CLOSE-UP FRuiTROP

A report by Denis Loeillet

Pineapple

Analysts of the international pineapple market have exhausted the long list of adjectives and expressions available to describe its continued dynamism and seemingly unlimited resistance to the morosity of the fruit and vegetable market. Year after year, *FruiTrop* reports ever-increasing scores. The volumes grown, the countries involved in production, import figures, consumption, etc. are all larger, stronger and higher than before. Fresh pineapple is the success story of the last twenty years. Consumption in the United States increased from 0.86 kg per person in 1996 to nearly 2.4 kg in 2007. The trend is the same in Europe with an increase from 0.7 kg in 1996 to 1.7 kg in 2007.

On the European market, the 2007 pineapple season was fairly mediocre, especially when compared to 2006. The volume balance was delicate and was only maintained thanks to features on which European market operators have very little control. They include mainly the supply of 'Sweet' from Latin America that continued to increase and set the pace of the season. This variety is increasingly the standard for the pineapple market. The volumes of 'Smooth Cayenne' continued to decrease to the point of being a minor feature of the market. Indeed, this variety is continuing to lose its popularity and is now sold on only a few markets in Europe—mainly in France and Eastern European countries.

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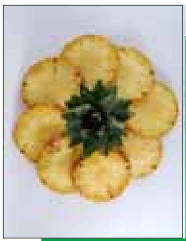

The European pineapple market

A cure for morosity

Pineapple seems to be a miraculous survivor on a fruit and vegetable market reported to be in distress, suffering competition from the unlimited inventiveness and increasingly elaborate techniques developed in the agrifood industry. There are several reasons for this unprecedented success in the history of tropical fruits. 'Production innovation' is one of them. Indeed, the pineapple saga cannot be understood without discussion of the renewal of the varietal range dared by Del Monte from the mid-1990s when the market had always been organised around the irremovable 'Smooth Cayenne' pineapple.

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Management of innovation

In the early 1990s, the semi-failure of its 'green' pineapple was soon forgotten with the release of 'Sweet' under the brand name Del Monte Gold™ Extra 'Sweet' Pineapple. In addition to its colour, a natural green turning golden yellow according to the season, the crop management sequences and production zones, the variety has good keeping qualities. Agronomists talk in terms of its robustness. Its sweetness is favoured by consumers. The latter is only an apparent feature. In fact, on the Brix scale of sugar content, 'Sweet' scores a couple of degrees less than 'Smooth Cayenne'. The explanation for the impression is that its acidity is half that of 'Smooth Cayenne'.

A faultless career

The replacement of the reference fruit 'Smooth Cayenne' is also the result of the tremendous machine that Del Monte set up in the Buenos Aires region in south-east Costa Rica. Five thousand hectares almost in one piece, a packing station running 24 hours a day, large personnel resources in particular for quality management, pre-refrigeration and customised land and sea logistics enabled 'Sweet', and above all the Del Monte brand, to become the absolute reference as regards quality. With exemplary protection of its innovation against dissemination, the company managed its resource closely for many years. Talk was more in terms of an allocation market rather than distribution at the end of the 1990s and beginning of the 2000s. Indeed, the growing demand for this brand of pineapple exceeded production capacity. The organisation of the fruit giant strengthened this sales efficiency and Europe was divided into zones, preventing any cannibalisation.

This industrial approach was all the more effective as Côte d'Ivoire was showing signs of great weakness in both produce quality (serious worsen-

Pineapple — World production and imports — Tonnes

	World production	Imports - Fresh fruit equivalent				
		Concentrate	Single juice	Canned pineapple	Fresh pineapple	Total imports
1969-71 aver.	5 467 282	2	145 681	738 506	160 356	1 044 545
1979-81 aver.	9 780 756	3 042	342 479	982 024	365 659	1 693 204
1989-91 aver.	11 391 306	2 338 905	286 742	1 477 612	586 539	4 689 799
1999	14 440 248	2 106 842	467 136	1 647 811	1 034 398	5 256 187
2000	14 384 134	1 850 697	485 403	1 693 352	1 051 524	5 080 976
2001	14 963 795	1 972 783	626 166	1 648 093	1 153 723	5 400 765
2002	15 838 240	3 036 701	423 299	1 663 852	1 315 832	6 439 684
2003	16 183 509	3 471 660	434 286	1 821 083	1 460 629	7 187 657
2004	16 963 218	3 304 070	450 360	1 888 479	1 705 946	7 348 855
2005	17 686 339	3 055 633	455 620	2 067 020	1 955 997	7 534 271

Source: FAO, CIRAD

ing) and sales. Cannibalisation was the rule, with everybody selling the same produce to anybody but at different prices. The efforts of the Côte d'Ivoire organisation OCAB to achieve better coordination of supply, stricter quality control of the produce shipped and regaining the market backed by a marketing plan were not able to halt its loss of influence on the European market. The movement of market shares was irrevocable: 93% in 1986 and 7% in 2007.

The pineapple market accelerated after this phase during which a source, Côte d'Ivoire, 100% 'Smooth Cayenne' and dominant on the European market, was replaced by a company, Del Monte, a brand, Extra 'Sweet', a source, Costa Rica, and a variety, 'MD-2'. And not only in Europe. The United States moved ahead of the European Union. The growth rates were stupefying, totalling + 242% in the last decade. Europe followed at a slower rate (+ 193%) that is nonetheless the envy of other sectors. The two reasons for this were rapidly growing supply and keen demand to put a new heavyweight on retail shelves. Impatient and jealous of Del Monte's exceptional commercial success, Costa Rican operators both large and small, the transnationals and then all the other producer countries capable of growing pineapple jumped on the cultivar as soon as it appeared that it was free of rights. After interminable court hearings in the United States concerning the variety in some cases and the name in others, the lock of ownership of the innovation was removed and supply gradually increased.

In favor of 'Smooth Cayenne' pineapple

'Sweet' has dethroned 'Smooth Cayenne' and has become the standard. However, some operators like Jean-luc Burquier in Guinea defend the cultural exception. This is his argument: *'The arrival of 'Sweet' in the 1990s stimulated pineapple consumption: the European market was stagnant at less than 300 000 tonnes per year and grew to 824 000 tonnes in 2007. Its yellow-green colour, fine crown, sweet taste, its reasonable price..., but insipid taste, no character and white, translucent pulp. It has become a fixture on supermarket shelves and perfect during these times of problems of purchasing power. But what has happened to the colour of the African sun, the delicious juice, the incomparable aroma and the subtle balance between acid and sugar? Let us learn to rediscover the authentic taste of pineapple that only 'Smooth Cayenne' can give... '.*

