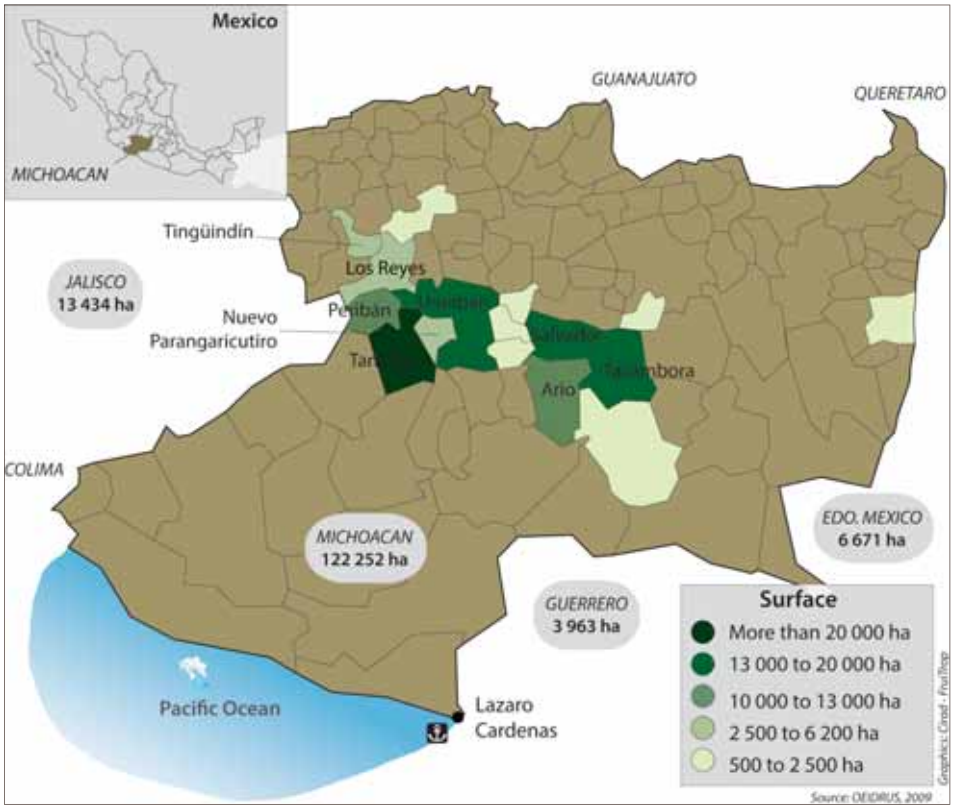
Producer country file

Mexican avocado

The historic leader in terms of production, Mexico has managed to develop within around twenty years the world's number one avocado export industry, feeding the strongly growing US market, which has become accessible. Mexico now controls more than half of world trade, thanks in particular to the immense Michoacán cultivation area. The activity remains highly profitable, but the industry is seeking to diversify its outlets ahead of the forthcoming boom in production.

Location

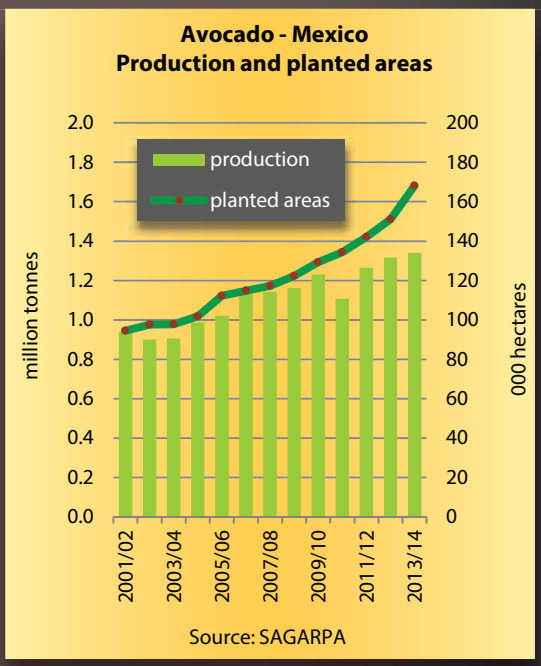
The Mexican cultivation area, the number one in the world with approximately 150 000 ha, is mainly packed into the south-west of the country. Michoacán State alone encompasses three quarters of the country's surface areas, with six central districts providing most of the production (Tancitaro, Tacambaro, Uruapan, Salvador Escalante, Periban and Ario de Rosales). This mountainous region offers the advantage of producing throughout most of the year, thanks to plantations located at an altitude varying from 1 600 to 2 400 m. In addition, generous rainfall from June to September makes it possible to cover half of the annual water requirements. The orchards are medium-sized (5 to 10 ha), and comprise mainly aged trees, whose productivity fluctuates between 9 and 11 t/ha. The neighbouring Jalisco State, where surface areas are growing rapidly, comes in second place with nearly 7 % of surface areas. The cultivation stock is young, and the more high-tech plantations produce approximately 15 t/ha. The nearby States of Nayarit, Mexico City, Morelos and Guerrero make up the bulk of the rest of the cultivation area.



Mexican avocado

Production

The crop started to take on a new scope in the 1970s, with the launch of a national policy of fruit growing development, using the improved varieties introduced in the 1960s, such as Hass. Production then embarked on a regular upward trend, to supply a local market where the fruit is a staple of the diet. The growth picked up pace in the 1990s with an export activity aimed mainly at Europe coming to the fore. A turning point came from 1997, with the gradual lifting of the sanitary barriers restricting access to the US market. The profitability of the crop is rising despite the relatively high level of production costs, and "green gold" surface areas are expanding at a very high rate in Michoacán, the only region authorised to export to the United States, as it is free from quarantine diseases and parasites. Production, which exceeded the one million-tonne mark in 2005-06, has been around 1.3 million tonnes in recent seasons. The more than 30 000 ha planted in addition since the start of the decade promise a very high tempo of production growth over the coming years.



Varieties and production calendar

Introduced from California in the 1960s, Hass is by far the main variety present in Mexico. We can also find some plantations of native cultivars (Sinaloa, Perfecto, etc.), or of Fuerte and Nabal. The special cultivation conditions for Hass in Mexico enable several flowering periods in a year. Each one bears fruits with different characteristics. These multiple flowering periods and the diversity of the planting altitudes ensure production throughout the year, with a slack period from May to July.

Observations:

- **Flor loca:** small size, as they are the first fruits harvested, with a rounded shape and smooth skin. The favourite in Mexico.
- **Aventajada:** pear-shaped, granular fruits.
- **Normal:** main flowering, fruits similar to Aventajada.
- **Marceña:** late flowering, fruits variable in appearance, small size, pear-shaped with thick skin. But good taste quality, since their oil content is high thanks to high sun exposure.

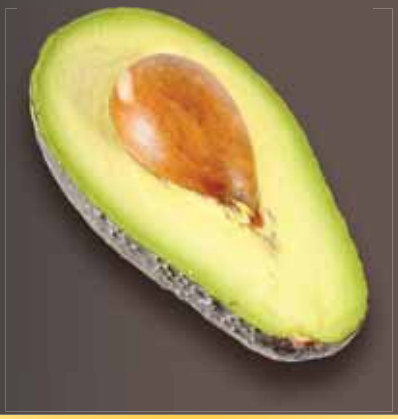
Avocado - Mexico - Production calendar

J	A	S	O	N	D	J	F	M	A	M	J
	Flor loca										
		Aventajada									
				Normal							
								Marceña			

Mexican avocado

Exports

The export activity really got started in the 1990s, to support the growth of the young European market. Yet it is thanks to sales in the United States that the Mexican export industry took on the scale at which it is known today. Firstly, the gradual lifting of the sanitary protection measures governing access to this market enabled exporters from Michoacán, still the only producer region approved today, to sell in an increasing number of States (19 States authorised in 1997, with complete opening since 2007, under the ALENA agreements). Secondly, the consumption boosting system implemented jointly by the various suppliers present on this market from 2002 under the aegis of the HAB, has led to a genuine boom in demand. Hence exports have soared from approximately 50 000 t per season in the late 1990s to more than 650 000 t the past two seasons. Despite the growth prospects in the United States remaining considerable, Mexican exporters are seeking to diversify their outlets, in view of the expected growth tempo over the next few years. Shipments to the nearby markets (El Salvador, Costa Rica, etc.) and above all to Canada and Japan, deemed safer than the European market, have grown considerably. APEAM coordinates shipments to the United States, and gathers a budget for conducting promotions. 80 % of volumes are exported by six or seven companies (mostly US and Chilean owned).