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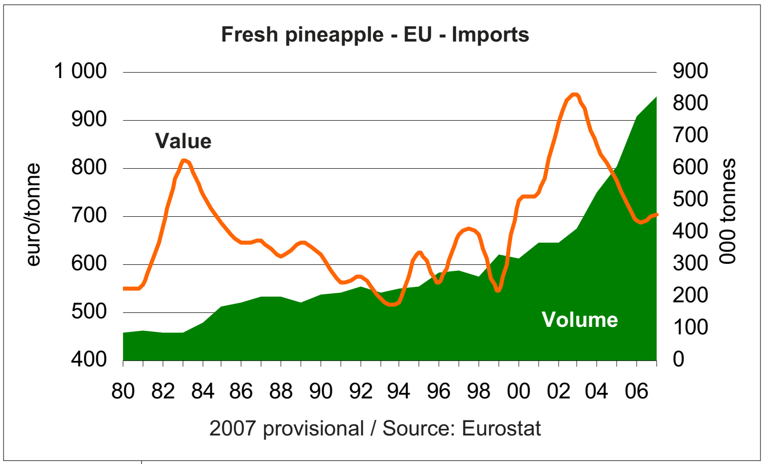
Central and South America, the Caribbean, West Africa etc. jumped on the bandwagon. The expansion of 'Sweet' everywhere marked the end of 'Smooth Cayenne'—in Côte d'Ivoire too. At the other end of the chain, other operators keen to get hold of part of what some saw as a pure economic advantage wished to increase the volumes of 'Sweet'. Retail distributors were interested in these strongly increasing supplies as they could renew consumers' interest in the fruit and vegetable departments with a strongly exotic fruit (with an original appearance and a taste that is not too marked) at comparatively low prices.



The future lies in renewal

What is the future of this market? The reply is both simple and complex. Simple because given the volumes sold and the alerts given by the market in 2007 (see the article entitled '*2007 pineapple season by market in Europe*'), it is clear that balance is becoming increasingly difficult. There is a risk of a crisis. The most complex aspect is that of knowing when it will come and operators are unequally equipped to face future difficulties. How can an operator like Del Monte that has capitalised on its name, that exports to the United States, Europe and a host of other countries, that supplies a full range of fruit and vegetables, etc. be compared with the mass of other operators? A crisis cannot be avoided— or a decrease in margins to rock-bottom levels that will call into question the development policies of producer countries while they continue to state that pineapple is a great national cause. The agronomic features of the plant are not such as to allow a rapid adjustment of supply to demand.

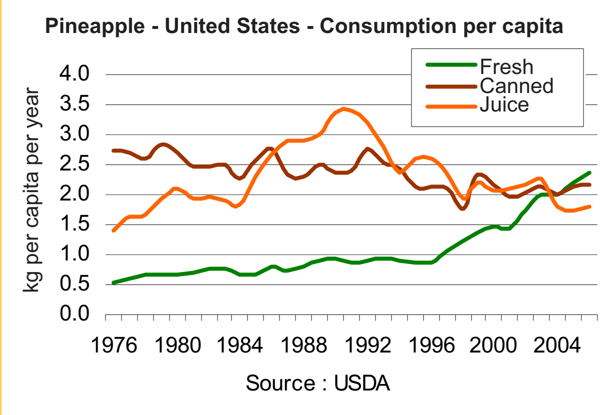
Pineapple — EU-27 monthly imports in 2007 — Tonnes

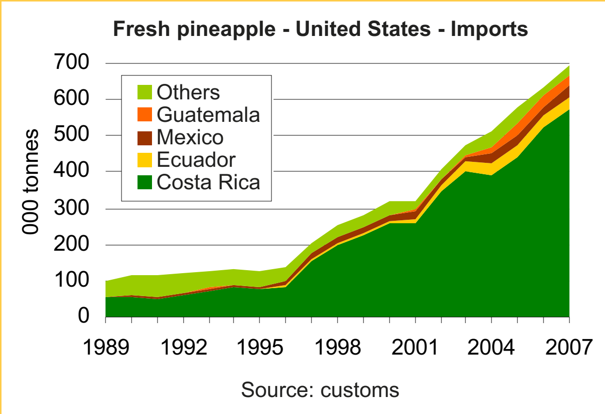
Origins	J	F	M	A	M	J	J	A	S	O	N	D	Total 2007	Total 2006
Extra-EU, incl.	**62 624**	**55 718**	**73 617**	**68 835**	**87 134**	**79 382**	**66 547**	**57 928**	**47 312**	**55 877**	**79 238**	**89 629**	**823 840**	**772 663**
Costa Rica	37 145	36 760	47 888	45 904	61 896	57 272	49 416	42 761	30 200	37 785	56 451	61 881	565 359	501 043
Côte d'Ivoire	7 950	4 862	5 984	7 172	5 771	3 589	3 687	2 361	3 790	3 516	4 471	6 099	59 251	94 760
Ecuador	5 022	3 743	4 348	4 744	3 657	3 802	2 898	3 968	3 654	4 096	4 046	5 264	49 243	36 702
Panama	2 889	2 501	3 560	3 177	3 204	3 454	2 689	3 211	2 995	2 675	2 748	4 066	37 168	31 476
Ghana	3 560	2 959	3 959	2 873	3 078	2 552	2 493	1 347	2 157	2 704	3 715	4 066	35 463	40 237
Brazil	1 260	1 966	2 474	1 887	3 198	2 285	2 183	2 531	2 391	1 773	2 231	2 188	26 367	16 400
Honduras	3 055	1 139	3 076	1 112	4 258	4 469	1 305	465	529	844	3 376	2 707	26 336	26 644
Cameroon	573	815	966	879	666	609	759	318	488	880	986	1 352	9 291	8 493
Guatemala	174	313	345	209	401	576	275	133	352	566	175	196	3 715	4 688
Thailand	282	177	255	238	333	221	303	395	243	342	454	454	3 698	3 391
South Africa	192	158	213	140	200	131	120	121	115	121	137	402	2 050	3 419
Benin	150	122	154	136	140	97	97	93	193	210	199	284	1 874	1 333
Togo	79	84	153	85	120	131	108	11	16	93	84	94	1 058	976
China	132	3	53	56	17		18	106	73	82	2	79	621	649
Mauritius	38	31	58	41	55	17	22	15	29	47	72	193	617	278
Uganda	25	51	42	38	25	35	31	31	32	27	30	37	403	262
Dom. Rep.	34	16	36	54	24	6	1					82	252	174
Malaysia	2		1		1	50	22	22		38	21	24	180	0
Philippines			0	13	36	13	25	13	16	1	13	24	153	133
Guinea	33	8		19	19					8	12	34	133	426
Sri Lanka	21	7	15	13	2	18	4	14	2	5	5	17	123	97
Vietnam		1		0		3	0		18	42		19	83	3
Intra-EU, incl.	**43 652**	**30 032**	**31 287**	**36 567**	**45 455**	**41 581**	**33 940**	**34 225**	**25 981**	**29 926**	**35 035**	**60 452**	**448 133**	**434 189**
Belgium-Lux.	17 425	6 289	9 303	13 332	18 652	14 642	13 383	12 481	8 300	10 785	13 301	18 022	155 916	117 123
Netherlands	12 780	9 518	9 094	11 309	12 427	12 579	9 339	11 158	8 159	7 352	8 728	13 872	126 314	139 592
France	3 545	2 783	3 031	2 907	2 917	2 669	1 515	1 539	1 796	3 483	3 094	5 066	34 344	55 745
Germany	3 205	3 282	2 985	2 609	2 922	2 933	2 254	1 871	1 893	2 097	2 152	3 498	31 701	47 021

Source: Eurostat

Pineapple in the United States: fresh-cut in the lead

Processed products are lagging behind for once. Fresh pineapple consumption in the United States exceeded that of juice and cans in 2004 and the trend is a clear upward one. Annual per capita consumption has increased nearly three-fold in the last decade, reaching 2.4 kg. Juice consumption has halved since its peak in 1991 at 3.4 kg (fresh fruit equivalent). This growth is characteristic of the fresh pineapple sector but this competition between fresh and processed has been made possible by the way in which fruit and vegetables are eaten in the USA. Fresh-cut is the rule and pineapple cannot get around it. Sales of fresh-cut fruits have doubled from USD 450 million to 1 billion since 2004. With 15% of sales, pineapple is running third after melon (41%) and fruit salads (30%).





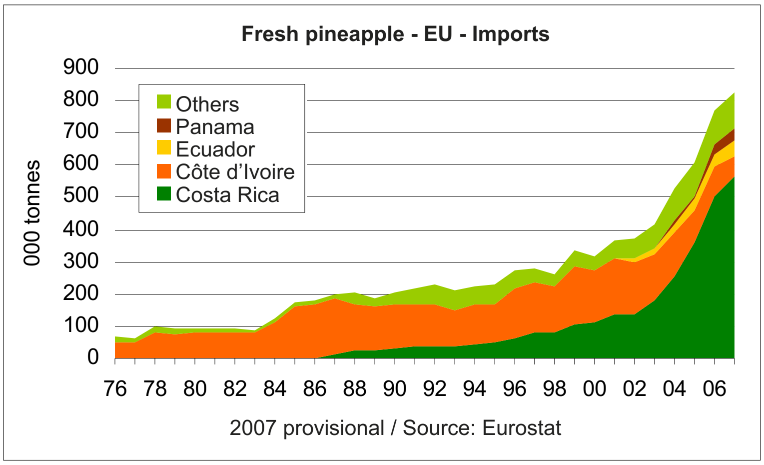
Fresh fruits — United States
Evolution of consumption
kg per capita per year

	1996	2006
Banana	12.50	11.34
Apple	8.46	8.03
Orange	6.41	5.38
Grapes	3.05	3.47
Strawberry	1.96	2.78
Others (excl. citrus)	1.94	2.62
Pineapple	**0.86**	**2.36**
Other citrus	1.49	2.21
Peach	1.98	2.07
Lemon	1.30	1.87
Avocado	0.72	1.53
Pear	1.38	1.44
Grapefruit	2.65	1.04
Cherry	0.18	0.50

Source: USDA

Indeed, the time elapsing between the decision to grow the crop and the harvesting of the first fruit is measured in years as production of planting material takes a very long time.

Operators view their future in different ways in this high-risk context. Some are going for quality, others consider that they have reserves in terms of competitiveness and then others would like to leave the vicious circle. They have the successful innovation of 'Sweet' in mind and hope to repeat the exploit with a new pineapple variety. Del Monte's 'Honey Gold' is a candidate. And then, for smaller quantities, other operators count on segmentation by means of transport (air or sea), returning to high-quality 'Smooth Cayenne' or hope for the ever-forecast boom in 'Victoria' pineapple that has never taken shape in hard figures. Finally, as is the case for other fruits, the increase in supplies of organic pineapple and fair-trade movement initiatives with produce from West Africa, especially Ghana, and also from Latin America should be noted.



The opening of new markets could give the sector a dignified way out. Increased purchasing power in particular in Eastern Europe and Russia could enhance the consumption of goods hitherto considered as being superfluous. It remains to be known whether the economic slump forecast will slow their development and whether these new eldorados turn out to be all glitter.

And meanwhile in the agrifood industry...

We know that the processed pineapple (canned products and juice) and fresh fruit markets have always been two separate worlds, each with its own production zones, agronomic constraints and market dynamics. Côte d'Ivoire wanted to combine the two worlds and paid a high price in the 1970s when, after the closing of canneries, it tried to shunt fruits intended for processing on to the fresh produce market. This separation of markets is remarkable when the market share wars between fresh oranges and orange juice are seen, or more generally the situation on the vegetable market. Pineapple seems to have definitively avoided the trap. But the frontier wall seems to be cracking. The food industry is now capable of supplying a high-quality alternative product that is remote from the light or heavy syrup canned fruit that has the name of pineapple and no more. The bars from 'Coeur de fruits' (Compagnie fruitière), and the fresh-cut packs from Del Monte and Dole, etc. are developing slowly. The right retail price positioning must now be found as for the great majority of consumers the choice of manufactured products is limited to low grade canned products or inordinately expensive fresh packs.

Finally, pineapple is a perfect example of what a market can draw from a product: fresh, semi-fresh, juice, tins, organic or fair-trade labels and varieties ('Smooth Cayenne', 'Sweet', 'Victoria', 'Sugarloaf', etc.). Other markets could draw inspiration from this abundance that should lead to supporting the excellent trend and keeping or recovering high value-added at all stages in the chain ■

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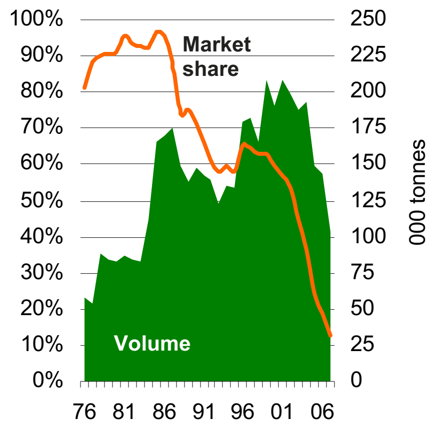
EU supply: Africa lagging

It is clear that Africa is far from recovering its position on the European and world pineapple markets. International supply is concentrated on the other side of the Atlantic. Indeed, Ecuador is joining Costa Rica in the leading handful of major suppliers of the European market, with nearly 50 000 tonnes shipped in 2007. This was the largest increase on the market. Ecuador is not the only production source to be establishing a position. Panama (+ 18%, with 37 000 tonnes) and Brazil (+ 61%, with 26 000 tonnes) display the same trend. Honduras is the only Latin American producer whose exports are stagnating (- 1%, with 26 000 tonnes).