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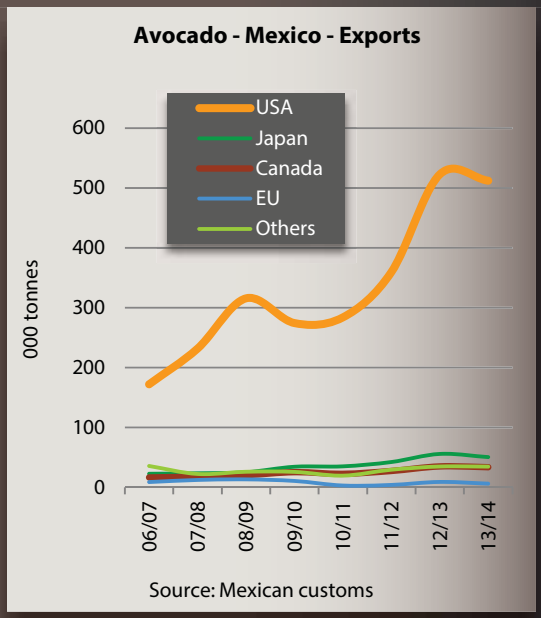
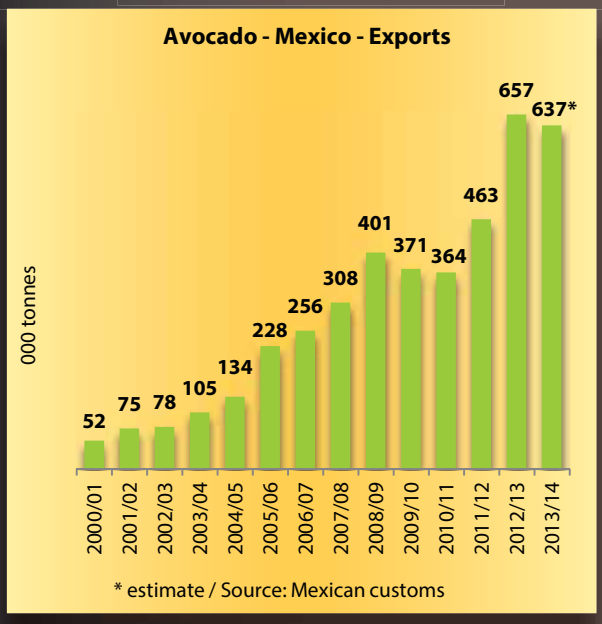
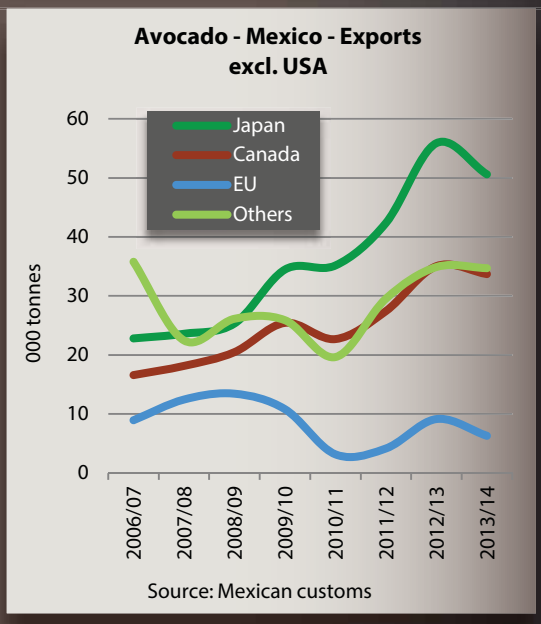




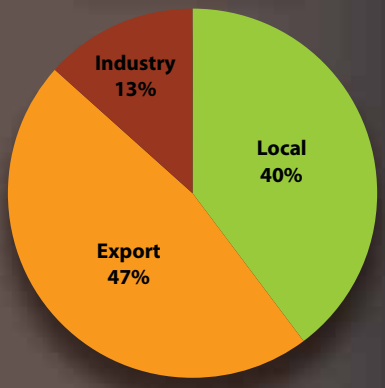


Mexican avocado

Outlets

The growth in international demand and rise in prices which followed have had profound repercussions on the breakdown of production by outlet. The local market, where the avocado is among the staple foods, is no longer in first place. Although the volumes consumed locally are still very large, they have tended to wane in recent years because of the product becoming more expensive at the retail stage. Exports are now the leading outlet, and have absorbed approximately half of the harvest in recent years, as opposed to barely 15 % ten years previously. The volumes aimed at industry have grown considerably since the late 1990s, and represent approximately 15 % of production. Mexico is the world leader on this segment, thanks to several factories working for the pharmaceutical industry (oil) or food industry (guacamole, frozen avocado).

Avocado - Mexico
Breakdown by outlet



Source: SAGARPA

Avocado - Mexico - Production cost in 2013

	Low-tech farms	High-tech farms
Cost	3 390 USD/ha	4 520 USD/t
Yield	8-10 t/ha	14-16 t/ha

Source: USDA

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Logistics

The containers are loaded at the packing station. Those earmarked for the EU are shipped by lorry from the production zone to Altamira, the port of Tamaulipas State, providing access to the Gulf of Mexico (East Coast). The journey of more than 900 km takes approximately 24 hours. The fruits earmarked for Japan set out from the port of Lazaro Cardenas, located on the west coast, approximately 250 km from the production zone. The US market is served by means of road logistics. The vast majority of these volumes pass through Texas (approximately 1 300 km to the border, i.e. 20 hours). The rest passes via Arizona. Imports to this country are duty free.

Avocado - Mexico - Sea freight

Markets	Main shipping lines		Transit time	Observations
	Port of departure	Port of arrival		
EU	Altamira	Le Havre Antwerp	19 days 21 days 25 days	CMA/CGM Hapag Lloyd, CSAV Maersk
	Lazaro-Cardenas	Rotterdam	25 days	Maersk
Japan	Lazaro-Cardenas	Yokohama	17-19 days	APL, Hapag Lloyd

Producer country file

Israeli avocado

A pioneering and dominant source in the Mediterranean, Israel can be classified among the leading 10 to 12 producer countries, with volumes up by approximately 100 000 t, still largely comprising green varieties. Focused on export, this country provides a significant proportion of the Community market supply during the winter season, where it has made a big contribution to raising the profile of the product. The cultivation area is still seeing slight expansion, in particular for Hass.

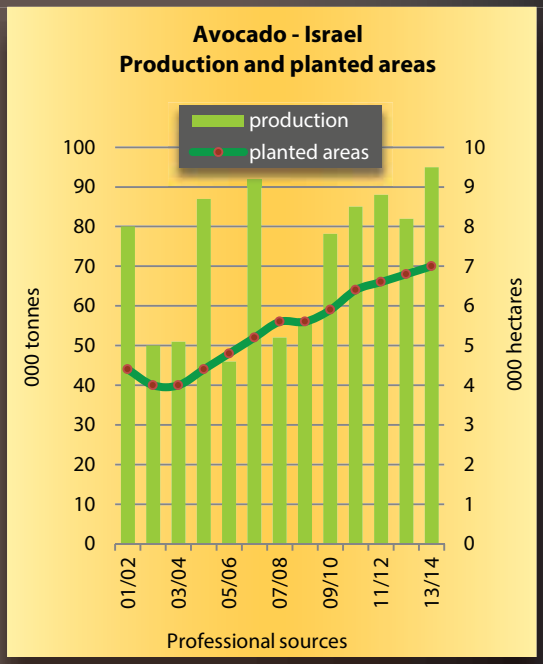
Location

The bulk of the 7 000 ha Israeli cultivation area is located on the coastal strip approximately 25 km wide between Tel Aviv and the Lebanese border. There are two distinct big centres separated by Mount Carmel. In the south, the Sharon Plain, which extends from the north of Tel Aviv to Mount Carmel, packs in approximately one third of the cultivation area. The north covers a similar surface area, in the zone renowned for the quality of its produce which extends from the City of Acre to the Lebanese border. The rest of the cultivation area is mainly located in the south of the country (approximately 16 % of surface areas, especially in the coastal zone located between Ashdod and Tel Aviv), in the Upper Jordan Valley and Upper Galilee, which both encompass approximately 9 % of the surface areas. The dry climate helps limit sanitary problems (no Phytophthora). Hence rational agriculture is very widespread and the average yields are high. However, the spread of the pest Ambrosia since the end of the last decade is a challenge taken very seriously by producers. The availability, quality and cost of irrigation water, still highly problematic in the early 2000s, have seen considerable improvement in most zones, thanks to massive use of recycling, and to a lesser degree to desalination. Hamsin, the hot wind which sometimes blows between April and June, can cause steep falls in production. The Volcani Centre provides significant research support.

Israeli avocado

Production

The crop expanded rapidly from the late 1950s, with the plantations culminating at 11 000 ha during the 1980s. Thereafter, surface areas gradually halved, after a succession of difficult seasons and the implementation of a less favourable economic policy for the primary sector. From covering just 4 000 ha in the early 2000s, the cultivation area has been reinvigorated, and now amounts to approximately 7 000 ha. It produced nearly 100 000 t in 2013-14. The growth in surface areas, which is continuing at a rate of approximately 200 to 300 ha/year, and the rising yields, should enable production to continue to climb (target 130 000 t to 150 000 t for 2020). Nearly three quarters of production come from kibbutzes or Moshavs, co-operative agricultural organisations. There are a good dozen packing stations established in the country. The two main ones alone, Granot and Milopri, pack approximately one half of production.



Varieties and production calendar

The season is relatively long, thanks to a wide varietal range, which has greatly evolved. The emphasis is currently on Hass, which represents approximately 35 to 40 % of total surface areas and 70 % of new plantations. As for green varieties, Pinkerton and Ettinger remain the two predominant varieties (approximately 15 to 20 % of total surface areas each). Fuerte is running out of steam, and represents less than 10 % of the cultivation stock. The rest of the range comprises Reed, Ardith, Arad, Nabal and Fino.