The market share of the three leading African suppliers (Côte d'Ivoire, Ghana and Cameroon) fell to 13% in 2007 from 19% in 2006 and 60% in 2000! Shipments from Côte d'Ivoire (- 37%, with 59 000 tonnes) and Ghana (- 13%, with 35 000 tonnes) decreased by 40 000 tonnes in one year. The increase in shipments from Cameroon (+ 9%, with 9 300 tonnes) has not changed the situation. Africa also has some sources that are trying to differentiate by shipping by air, by concentrating on other varieties such as 'Sugarloaf' pineapple or by keeping 'Smooth Cayenne' as their main fruit. Benin, Togo, Uganda and Guinea exported 3 525 tonnes to the EU in 2007.

Fresh pineapple - EU - Africa market shares and volumes (Côte d'Ivoire, Ghana and Cameroon)



2007 provisional / Source: Eurostat


Del Monte
Quality
le plaìsir
Del Monte Gold
Del Monte
Quality
Extra Sweet Pineapple
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Tél: 01 56 70 26 31 · Fax: 01 56 70 26 30 · Courriel: commercial@simba.fr

2007 pineapple season by market in Europe

Most of the pineapple sales on the four main markets monitored (Germany, Belgium, France and the Netherlands) mainly concerned 'Sweet' fruits. France is the only country in which real consumption flows of 'Smooth Cayenne' are still observed; the other markets mentioned just supply customers in the eastern countries still interested in the variety. However, the quality of the very small supplies of 'Smooth Cayenne' was much more even, although the fruits displayed a colour defect for a while. Weaknesses were observed in supplies of 'Sweet', and especially in those from Costa Rica. Irregularity in production procedures is observed with the increasing number of brands, resulting in fruits with delicate keeping potential in shops or storage, which was not the case before. This situation made it possible to show off fruits from the other Latin American supplier countries and especially Panama, whose fruits had a much more reliable quality image throughout the season.

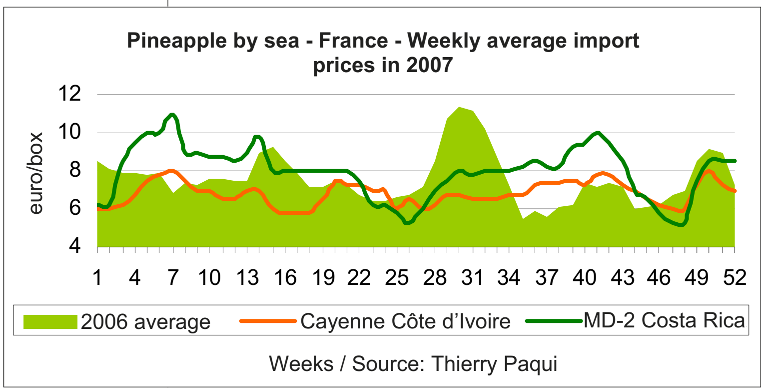
Unlike 2006, there were no spectacular rises in price at certain moments during the season, but more of a steady flow with prices holding within fairly steady ranges, with a few exceptions. Once again, the two main falls in price during the season resulted from surpluses of 'Sweet' from Latin America.

France

The increasing gap between prices of 'Smooth Cayenne' and 'Sweet' is striking when those of 2007 are compared with 2006 levels. There were no truly spectacular increases in 'Sweet' prices as in 2006. Fruits sold more smoothly and above all at more regular prices, with two exceptions. Although there are markets for both 'Sweet' and 'Smooth Cayenne' in France, re-exports should not be neglected as these played an important role in regulating the flows of goods, especially when domestic demand was at its lowest. As supplies were small, 'Smooth Cayenne' soon became limited to an increasingly marginal market, except when over-large quantities were received during the last fortnight of the year.

The season was fairly good overall on the French market, depending mainly on the quantities of 'Sweet' available. Two dips were seen—in June and November—when over-large volumes clogged the market and brought prices down.

Quantities of 'Sweet' continued to increase during the 2007 season, but did not reach the level attained at the beginning of 2006. This had a noteworthy effect on prices, with a more distinct difference with those of 'Smooth Cayenne'; this had not really happened in 2006. Supplies of 'Sweet' were smaller than expected in the first part of the season, from January to Easter. Demand increased strongly, especially in February, and operators scored well with sales. However, a slight weakening in demand was felt even though supply was not too large. Anticipating the impact that this could have on prices just before Easter, major brands like Del



Monte used fairly aggressive policies, selling their fruits at the same prices as those from other Latin American sources, that is to say one or two euros cheaper than usual. This increased the pressure on the sales of the other Latin American brands insofar as clients prefer known brands if the price is the same. Sales of 'Smooth Cayenne' were fairly stable during the first part of the season, although slightly smaller than in 2006. The main reason for the lower prices was the more regular release of volumes of 'Sweet'. To this was added the quality concerns (inadequate colour) affecting most 'Smooth Cayenne' exports from Côte d'Ivoire following the tightening up of the monitoring of Ethrel application at departure.

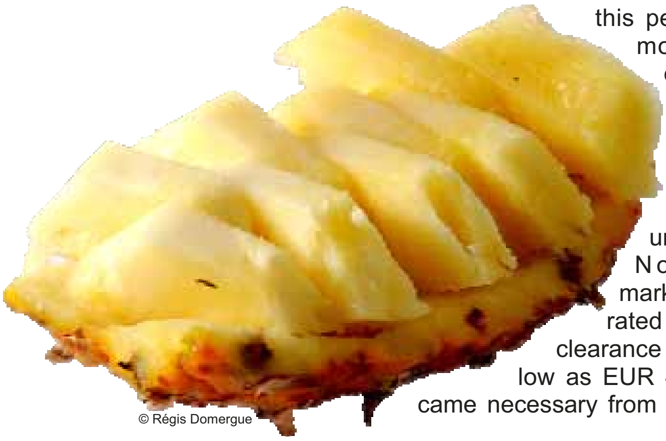
© Denis Loeillet

Demand slumped as usual after Easter while volumes of 'Sweet' continued to increase. A fall in prices began in May and lasted until July. The lowest levels were reached in June when supply was at its largest and when the focus of demand switched to the season's fruits. Major brands like Del Monte increased pressure on the market by lowering their prices. The supply of 'Sweet' continued to increase while that of 'Smooth Cayenne' decreased steadily.

In July and August operators concentrated on managing their stocks. This is when the first quality problems appeared in certain fruits from Costa Rica that kept badly.

Several factors account for the sharp rise in price that started in August. First, supply from Latin America decreased considerably from July onwards, reaching a level well below the nonetheless weak demand. This marked decrease in goods was accentuated by Latin American operators' preference for supplying the brisker, more dynamic North American market—that was above all more profitable than the European market. Small supplies combined with continuing increase in demand enabled prices to rise until October, in spite of growing concern for the quality of certain brands of 'Sweet'. 'Smooth Cayenne' supplies remained very small during this period, forming no more than a presence.

Operators feared the worst with the arrival of very large volumes of 'Sweet' in November. The market became saturated very quickly and clearance sales at prices as low as EUR 4.50 per box became necessary from the second week of the month onwards. Once again, the small supplies of 'Smooth Cayenne' prevented prices of this from dipping in the wake of those of 'Sweet'. It is true that they were low but they held at a level slightly higher than those of 'Sweet' for a month.



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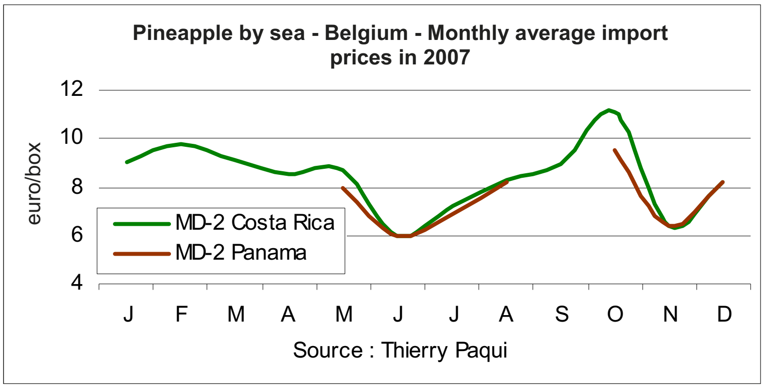
Clearance sales continued until the second half of December. The decrease in volumes of 'Sweet' then allowed prices to rise a little. In contrast, supply of 'Smooth Cayenne' was very large throughout December—with more than 10 000 palettes landed in two weeks in mid-month! Although sales of 'Smooth Cayenne' went smoothly at the beginning of the month as the batches available consisted of good quality fruits, over-large quantities of ripe fruits and a few logistic problems (gales resulting in the late docking of ships and the late distribution of fruits) prevented operators from profiting from the good market conditions. Practically all the fruits were for the Eastern European markets, and especially Russia, and could not be loaded and delivered in time. This resulted in numerous cancelled sales. The prices used here for reference to calculate averages are based on a proportion of the sales completed in France and thus concern only part of the total insofar as the French market is not the main outlet at this time of the year. According to sector operators, the disputes resulting from the sales cancelled in December still remain to be settled and will certainly lower the estimate given here.

Belgium

The pineapple season is appraised on the basis of sales of 'Sweet' from Latin America and especially from Costa Rica as the Belgian market takes this variety alone. It is true that a few palettes of 'Smooth Cayenne' arrive regularly but these are for the Eastern European markets. The last season was no exception and performance was good overall, with re-exports also playing an important role.



The comparatively good situation and returns on this market resulted mainly from small supply throughout the season. Supply never exceeded demand, keeping price levels satisfactory and generally higher than those in France, for example. However, as on the other European markets monitored, prices fell strongly in Belgium in June and November. The market seemed less affected by the increased shipments from Latin America from May onwards. It is true that demand weakened slightly, but the downward price movement was triggered above all by quality problems in fruits from Costa Rica, the main market supplier, combined with the decrease in demand. Increasingly large quantities of fruits arrived in June when there was practically no demand at all and the market finally became depressed. All operators cleared goods at prices as low as EUR 4.00 per box in order to handle the situation. Unfortunately, the small demand and the recurrent quality problems in Costa Rica fruits prevented a rapid improvement of the market. At the end of August, after a significant decrease in the volumes arriving from Latin America, prices gradually recovered and reached their highest level in October. In November, the arrival of large quantities of fruits and decreased demand set prices tumbling once again. Numerous clearance sales were run as operators cleared stocks of these fruits before the Christmas period. The market improved in the second week of December and held until just before Christmas when the dynamics were interrupted by the succession of long weekends that took the steam out of demand.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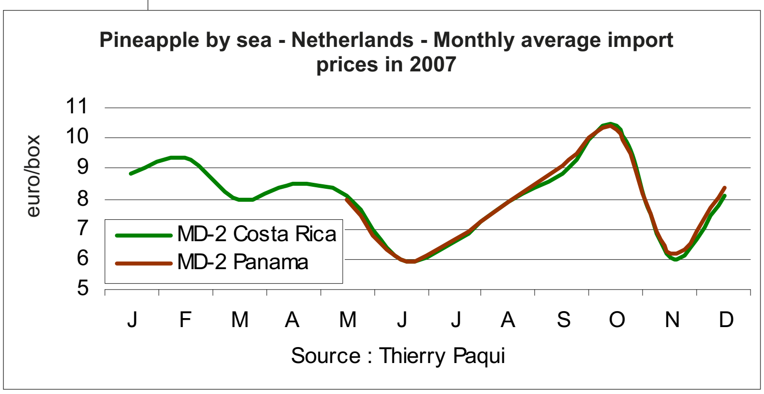
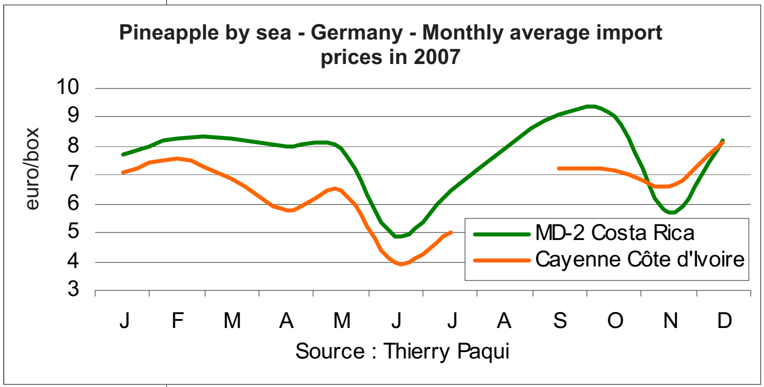
Netherlands

This is the re-export market par excellence. Sales on the domestic market were completed at slightly higher prices than those shown in the graph. The Netherlands also took delivery of batches of 'Smooth Cayenne' throughout the season, but these were often purchased from French or German operators for re-export to Eastern European countries. Domestic market consumption and the main sales to the other European markets (in the north and south) consisted almost only of 'Sweet'. Dutch operators are used to handling large quantities of fruits and often noted a worsening of the quality of produce from Costa Rica; this often concerned the behaviour of minor brands during storage. This irregularity in quality encouraged operators to further diversify their sources, thus allowing a supplier like Panama to gain a better position.