© Guy Bréhinier

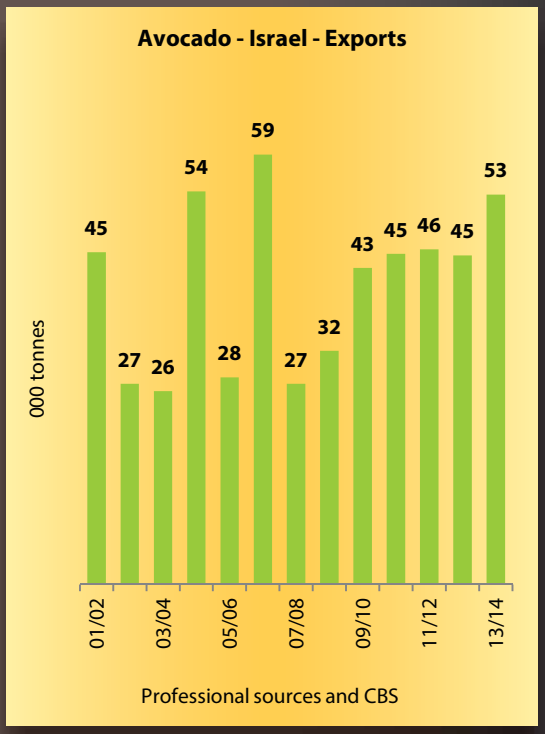
Avocado - Israel - Production calendar

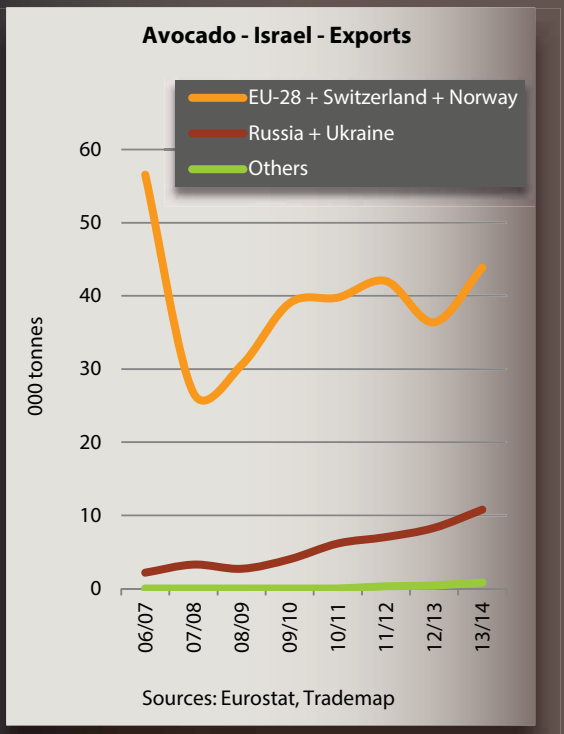
O	N	D	J	F	M	A	M	J	J	A	S
Ettinger											
	Fuerte										
	Hass										
		Pinkerton									
			Nabal								
				Ardith							
					Reed						

Israeli avocado

Exports

Exports, which follow a distinct production cycle, are very slightly down since the end of the recession period of the 1980s. Volumes are currently fluctuating between 45 000 and 53 000 t, in a season with normal climate conditions. Exporters are following a diversification strategy based on shipments targeted according to the respective expectations of each market, in size and variety. Approximately 80 % of volumes are still aimed at the European Union, where Israel has made a big contribution to the familiarity and growth in avocado consumption. France is still the main destination, receiving approximately 40 % of exports dedicated to the EU. The British, Benelux, Scandinavian and German markets, where the presence of the Israeli avocado has grown over recent seasons, follow in the ranking. Eastern European countries, whether Intra or Extra-Community, have become important destinations for green varieties, whose outlet is increasingly restricted in Western Europe. Hence, Russia now absorbs nearly 20 % of total exports. Liberalised since the end of the State monopoly held by Agrexco until 1993, exports are now in the hands of around a dozen private companies. The two main ones alone, Mehadrin and Galilee, represent two thirds of volumes.





Israeli avocado

Outlets

The industry is export focused. However, the local market plays a key role, since it is proving highly lucrative, even for merchandise lacking quality standards sufficient for export. Israel's some 7.9 million inhabitants are currently absorbing increasing volumes, representing nearly half of the harvest. Hence consumption per capita is among the highest in the world, fluctuating between 5.5 and 6 kg/year, depending on production level and price. The big fruits (sizes 10 to 14) are the most prized, especially in the Ettinger variety. Hence the volumes available for processing are very limited.

Avocado - Israel
Breakdown by outlet

Professional sources

Ardith

Nabal

© Guy Blehinier

Fuerte

Logistics

The merchandise loaded in reefer containers are routed by refrigerated lorries to the ports of Ashdod or Haifa. They are then shipped by sea thanks to the general purpose sea lines serving the Mediterranean. France (port of Fos-sur-Mer) is reached in 5 days, and the United Kingdom (port of Felixstowe) in 10 days. France remains a major entry point, through which a significant proportion of merchandise aimed at other Union countries passes.

Avocado - Israel - Sea freight

Market	Main shipping lines		Transit time	Observations
	Port of departure	Port of arrival		
EU	Ashdod Haifa	Fos sur Mer	5 days	Non-specialized lines
		Felixstowe	10 days	

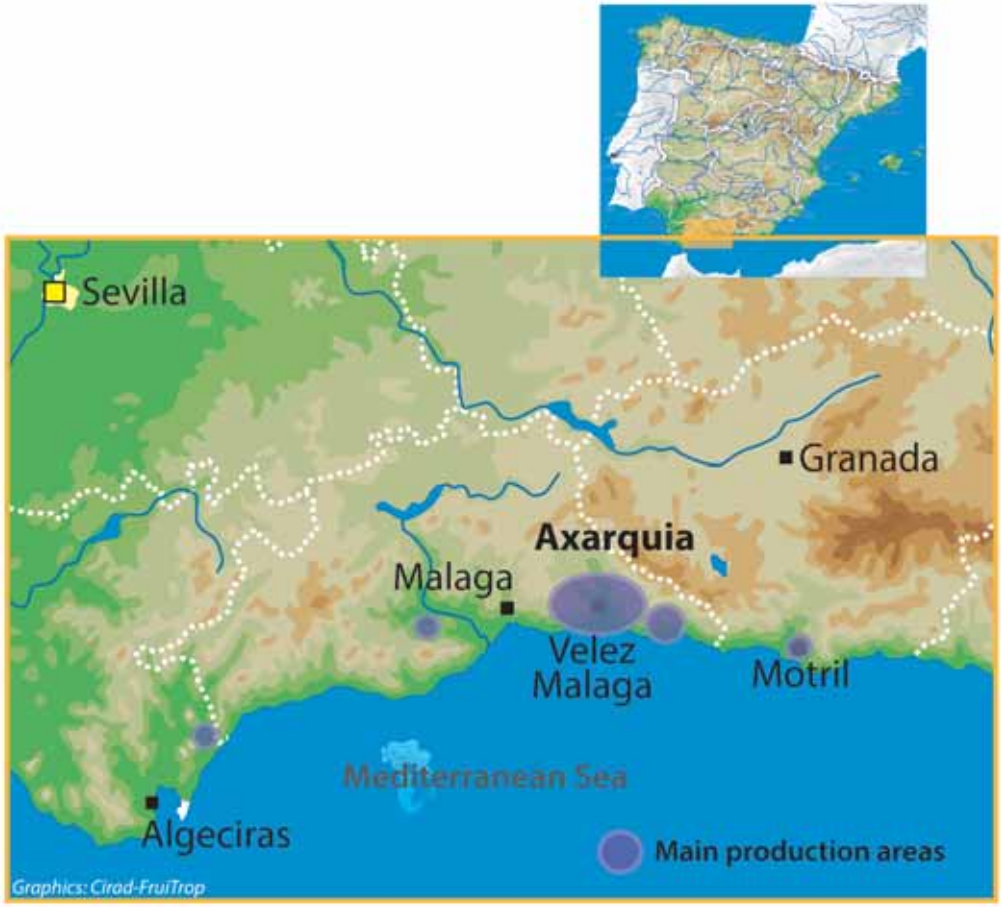
Producer country file

Spanish avocado

The Spanish avocado industry, created in the early 1970s, is now among the world's leading exporters, with shipments of approximately 40 000 to 50 000 t/ year. Spain is the only country in the EU to produce significant volumes on the European continent, thanks to the special climatic conditions of the Andalusian coast. This source is one of the major players on the Community market, where it focuses its shipments given the comparative advantages at its disposal in terms of logistics and customs.

Location

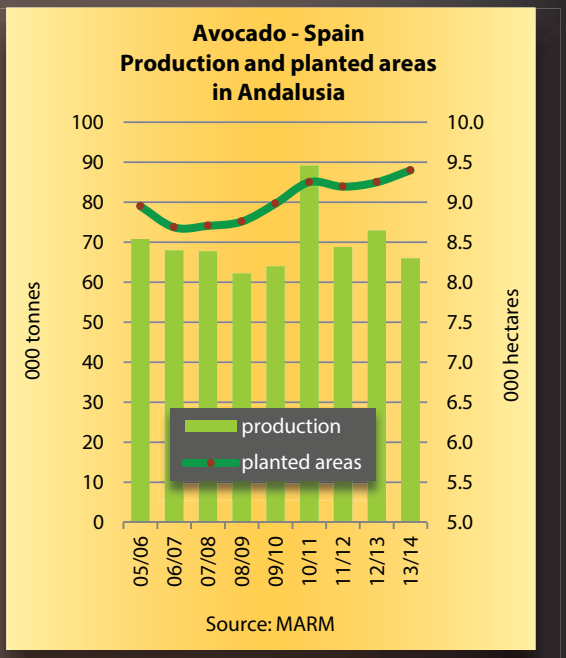
The cultivation area covers approximately 10 000 ha, with more than 90 % is packed into the Andalusian coast, between the sea and the first foothills of the Sierra Nevada (Costa Tropical). This coastal strip approximately 80 km long and ten kilometres wide, located between the west of Malaga and Motril, enjoys a climate of its own. The winters there are mild, and the low rainfall is compensated for by the generally decent availability of quality water, mainly supplied by the Sierra Nevada dams. Sanitary problems are limited to fungal root diseases and a mite. Under demographic and tourism pressure, the zones west of Malaga are tending to stabilise or shrink, while plantations are expanding slightly in Axarquia and, to a lesser degree in the Grenada region, more difficult to work. Pioneering orchards, covering around one hundred hectares, were recently established in the cooler region of Alicante. The rest of the plantations for the most part can be found in the Canary Islands, on La Palma and Tenerife.