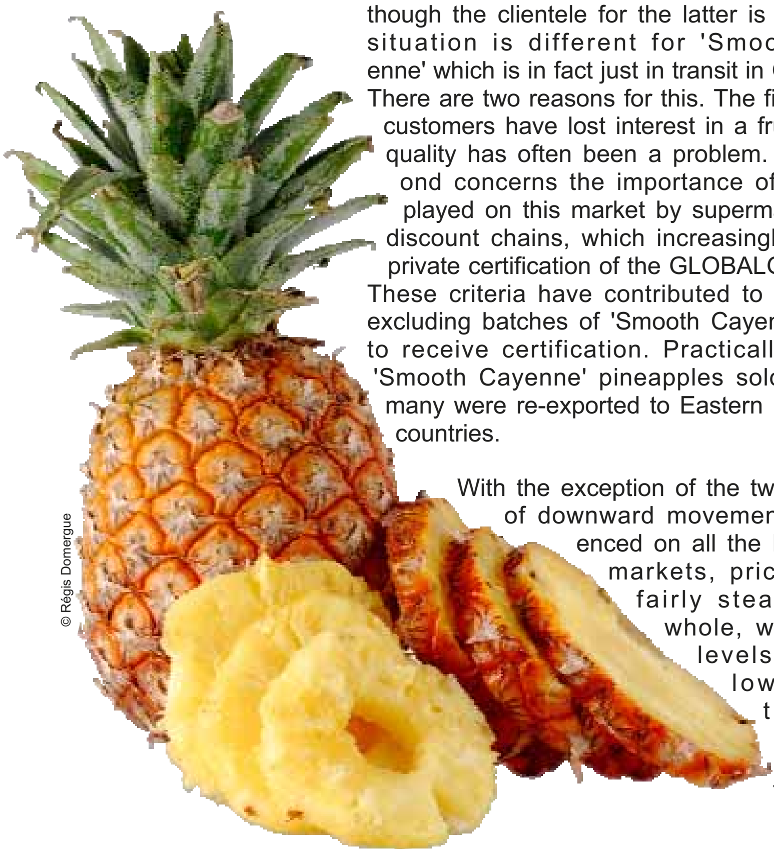
Supply was fairly meagre at the beginning of the season. Prices were good in February as demand amply exceeded supply. However, prices did not rocket in the way some operators had hoped. Demand from the markets in southern (Spain and Italy) and northern (mainly Germany) Europe made it possible to conserve a degree of market dynamism. Operators were therefore fairly worried when the volumes from Latin America began to increase in March, gaining steady but regular momentum before Easter when demand was not exceptionally large. Everybody feared that over-large quantities would bring prices down. The fluid sales from March to May were there-



fore viewed with a certain satisfaction. The situation became complicated at the beginning of June. Indeed, the season's fruits occupied a large proportion of displays with the arrival of fine weather while supply of 'Sweet' from Latin America continued to increase. Prices fell under pressure from volumes that were too large and loss of interest in pineapple. This hit all the more hard as it started just before the holidays and continued throughout July. Clearance sales and a decrease in supply from Latin America enabled a price recovery in August that lasted until October, the best month of the season. However, it should be specified that these good sales were only possible because of the small volumes available; they did not involve large quantities. November took many operators by surprise. Demand faded in less than a week under pressure from large volumes. Operators therefore ran several clearance operations to halt the worsening of the market and to prevent the accumulation of stocks that would be too large for Christmas. These took the pressure off and brought prices back to satisfactory levels.



Germany



Together with France, the German market is one of the rare ones on which batches of both 'Smooth Cayenne' and 'Sweet' are found. Although the clientele for the latter is solid, the situation is different for 'Smooth Cayenne' which is in fact just in transit in Germany. There are two reasons for this. The first is that customers have lost interest in a fruit whose quality has often been a problem. The second concerns the importance of the role played on this market by supermarket and discount chains, which increasingly require private certification of the GLOBALGAP type. These criteria have contributed to gradually excluding batches of 'Smooth Cayenne'—late to receive certification. Practically all the 'Smooth Cayenne' pineapples sold in Germany were re-exported to Eastern European countries.

With the exception of the two periods of downward movement experienced on all the European markets, prices were fairly steady as a whole, with retail levels slightly lower than those of the other markets. This is explained mainly by the role played by discount stores in retailing and sales fluidity.

The market was not generously supplied with fruits at the beginning of the season. Demand for 'Sweet' was good but not such as to allow a distinct increase in price. The prices of the (small) batches of 'Smooth Cayenne' available in January and February were roughly the same as those of 'Sweet' and operators even regretted the absence of certification of some 'Smooth Cayenne' brands as this prevented them from releasing them on the German market. As the volumes of 'Sweet' increased steadily on the European markets from March onwards, 'Smooth Cayenne' prices were gradually left behind. The arrival of large volumes of 'Sweet' in June—when demand was focused on the season's fruits—put sales of 'Smooth Cayenne' under pressure. Sales of batches were observed at prices as low as EUR 3.00 per box, while the situation was hardly better on the 'Sweet' market, where sales were completed at around EUR 4.00 per box. Facilitated by the decrease in arrivals of 'Sweet', clearance of stored batches in July did not have expected effect on demand for 'Smooth Cayenne'. Operators therefore voluntarily halted supplies in the early weeks of July and did not resume buying until September. The return of batches of 'Smooth Cayenne' to the market coincided with a decrease in supplies from Latin America. The subsequent price recovery of 'Sweet' did not really benefit 'Smooth Cayenne' exports and these remained fairly stable. It is noted that supplies of 'Smooth Cayenne' to this market were nonetheless very limited throughout the season. In November, during the second period of falling prices, the small number of batches of 'Smooth Cayenne' were less hard-hit and even succeeded in holding at above 'Sweet' for a moment. Thanks to promotion operations, discount chains succeeded in improving the market by clearing stocks. This led to a slight rise in the prices of 'Sweet' and of 'Smooth Cayenne' for the Eastern European markets ■

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European pineapple imports by air

A market in danger?

Although pineapples are shipped by air to Belgium and Switzerland, markets as fully developed as France are rare. The operators specialised in this shipping method have stricter quality requirements than the others. Produce arriving by air is sold on niche markets and must therefore possess certain guarantees of quality and freshness that are stricter than those of fruits shipped by sea.

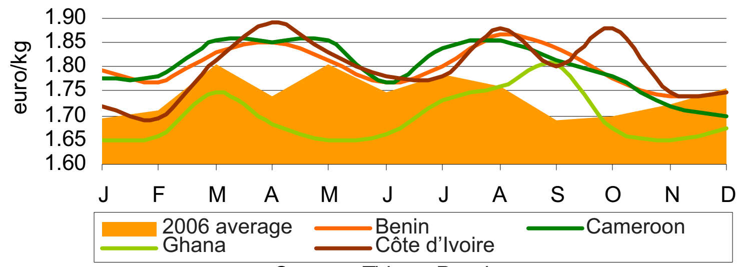
Accumulation of defects

The sources shipping pineapple to the French market by air are always criticised for much the same defects: the quality is too uneven and the goods delivered are not up to air quality standard. More specific note is also made of fruits frequently of dull appearance, the presence of scales and above all green fruits, whereas appearance and colour are among the key features in selling pineapples.

Varying according to the supplier country, defects can be grouped as problems resulting from production systems (farm gate fruit purchases and sometimes the absence of real production facilities) and packing infrastructure (no real facilities for handling and above all sorting the fruits). To these are added problems of packing and appearance, as the boxes are often not strong enough and the produce does not arrive at its best.

The 2007 season hardly differed from this and the accumulation of these small problems finally formed a serious handicap for the development of the market for pineapple shipped by air. What seems to have been caused by inadequate training of fruit sorters can only be regretted.