Spanish avocado

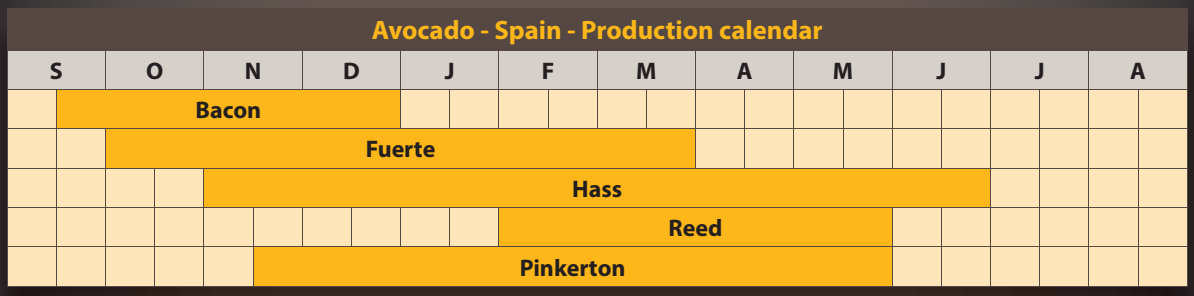
Production

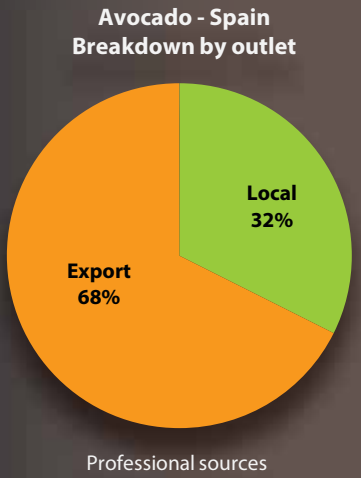
The introduction of the crop to the Canary Islands goes back a long way (16th Century), though only recently to the Peninsula. The first industrial plantations were set up in the early 1970s. The surface areas, amounting to barely 1 000 ha in the late 1970s, boomed during the 1980s (water supply infrastructures developing, and fall in profitability of open-air market gardening, under pressure from the emergence of the Almeria zone). Andalusian production, which has fluctuated between 65 000 and 75 000 t in recent seasons, should grow slightly in the medium term. Avocado surface areas are growing by approximately one hundred hectares per year, with competition from the mango, which has a lower water consumption and has been hitherto highly profitable, slightly less strong than in the past. Approximately 40 % of farms are traditional, amounting to less than 5 ha. These facilities coexist with modern industrial plantations.



Varieties and production calendar

The Hass variety makes up more than three quarters of production, and is on a growth trend. The main smooth varieties are Fuerte and Bacon, with the latter also acting as a pollinator and wind break. The range is rounded off by some Lamb Hass plantations in the cooler region of Alicante, with Reed and Maluma planted recently.





Outlets

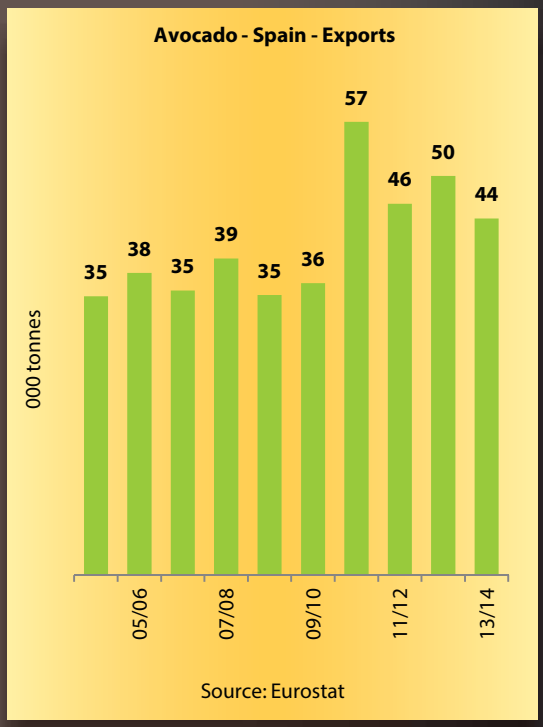
Priority is given to shipments to other EU countries, given the logistical advantages at Spain's disposal.

However, the local market, paradoxically practically non-existent in the early 1990s, is now growing. Consumption remains among the lowest in producer countries, but has been rising in recent years. There are some processing units (oil, pulp), including a recent one of substantial size.

Spanish avocado

Exports

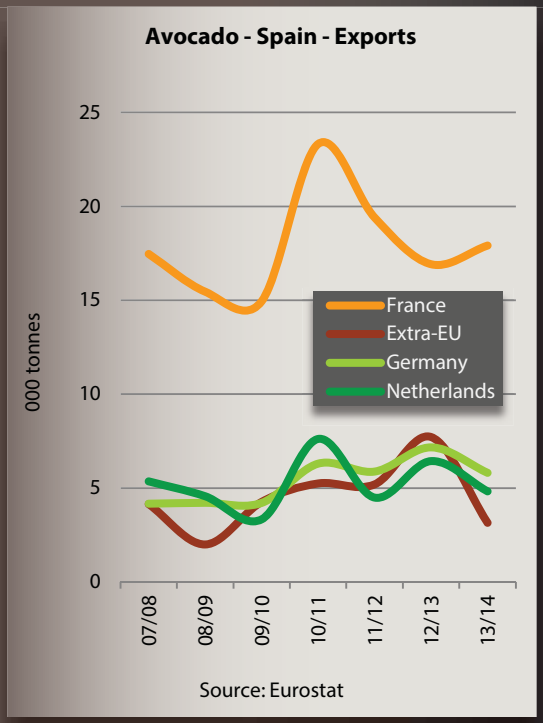
Exports exceeded 10 000 t during the 1980s, and grew steeply between the beginning and end of the 1990s. In recent seasons, volumes have been between 40 000 and 50 000 t. Spanish exporters very much target the European Union, which absorbs 80 % of volumes. Road transport is fast and economic, in particular to serve France, the main EU consumer country. In addition, this source has the advantages of the Common Market, especially in terms of customs, unlike all of its competitors. France remains the main market for the Spanish avocado, absorbing approximately 50 % of volumes. Germany has become Spain's number two customer in recent years, ahead of the Netherlands and the United Kingdom, which is losing ground. Shipments to the East of the Community are growing, though they remain limited. Volumes shipped outside of the EU are on a significant growth trend. The bulk of shipments is aimed at Morocco (entry-level small fruits). Some volumes are also exported to distant markets (South Africa). Most of the volumes are sold by a cooperative, and around just ten traders, some of which are also producers. There is no interprofessional association.




© Carolina Dawson

Logistics

Logistics are exclusively by road for serving the EU markets. The vast majority of volumes pass via the logistics hub at Perpignan's Saint-Charles market, which is reached in around 16 hours. The United Kingdom and Scandinavia receive deliveries within 72 hours. Shipments to distant markets are made by air, via Malaga airport.



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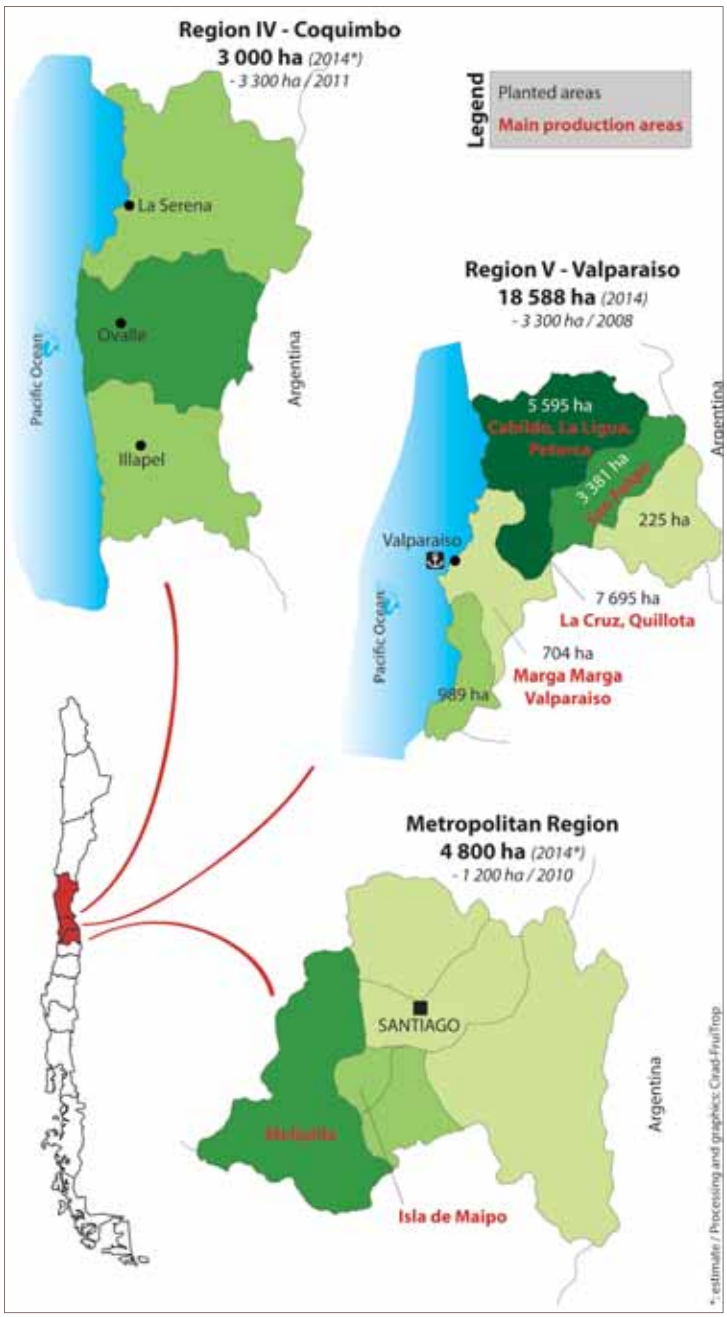
Producer country file

Chilean avocado



From 1990 to 2000, Chilean professionals managed to develop the world's second biggest export industry, based on the growing appetite of US consumers. However, the rising Mexican competition on this market, in a more difficult climate context at local level, has forced them to drastically reduce the rate of planting, and develop a new economic model. The internal market has become a major outlet, while exports have refocused on the EU.

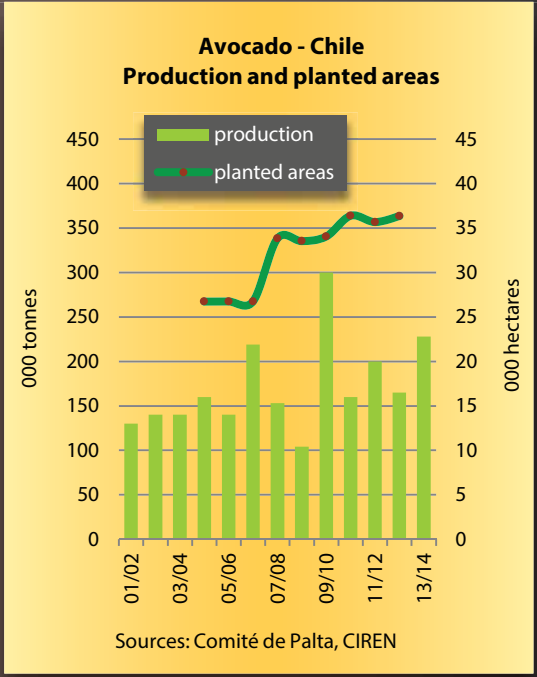
Location

Chile possesses assets for fruit growing thanks to the natural sanitary protection provided by the sea, the Andes mountain belt and the Atacama Desert. The cultivation area, which is packed into the centre of the country, has reportedly shrunk very considerably in recent years, now amounting to approximately 26 000 ha according to professional estimates. Region V (Valparaiso) encompasses two thirds of its surface areas, divided between two main centres. The orchards of the Aconcagua valley, the traditional zone located in the heart of the region (cities of La Cruz, Quillota and San Felipe), have been extended by harnessing the foothills of the mountain belt. The orchards in the valleys of the Petorca River and La Ligua rivers, located in the north, have grown more recently, but are on a downward trend. The rest of the cultivation area is primarily found in the neighbouring regions. The surface areas are tending to shrink slightly in the Metropolitan region, into which the south-west's cultivation zones are packed (Melipilla/Isla de Maipo), due to their better water reserves. There has been a steeper fall in region IV, especially in the main production centre (river valleys located upstream and downstream of Ovalle).

Chilean avocado

Production

The promotion effort led jointly in the United States by Comité de Palta and HAB enabled the Chilean industry to take off in the mid-90s, by developing an export activity aimed at feeding the growing appetite of North American consumers. Production doubled in less than ten years, culminating at more than 200 000 t in 2006-07. Thereafter, the horizon clouded over. Frosts have regularly struck certain pioneering plantations set up in highly frost-exposed plain zones. In addition, a drought, which is only getting worse, has set in from the north of region IV to the south of region V (particularly heavily impacting on La Ligua and Petorca valleys, and in the Ovalle region). Furthermore, the profitability has deteriorated because of Mexican competition coming to the fore in the United States and a less favourable exchange rate. The most low-tech producers are now in a precarious economic situation. The industry is seeking to recover a better level of competitiveness, by taking a strategic turn toward Europe and other diversification markets, and by developing technical innovations, in particular to boost an often low average yield (low soil porosity). The current production potential is said to be around 250 000 t in a normal year.



Varieties and production calendar


© Régis Domergue

Forced by demand from the North American market, Chilean producers have converted to Hass, which now represents the bulk of their production. The rest of the harvest comprises a wide varietal range. The many Chilean varieties, predominant in the 1970s, are now highly marginalised, and aimed at the local market. The main one, Negra de La Cruz, now represents just 2.5 % of surface areas. The proportion of Fuerte has decreased steeply. Other varieties are present, such as Edranol, Bacon or Zutano, but they are primarily used as Hass pollinators.

The production calendar covers a long period, thanks to the heterogeneity of plantation distribution in terms of latitude and distance from the sea. Most of the volumes are produced between September and March.

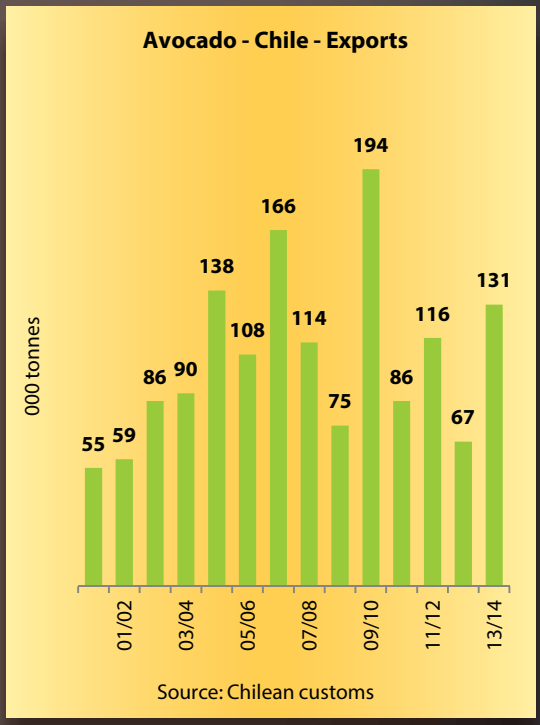
Avocado - Chile - Production calendar

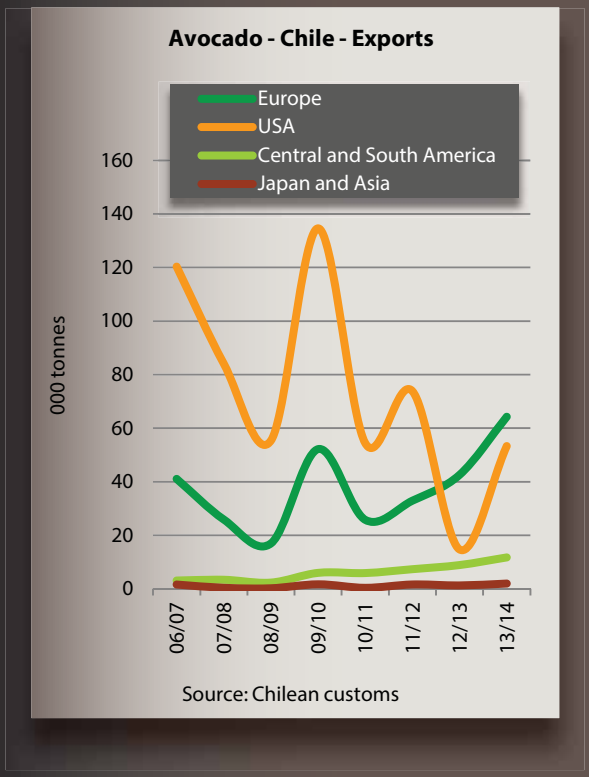
J	F	M	A	M	J	J	A	S	O	N	D
Chilenas											
Negra de la Cruz											
Fuerte											
Hass											
Esther											

Chilean avocado

Exports

The explosive growth of exports from the late 1990s is exemplary. It should in large part be credited to Comité de Palta, the organisation for local and international promotion of the industry, funded by professionals. This structure developed an original collaboration strategy with the California Avocado Commission (CAC), in order to jointly tap into the potential of the US market (harnessing the complementarities of the production calendars, supply regulation and promotions). Hence total exports went from less than 20 000 t in 1997-98 to nearly 200 000 t in 2009-10. However, the lightning rise of the Mexican competition in the United States has changed things around. The EU, initially a diversification market, as it was more difficult to operate on (controlled atmosphere required to extend the shelf life to 45 days), has become the number one destination for the Chilean avocado since the 2012-13 season. Exports to the neighbouring markets are also tending to see considerable growth, particularly to Argentina, while the Brazilian borders have just opened up. Asia (and Japan in particular) is absorbing increasing quantities, though they still remain limited.





Chilean avocado

Outlets

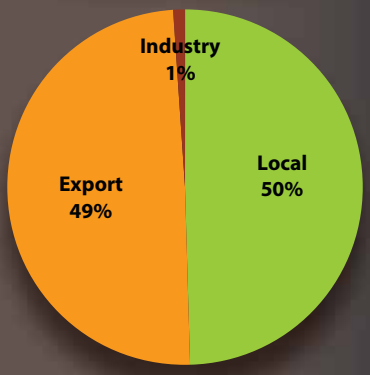
The export sector, the original outlet of Chilean production, continues to absorb a large proportion of volumes, fluctuating from 60 to 65 % of total volumes in a normal production year. However, the local market is a fallback value increasingly prized by producers, with its market share even climbing to nearly 60 % during the "little" 2012-13 season. The promotion efforts made by Comité de Palta have helped raise consumption to more than 5 kg/capita. Furthermore, the local market has the advantage of being easy to operate on, and secure in terms of payment for producers. The volumes earmarked for processing are marginal.