Pineapple by air - France - Monthly average import prices by origin in 2007



Source : Thierry Paqui

An increase in 'price after sale' agreements

Operators report an increase in sales on a price after sale basis. This now seems to have become standard practice on this market with importers using the system more and more in order to shift their stocks.

All the pineapples on the market were sold on practically the same price basis, with the exception of fruits from Ghana, for which freight costs are smaller.

The season was fairly satisfactory for exports of 'Smooth Cayenne' and 'Sugarloaf' from **Benin**. Although it can readily be affirmed that Benin ships fruits with good taste qualities, it should also be noted that the sector does not fully exploit its potential. The fruits were very irregular throughout the season, especially as regards colour. The best sales were concluded in March-April and August-September, two periods during which supplies of pineapple by air were particularly small, enabling operators to keep prices at a good level. However, it can be regretted that in spite of the very small supplies, prices cleared EUR 1.90 per kg only very rarely. Sales of fruits from Benin were also disturbed by the presence on the market of other pineapples from this source but of mediocre quality and available at very low prices. In certain cases, fruits were available at EUR 1.50 per kg when prices were around EUR 1.70-1.80 per kg. After seeming to be trying to replace shipments of 'Smooth Cayenne' in 2006, the volumes of 'Sugarloaf' fruits decreased. Their price was also less steady, with sales

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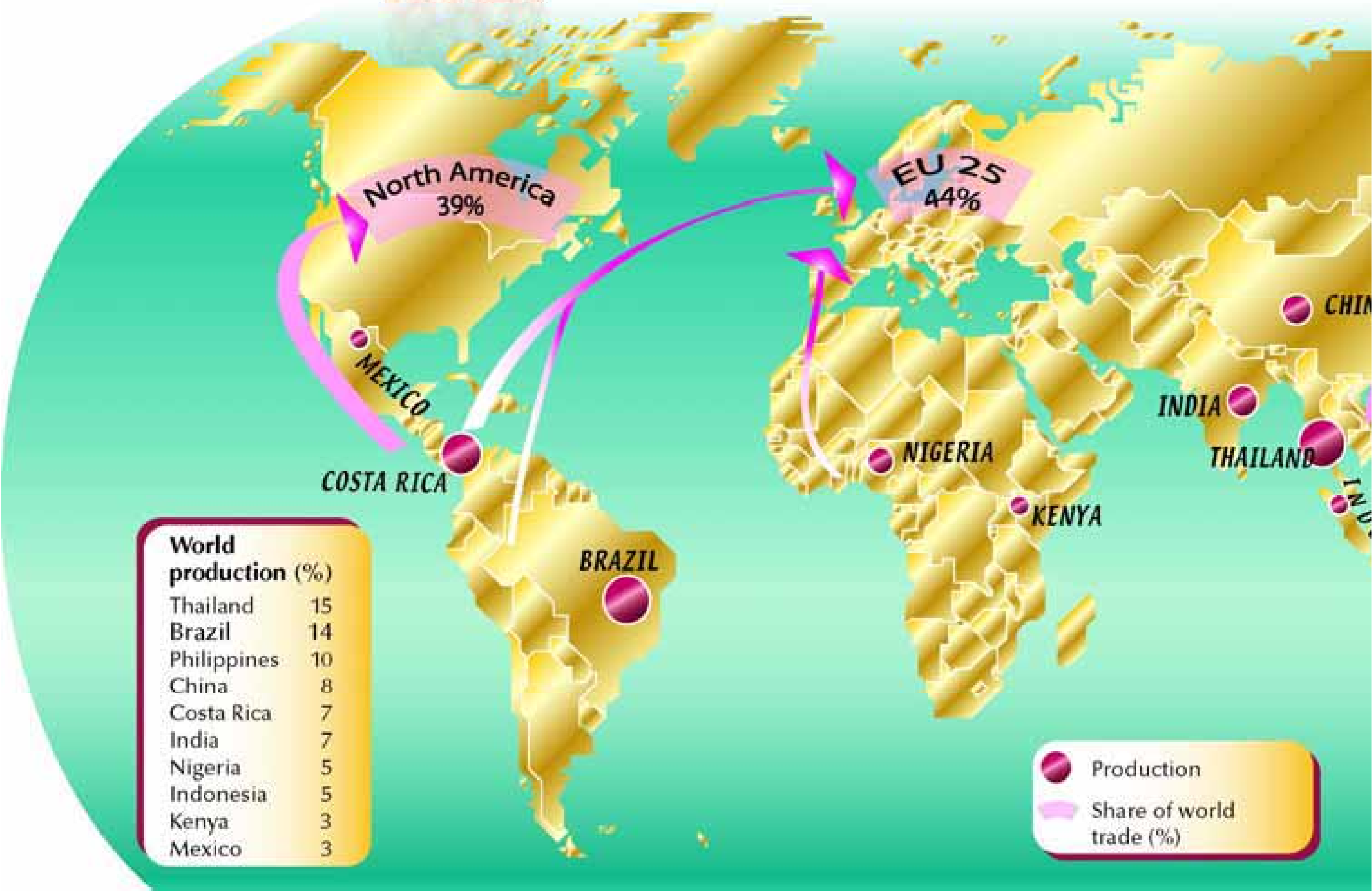
Pineapple...

production: 18 200 000 t
world trade: 2 000 000 t



Pineapple — United States imports

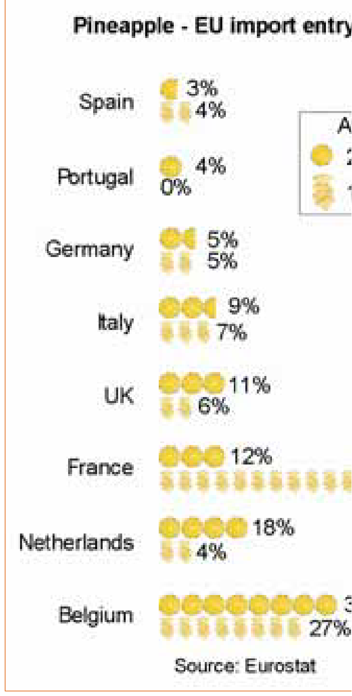
tonnes	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total	**135 255**	**203 993**	**252 848**	**283 097**	**318 837**	**321 299**	**405 714**	**476 660**	**511 050**	**577 792**	**634 069**	**696 820**
Costa Rica	84 695	154 183	200 899	226 029	257 783	261 199	344 731	399 826	392 323	438 954	522 520	574 954
Ecuador	3 943	4 193	2 289	5 163	6 505	8 443	17 780	28 578	33 608	37 199	35 830	33 411
Mexico	7 987	15 414	17 597	14 491	17 200	24 527	18 041	14 974	27 033	27 339	22 073	29 018
Guatemala	398	100	266	1 718	633	2 531	733	2 918	17 563	32 491	33 069	27 474
Honduras	27 099	24 680	26 950	33 555	32 841	20 122	20 629	24 728	34 419	32 988	12 685	20 160
Panama	2 553	256	136	0	125	255	422	482	1 762	3 774	3 373	7 754
Thailand	2 803	2 404	2 951	2 093	2 837	3 605	3 095	4 191	3 996	4 548	3 488	3 264
Others	5 778	2 763	1 760	48	913	617	284	962	347	458	1 032	786