Avocado - Chile - Production cost in 2012

USD per hectare	Metropolitan and Valparaiso region	
	Plains	Hills
Labour	2 146	2 381
Inputs	2 145	3 424
Others	536	726
Total	**4 828**	**6 531**

Source: USDA

Avocado - Chile
Breakdown by outlet



Professional sources

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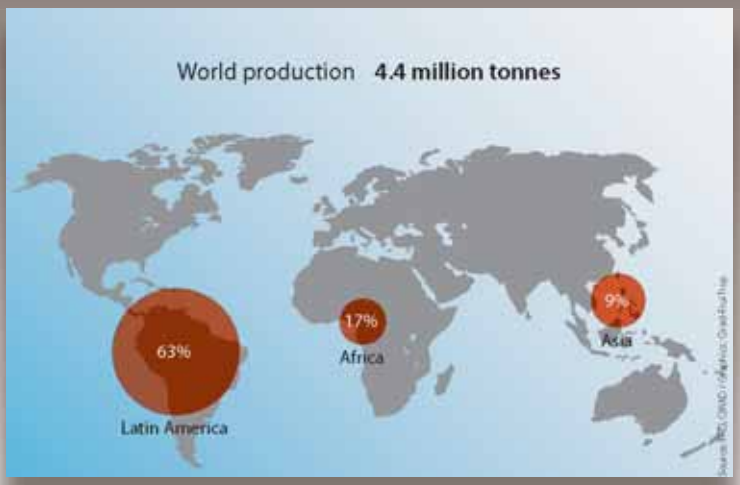
Logistics

Most of the merchandise is shipped by road to the port of Valparaiso. It is located near the production zones, and has a USDA inspection station. In the United States, Chilean exporters enjoy access to the efficient Californian distribution network. Controlled atmospheres are systematically applied for shipments to Japan, and for approximately two thirds of shipments to the EU.

Avocado - Chile - Sea freight

Market	Main shipping lines		Transit time	Observations
	Port of departure	Port of arrival		
USA	Valparaiso	West coast: Los Angeles, Long Beach, San Diego	12-17 days	Makes up the bulk of American imports from Chile
		Florida: Miami	10-12 days	
		East coast: New York, Philadelphia	15-22 days	
Japan	Valparaiso	Tokyo	25 days	
EU	Valparaiso	Dunkirk Rotterdam Algeciras Felixstowe	21 days 20 days 17 days 22 days	

AVOCADO — Production (2013-14)



Avocado — The 10 leading producer countries	
tonnes	**2013-14 or FAO 2012**
Mexico	1 340 000
Indonesia	294 200
Dominican Republic	290 000
Chile	228 000
Colombia	219 000
Peru	215 000
Kenya	186 000
United States	169 000
Brazil	159 000
Rwanda	145 000

Sources: FAO, USDA, professionals

AVOCADO — Exports (2013-14)

Avocado — The 6 leading exporting countries	
tonnes	**2013-14**
Mexico	635 000
Chile	131 257
Peru	113 133
Spain	44 440
South Africa	49 460
Israel	53 054

Sources: FAO, USDA, professionals

AVOCADO — Imports (2013-14)

Avocado — The 6 leading importing countries	
tonnes	**2013-14**
United States	603 149
Netherlands	153 378
France	105 288
Japan	56 836
United Kingdom	44 978
Canada	44 599

Sources: FAO, USDA, professionals

USA — Imports — Main supplier countries						
tonnes	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Total	**371 662**	**420 361**	**351 120**	**462 777**	**561 892**	**603 149**
Mexico	301 695	270 200	281 672	360 924	515 143	512 276
Chile	56 363	133 888	54 355	74 701	14 721	53 305
Peru	-	11	137	9 157	15 860	*21 617*
Dom. Rep.	13 584	15 984	14 956	17 204	16 150	15 947
New Zealand	-	269	-	791	-	-
Others	20	9	-	-	18	4

Source: USDA

Canada — Imports — Main supplier countries						
tonnes	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Total	**23 665**	**32 196**	**33 467**	**37 974**	**48 599**	**44 418**
Mexico*	20 474	25 435	22 687	27 431	36 299	33 451
USA*	2 053	3 814	7 728	6 497	8 786	7 189
Peru	450	1 342	1 266	2 483	2 282	2 905
Dom. Rep.	143	314	314	255	351	456
Chile	492	1 196	1 340	1 055	659	261
Brazil	43	75	109	166	131	75

Sources: COMTRADE and *national customs

South America — Main markets							
tonnes	2007	2008	2009	2010	2011	2012	2013
Total	**14 887**	**11 047**	**19 088**	**18 881**	**15 048**	**17 670**	**18 403**
Argentina	3 221	2 638	3 494	8 357	5 493	9 179	9 621
Colombia	11 226	7 507	12 501	9 044	7 190	6 023	3 904
Chile	400	390	678	303	1 880	698	3 882
Ecuador	40	512	2 416	1 177	485	1 770	996

Sources: COMTRADE

Central America and Mexico — Main markets							
tonnes	2007	2008	2009	2010	2011	2012	2013
Total	**27 426**	**26 365**	**28 683**	**35 956**	**27 486**	**42 132**	**42 266**
Costa Rica	6 970	7 571	6 809	9 638	9 958	13 731	13 061
Salvador	10 079	9 747	11 163	9 308	9 262	13 754	12 666
Honduras	9 335	7 566	8 939	9 032	6 426	10 412	11 405
Guatemala	950	1 087	1 772	1 380	900	3 312	2 923
Mexico	91	393	0	6 598	940	923	2 211

Sources: COMTRADE

European Union — Imports — Main supplier countries						
tonnes	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Total, incl.	**210 487**	**239 451**	**239 726**	**225 748**	**266 280**	**312 143**
N. Hemis. total	**94 540**	**134 816**	**118 742**	**113 733**	**132 766**	**162 344**
Chile	15 832	51 383	25 244	32 637	41 074	62 968
Israel	30 071	38 522	38 512	40 448	35 175	42 844
Spain	32 930	31 420	44 460	33 270	42 000	41 300
Mexico	11 647	9 326	3 371	2 909	9 085	6 293
Morocco	1 908	977	3 346	2 803	840	4 766
Dom. Rep.	2 077	3 016	3 621	1 312	2 451	1 749
Tanzania	5	21	62	133	968	1 259
Colombia	25	51	121	121	486	1 162
S. Hemis. total	**115 539**	**104 301**	**120 933**	**111 936**	**132 852**	**148 824**
Peru	49 829	45 661	56 345	66 155	62 618	86 260
Southern Afr.*	51 109	38 821	47 800	27 375	49 083	45 165
Kenya	11 841	15 038	14 123	15 028	17 078	13 313
Brazil	1 790	2 797	2 665	3 006	3 959	3 928
Argentina	970	1 984	-	372	114	158

* South Africa, Zimbabwe, Swaziland / Source: Eurostat

Other Western European countries — Main markets							
tonnes	2007	2008	2009	2010	2011	2012	2013
Total	**8 320**	**9 018**	**9 568**	**11 538**	**13 644**	**14 779**	**17 146**
Norway	3 219	3 841	4 046	5 154	6 555	7 090	8 785
Switzerland	4 936	4 995	5 340	6 152	6 789	7 340	7 915
Iceland	165	183	183	232	300	349	446

Sources: COMTRADE

Russia — Imports — Main supplier countries							
tonnes	2007	2008	2009	2010	2011	2012	2013
Total	**4 392**	**4 806**	**5 827**	**8 367**	**9 474**	**11 156**	**13 948**
N. Hemis. total	**2 928**	**2 180**	**3 479**	**5 318**	**6 199**	**6 925**	**8 997**
Israel	2 769	2 016	3 316	5135	5794	6674	8716
Spain	159	164	163	183	405	251	281
S. Hemis. total	**1 377**	**2 515**	**2 224**	**2 861**	**3 087**	**3 934**	**4 545**
South Africa	1 225	1 923	1 445	1 984	1 321	2 345	2 678
Peru	42	442	438	597	1 475	1 259	1 462
Kenya	110	150	342	280	291	330	405

Sources: COMTRADE

Other Eastern European countries — Main markets							
tonnes	2007	2008	2009	2010	2011	2012	2013
Total	**702**	**884**	**905**	**1 362**	**1 630**	**2 066**	**2 828**
Ukraine	510	691	694	1 026	1 249	1 623	2 068
Belarus	91	97	113	177	229	255	482
Croatia	53	42	61	108	101	118	192
Serbia	48	54	37	51	51	70	86

Sources: COMTRADE

Japan — Imports — Main supplier countries						
tonnes	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Total	**26 054**	**37 520**	**39 043**	**47 734**	**62 687**	**56 836**
Mexico	25 220	33 603	35 733	40 722	56 373	50 278
United States	77	1 023	2 430	3 966	5 140	4 971
Chile	224	1 673	334	1 014	535	892
New Zealand	533	1 221	546	2 032	639	695

Source: national customs

Other Asia countries — Main markets							
tonnes	2007	2008	2009	2010	2011	2012	2013
Total	**2 965**	**2 869**	**3 534**	**4 616**	**5 255**	**6 103**	**6 568**
China	1 305	989	1 293	1 976	2 393	2 783	2 851
Singapore	659	747	978	1 285	1 497	1 691	2 015
South Korea	655	492	325	457	402	534	722
Thailand	188	413	664	540	440	530	552
Malaysia	158	228	274	359	523	565	428

Sources: COMTRADE

Oceania — Main markets							
tonnes	2007	2008	2009	2010	2011	2012	2013
Total	**7 764**	**9 737**	**9 551**	**9 415**	**16 166**	**10 725**	**12 593**
Australia	7 675	9 729	9 509	9 287	16 166	10 723	12 567
New Zealand	89	8	42	128	-	2	26

Sources: COMTRADE

Persian Gulf — Main markets							
tonnes	2007	2008	2009	2010	2011	2012	2013
Total	**3 118**	**3 759**	**4 120**	**6 596**	**8 164**	**14 410**	**15 348**
Saudi Arabia	542	376	682	1 610	2 056	7 736	*8 000*
United Arab Em.	1 735	2 528	*2 442*	*4 000*	*5 000*	*5 500*	*6 000*
Qatar	235	217	338	366	360	486	598
Kuwait	426	371	*400*	*400*	*400*	*400*	*400*
Yemen	180	268	258	220	348	288	*350*

Sources: COMTRADE

Africa — Main markets							
tonnes	2007	2008	2009	2010	2011	2012	2013
Total	**7 525**	**8 669**	**8 942**	**11 045**	**9 598**	**11 107**	**15 086**
Morocco	5 162	7 105	6 927	8 055	6 683	8 817	9 130
Egypt	34	104	70	445	85	112	2 914
South Africa	1 886	1 123	1 381	1 976	2 156	1 660	2 308
Namibia	443	337	564	569	674	518	734

Sources: COMTRADE

The main avocado varieties

Avocado is a dicotyledon of the genus Persea of the Lauraceae family. More than 200 varieties are divided between three races. The Mexican race is of little commercial interest as most of the fruits are too small. However, its agronomic qualities mean that it is widely used as rootstock or as a parent. Practically all sales of fruits of the West Indian race are on domestic markets. International trade handles mainly varieties belonging to the Guatemalan race or crosses between the Guatemalan and Mexican races.

The Guatemalan race

Persea nubigena* L. Wins var. *guatemalensis

This race probably originated not only in the highlands of Guatemala but also in the Chiapas in Mexico. The leaves are large and uniformly dark green on both faces. Although it is not as tolerant to cold as the Mexican race, it is useful for marginal cultivation zones. The fruits are roundish and have thick, very hard warty skin. The size may vary considerably but they are generally larger than fruits of the Mexican race. The seed is fairly small and almost always clings. Pulp oil content is medium at 10 to 20%. Flowering to harvest time is 8 to 10 months. It can be longer in the cold parts of California (12 to 14 months). The race is a good parent for crosses (contributing genes for small seeds). Nearly 40% of avocados belong to this race, including 'Anaheim', 'Corona', 'Sharwil' and the major commercial varieties such as 'Edranol', 'Gwen', 'Hass', 'Nabal' and 'Reed'.

The West Indian race

Persea americana* Miller var. *americana

In spite of its name, this race probably originated in Colombia. It is well suited to humid tropical regions where it is used to supply local markets. The tree has large green leaves. The fruits are elongated, usually large and weigh 400 to 900 g. The epidermis is fairly thin (0.8 to 1.5 mm) and is smooth and shiny, soft green or greenish yellow or reddish when mature. The pulp is watery with a low oil content (< 10%). The seed—often free—is large and has a more or less corrugated surface. All these characteristics make the fruits delicate. They often display pulp browning (caused by chilling injury) at the temperatures generally used for the storage and refrigerated transport of fruits of the other races (+ 6°C, + 8°C). The race is the most sensitive one to cold and aridity but the most tolerant to salinity. The flowering to harvest time is only 5 to 7 months. The West Indian race groups about 15% of avocado varieties and the best known among them are 'Peterson', 'Pollock' and 'Waldin'.

The Mexican race

***Persea americana* Miller var. *drymifolia* Schlecht and Cham.**

This fairly hardy race is adapted to low temperatures originated in the Mexican highlands. It differs from the two other races in several botanical characteristics:

- the leaves are generally small and release a characteristic anise odour when crumpled;
- flowering is earlier than in the other races and the flowering to harvest time is 7 to 9 months;
- the fruits are small and elongated and rarely weigh more than 250 g. The skin is very thin and smooth.

The pulp is often fibrous and has a high oil content (> 15%). The seed is generally large and sometimes free. This race is very sensitive to salinity. In contrast, it tolerates high temperatures and comparatively low relative humidity. Furthermore, it has greater tolerance to *Phytophthora cinnamomi* than the other races. It thus forms good rootstock and its genetic potential is well exploited in hybridisation breeding programmes. Finally, its high lipid content is an interesting feature when the fruits are used for oil production. About 20% of varieties belong to this race. The best known include 'Duke', 'Gottfried', 'Mexicolo', 'Topa Topa' and 'Zutano'.

Hybrids

A large proportion of the varieties of interest for international trade are hybrids. These are generally natural crosses and in rarer cases are the result of breeding exploiting the inter-fertility of the three races. The main selection criteria are agronomic (resistance to pests and diseases, especially Phytophthora, tolerance to salinity and cold, productivity, etc.) and those related to fruit quality (size, high pulp percentage, flavour, absence of fibres, oil content, etc.). 'Bacon', 'Ettinger', 'Fuerte' and 'Lula' in particular are natural Mexican x Guatemalan hybrids. Guatemalan x West Indian hybrids, mainly from Florida, include the varieties 'Ajax', 'Booth', 'Choquette', 'Collinson' and 'Simpson'. Mexican x West Indian hybrids such as 'Indian River' are very rare. Other varieties resulting from inter-race crosses are possible.

Hass

Guatemalan race

Flowering type: A
Fruit shape: pyriform
Skin: dark green and brown at maturity, not very thick, warty
Oil content: 18 to 20%
Average weight: 250 to 350 g
Seed:skin:pulp ratio: 16:12:72 (small seed)

'Hass' has replaced 'Fuerte' as the sector standard. It is currently the most commonly planted avocado in the world. It was selected by Rudolph Hass in California in the early 1920s and registered in 1935. The tree is vigorous and highly productive. The fruits vary in shape in some production regions, ranging from pyriform to ovoid. Average fruits size is fairly small in hot regions. Keeps well on the tree. The skin turns from dark green to purplish brown at maturity. It is easy to remove from the pulp. The organoleptic qualities are excellent. Rich flavour (nutty taste) and buttery nonfibrous pulp.

Fuerte

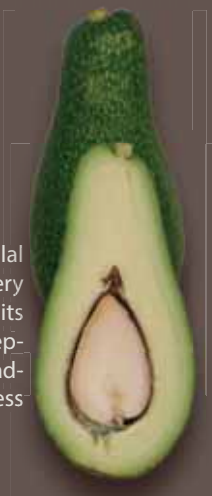
Mexican x Guatemalan hybrid

Flowering type: B
Fruit shape: obovate
Skin: green, matt, smooth, medium thickness. Pliable and tough, it is easy to remove
Oil content: 16 to 18%
Average weight: 250 to 400 g
Seed:skin:pulp ratio: 15:10:75 (large seed)

This variety was long the most commonly planted in the world and originated in Mexico (Atlixco). The tree is vigorous with fairly good resistance to frost (to 4°C), but is particularly temperature-sensitive during the flowering period. Productivity is generally good in temperate zones but it displays strong alternate bearing. The fruits are easy to peel and have excellent organoleptic qualities (buttery pulp).

Ettinger

Mexican x Guatemalan hybrid



Flowering type: B
Fruit shape: narrowly obovate
Skin: bright green, fine, fairly smooth
Oil content: 18 to 22%
Average weight: 250 to 350 g
Seed:skin:pulp ratio: fairly large seed

This variety was bred from 'Fuerte' in Kefar Malal in Israel, where it is mainly grown. The tree is very fertile and vigorous with an erect habit. The fruits are similar to those of 'Fuerte'. The skin is susceptible to problems of corky areas and tends to adhere to the pulp. The pulp is buttery and fibreless and has good organoleptic qualities.

Reed

Guatemalan race

Flowering type: A
Fruit shape: spheroid
Skin: medium thickness, slightly rough, pliable
Oil content: 19 to 20%
Average weight: 400 to 500 g
Seed:skin:pulp ratio: 17:11:72

This variety of Californian origin was selected by James Reed. Registered in 1960, the patent expired in 1977. It has succeeded in conserving the qualities of its parents 'Nabal' and 'Anaheim' without their negative features. It is fairly productive and alternate bearing is not marked. Its resistance to cold is comparable to that of 'Hass'. The fruits are large and a singular round shape. They keep well on the tree. The organoleptic qualities are excellent and the buttery pulp has a slight nutty taste and does not blacken after slicing. Peeling is also easy.

Pinkerton

Mexican x Guatemalan hybrid

Flowering type: A
Fruit shape: pyriform
Skin: dark green, rough, tough and pliable, medium thick, easy to peel
Oil content: 18 to 25%
Average weight: 270 to 400 g
Seed:skin:pulp ratio: 10:13:77 (small seed)

A recent variety bred in California by John Pinkerton and registered in 1975. It is probably the result of a Hass x Rincon cross. The tree is very vigorous and tolerates temperatures of -1/-2°C to 30°C. Production is good and alternate bearing is little marked. The fruits may suffer from ring-neck if the tree is under conditions of stress. The organoleptic qualities of this variety are excellent (nutty taste). The pulp is smooth, buttery and fibre-less.

Photos © Guy Bréhinier

Avocado quality defects

Parasite disorders

The most common: Anthracnose (black rot due to *Colletotrichum*)

Mild internal anthracnose

Mild internal anthracnose

Mild internal anthracnose

Mild to severe external anthracnose

Final-stage external anthracnose

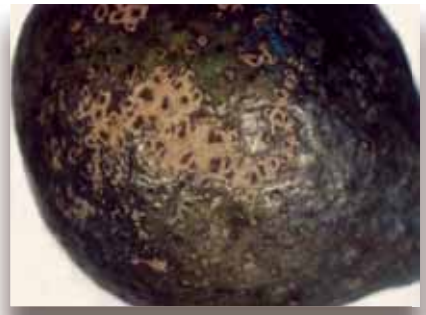
Stem-end necrosis (*Fusarium spp., Lasiodiplodia theobromae, Dothiorella gregaria*)

Stem-end necrosis due to Fusarium

Stem-end necrosis

Stem-end necrosis

Epidermal disorders



Surface disorder due to *Sphacelma persea* - Scab

Surface disorder due to *Sphacelma persea* - Scab

Photos © Pierre Gerbaud et E. Laville

Physiological disorders

Damage caused by the cold Poor regulation of controlled atmosphere

Internal damage, early development

Internal damage, mid-stage development

Internal damage, late development

External damage

Lack of O2 and excess CO2

Mechanical and other problems

Variation in coloration and maturity Mechanical bruising

Variation in coloration and maturity

Mechanical bruising

Cork-like patch due to friction

Cork-like ridges due to friction

Burst nodules due to friction

Photos © Pierre Gerbaud et E. Laville

Avocado post-harvest

Post-harvest management of fruits is of prime importance. It affects both quality and yield as losses can range from 5 to 50%.

The special features of climacteric fruits

Climacteric fruits have special physiological characteristics. They must be harvested after reaching a sufficiently advanced stage of development and hence of maturity. It is only then that they are capable of synthesising sufficient amounts of ethylene to be able to start ripening (a strong increase in respiration that physiologists refer to as the 'climacteric' marks the start of deep-seated physiological changes). Only mature fruits will display satisfactory organoleptic characteristics once they have ripened. Avocado is a singular climacteric fruit. It can only start the ripening process after it has been picked. One of the best ways of storing the fruit is therefore to leave it on the tree. Some varieties can remain on the branch for several months, depending on the season. Suitability for 'tree storage' is generally very small or non-existent for West Indian cultivars but marked for hybrids, especially for Guatemalan x Mexican crosses. Nevertheless, prolonged storage can have a negative effect on production in the following season. These physiological considerations highlight the importance of the harvest date. Several variables that depend on the variety and the producer country concerned are to be taken into consideration to judge the optimum stage of maturity. Visual appraisal, fruit weight and diameter and the number of days after flowering give useful information but this is not accurate enough. Determining the matter content—strongly correlated with the oil content—is the most commonly used method. Appraisal of the stage of maturity is completed by analysis of enzymatic activity, electrical conductivity, aromatic compounds or precursors or by tasting tests when the fruits have ripened.

Photos © Eric Imbert

Storage

Cooling

The temperature is lowered to slow the metabolism of the fruit so that it can be stored. This slows ethylene synthesis and its effects. It is therefore sought to bring the fruits to the best temperature for storage as rapidly as possible after harvesting (ideally in less than 6 hours). The duration of cooling depends on the initial and final temperature of the fruit and on the ambient air conditions (temperature, wind velocity and relative humidity). The time necessary varies from 8 to 10 hours. It is important to halt the cooling phase 2°C before the final temperature desired to be sure not to reach temperatures that are too low and that might damage the produce.

Refrigeration

Optimum storage temperatures vary according to the variety, the period of the season (maturity) and the storage period desired. In general, the temperature for mature avocado ranges from 5 to 12°C with atmospheric relative humidity of 85 to 95%. The more delicate end-of-season fruits are stored in the lower part of the temperature range. For 'Hass', physiologists advise maintaining fruits at 5 to 7°C at the beginning of the season and 4.5 to 5.5°C at the end. More than four weeks of storage at these temperatures is not recommended. The optimum temperature range for 'Fuerte' is 6 to 8°C but not for more than three weeks. In practice, professionals keep all the classic commercial varieties at between 5 and 6°C. Temperatures must be strictly controlled to prevent any fluctuation. Movement of air is also regulated. Heat is released during the beginning of the ripening process and this must be taken into account. Respect of the cold chain is of crucial importance.

Controlled atmosphere

Controlled atmospheres are widely used for long transport and can lengthen the duration of storage. Low O2 levels combined with high CO2 reduce respiration and ethylene production. An O2 content of 2 to 5% and CO2 of 3 to 10% are generally used. The main classic commercial varieties can thus be stored for 5 to 6 weeks and even longer for 'Hass'. The effects of unsuitable O2 and CO2 levels are described in the paragraph entitled 'Main types of post-harvest physiological deterioration' below.

Alternative technologies for long storage

Treatment with 1-MCP. Application of 1-MCP (1-methylcyclopropene) is reported to limit the internal symptoms of chilling injury (dulling of the pulp, vascular browning) in fruits stored for more than four weeks. The technique is said to give good results especially for the green varieties that are less suitable than 'Hass' for long storage (with regard to the standards in force). It has been used on a proportion of the South African harvest for three years.

Step-down temperature. This technique has been used in the South African avocado sector for several years to conserve fruit quality and reduce internal symptoms of chilling injury. The storage temperature is lowered in steps (1 to 2°C each week) during transport, with care taken not to descend lower than 3.5°C. There are procedures (temperature and duration) for the different cultivars and regions of South Africa.

Photos © Eric Imbert

Packing

Fruits with the desired maturity index are sorted, washed and graded before packing. Each market has its own packing requirements.

Avocado — USA — 11.34-kg box 43 x 32.6 x 17.50 cm

Weight (g)	Size
422	28
377	32
340	36
298	40
241	48
196	60
156	70
122	84
102	96

Avocado — USA 5.67-kg box

Weight (g)	Size
422	14
377	16
340	18
298	20
241	24
196	30
156	35

Avocado — Europe — 4-kg box 35 x 28.5 x 9 cm

Weight (g)	Size
461-475	8
366-400	10
306-365	12
266-305	14
236-265	16
211-235	18
190-210	20
176-189	22
156-170	24
146-155	26

Avocado — Japan — 6-kg box 43.9 x 33.1 x 11 cm

Weight (g)	Size
340	18
298	20
241	24
196	30
156	35

Ripening

The ideal temperature for ripening is 15 to 20°C. Above 25°C, ripening is irregular, unpleasant flavours appear and the risk of rot increases. This natural process can also be controlled. Treatment with ethylene (100 ppm at 20°C for 12 to 72 hours depending on the maturity of the fruit) speeds up ripening by 3 to 6 days. It is possible to obtain fruits at an even stage of ripeness in chambers in which temperature, relative humidity and ethylene content are the main parameters controlled. Nevertheless, ripening still depends on the initial stage of maturity of the fruit.

The main precautions to be taken in shops

Avocado fruits are very sensitive to impacts and to pressing by consumers. Ripe and nearly ripe fruits must be stored at lower temperatures (1 to 6°C). Misting is not recommended.

Photos © Eric Imbert

Main types of post-harvest physiological deterioration of avocado

Storage-related damage

Chilling injury. This damage is caused by low temperatures—generally lower than 3°C—or by prolonged storage. The symptoms may appear three days after packing during storage and more often when the fruits are removed from the cold room. Two forms of chilling injury are observed. The symptom of internal chilling injury is a browning of the pulp starting at the base of the fruit and sometimes vascular browning in the same area. In 'Fuerte', this disorder takes the form of small dark spots in the pulp. The symptoms of external chilling injury are irregular black spots on the epidermis. They may appear during storage and most frequently when the fruits are removed from cold storage.

O2 deficit and excessive CO2. Too great a decrease in the O2 level (in particular to less than 1%) can cause irregular brown spotting of the epidermis that can spread to the pulp. Too high a CO2 level (over 10%) can cause discoloration of the epidermis and the development of unpleasant flavours, especially when the O2 level is low.

Fungal infection in the field revealed during or after storage

The control of fungal diseases requires effective orchard management and appropriate treatments before the harvest. All bruising of the fruits must be avoided at the post-harvest stage, they must be refrigerated rapidly and the cold chain maintained.

Anthracnose. This is the most frequent disease during storage and is caused by infection of the fruit by *Colletotrichum gloeosporioides* in the orchard and appears only during ripening. It causes serious necrosis. Ordinary small, scattered injuries develop into large circular brown spots on the epidermis. The underlying pulp blackens and the rot reaches the stone. The rate of development of this rot depends on the transport and storage temperature and above all the state of maturity of the fruits.

Stem-end rot. This disease is also caused by infection by a fungus, *Botryodiplodia theobromae*. Small pale brown spots appear initially in the stem zone. The rot spreads rapidly to the rest of the fruit. The pulp is then infected to the stone. Any injury in the epidermis favours infection by the pathogen.

Avocado — Post-harvest diseases caused by pathogenic fungi

Pathogen	Diseases
Alternaria spp	Black rot
Botryodiplodia theobromae	Stem-end rot
Botryosphaeria ribis (*Dithiorella gregaria*)	Stem-end rot
Colletotrichum gloeosporioides	Anthracnose: Black rot
Fusarium spp	Stem-end rot
Penicillium expansum	Blue mould
Pestalotiopsis perseae	Brown spots
Phomopsis perseae	Brown rot
Phytophthora citricola	Small surface injuries
Pseudocercospora purpurea	Soft rot
Rhizopus stolonifer	Corky patches on epidermis
Trichothecium roseum	Pink rot

The harvest stage in the case of climacteric fruits

This stage is particularly important since the state of maturity of the fruit is "set" upon harvesting (see **FruiTrop** No.198, page 29, maturation article). The impact of the harvest stage is split into two aspects (see diagram):

- in qualitative terms, the earlier a fruit is harvested, the less taste properties it will exhibit, with a fairly low sugar content (enrichment in sugars is linked to the length of time on the plant) and a poor ability to develop flavours;
- in commercial terms, a fruit harvested at a stage too close to the fruit's true maturity will have a lower conservability. But if the fruit is harvested too early, its ability to ripen may be insufficient, and it will not be able to go through the correct maturation development.

Importers are dependent on the compromise which may be found to reconcile taste quality and market distribution. Defining an optimum harvest stage is a real challenge, since there are not necessarily any clear visual descriptors indicating with acceptable precision the stage of maturity before maturation of climacteric fruits (known as the preclimacteric stage).

In parallel, with the markets constantly changing, the development of triggering (avocado, mango) becomes singularly complicated: how to be sure that the fruits have reached their ability to ripen? How to adapt the triggering process to the fruit stage of maturity, in the knowledge that the batches are heterogeneous?

There are possible alternatives for improving batch homogeneity, but this calls for a high degree of interaction between the production and distribution industries. Eventually, we will need to take into account the changes to cropping techniques on fruit physiology (conservation, metabolism of maturation). We will also need to assess the possibility of sorting fruits using non-destructive measures, to obtain homogeneous batches in order to adapt and ensure the performance of the triggering techniques.