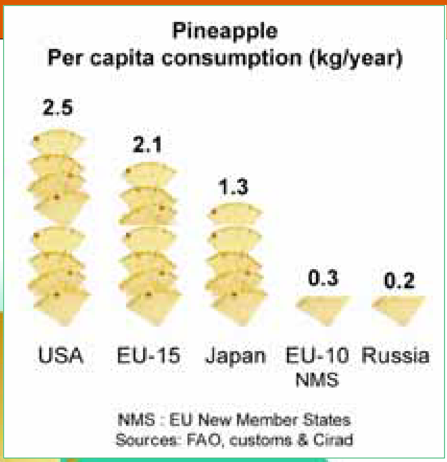
Source: US customs

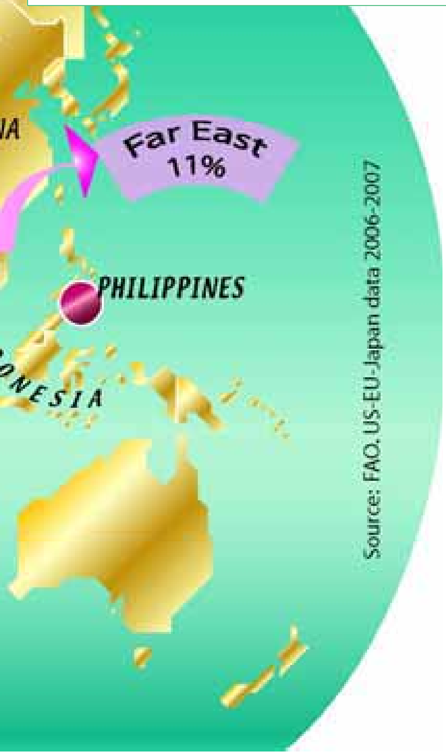
Pineapple — Japanese imports

tonnes	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total, incl.	**96 618**	**96 087**	**84 710**	**89 866**	**100 092**	**118 344**	**122 871**	**122 690**	**142 281**	**155 426**	**152 479**	**165 794**
Philippines	96 274	95 648	84 016	88 329	98 378	115 818	120 164	120 482	139 165	152 577	151 567	165 118
Taiwan	343	378	635	1 000	832	938	368	861	1 025	841	421	459
USA	1	1	12	-	-	533	1 138	579	1 786	1 751	385	16
China	-	28	30	261	416	533	730	596	263	252	106	167
Malaysia	-	-	-	-	274	255	197	-	19	-	-	-
Ecuador	-	-	-	-	-	26	3	-	-	-	-	-
Thailand	-	32	17	274	192	240	270	66	23	5	-	-

Source: Japanese customs (code 080430010)





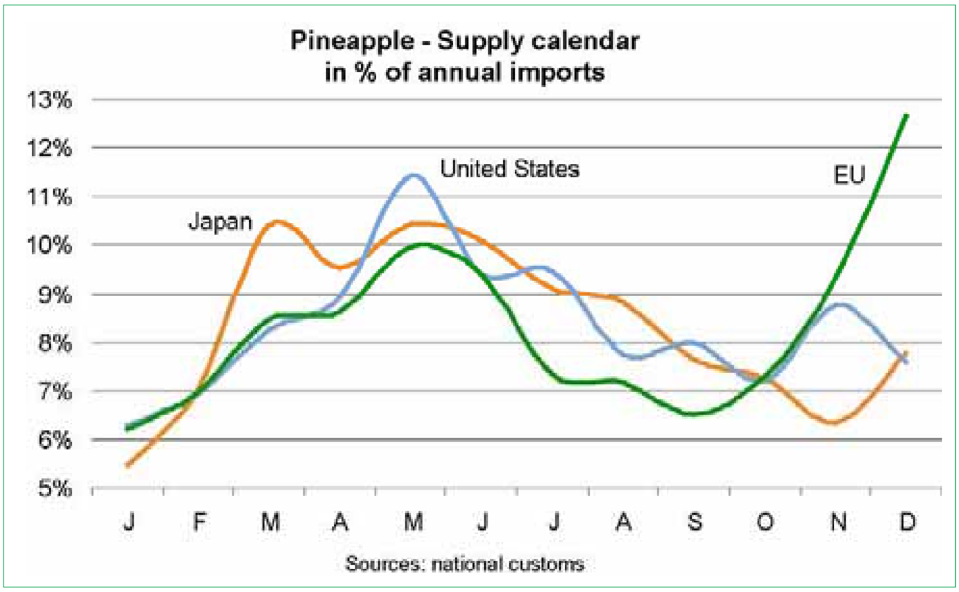


Pineapple World production	
2006	tonnes
World	**18 201 076**
Thailand	2 705 179
Brazil	2 487 116
Philippines	1 833 910
China	1 400 000
India	1 229 400
Costa Rica	1 200 000
Indonesia	925 082
Nigeria	895 000
Mexico	627 831
Kenya	600 000
Vietnam	470 000
Colombia	419 647
Venezuela	356 879

Pineapple World exports	
2007	tonnes
World	**2 000 000**
Costa Rica	1 346 326
Philippines	214 914
Ecuador	82 600
Honduras	61 069
Côte d'Ivoire	60 000
Ghana	49 196
Panama	45 000
Guatemala	40 359
Mexico	33 075
Brazil	26 000
Malaysia	19 445
United States	15 000
China	12 000

Pineapple World imports	
2007	tonnes
World	**2 000 000**
EU 15*, incl.	823 900
Belgium	281 093
Netherlands	158 463
United Kingdom	106 568
Italy	85 450
Spain	68 681
France	46 912
United States	697 000
Japan	165 800
Canada	83 929
NMS**	49 000
South Korea	48 763
Russia	22 870

* extra-Community origins, ** 12 EU New Member States / Sources: FAO, customs EU, USA, Japan



Pineapple — EU-25 — Imports and re-exports

tonnes	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total extra-EU, incl.	**274 772**	**281 449**	**263 211**	**332 581**	**318 289**	**367 017**	**369 483**	**410 889**	**521 933**	**609 484**	**770 927**	**823 883**
Costa Rica	64 312	83 400	79 024	106 225	112 740	135 024	139 172	179 154	250 425	363 169	500 128	565 737
Côte d'Ivoire	153 943	154 295	141 580	177 775	158 163	174 505	160 537	135 686	136 009	99 685	94 427	59 272
Ghana	22 191	23 912	18 968	25 659	29 321	32 590	35 745	43 093	51 421	44 984	40 109	35 182
Ecuador	133	16	521	1 233	348	3 564	7 823	19 575	27 521	32 598	36 570	49 243
Panama	0	18	214	16	17	35	0	3 649	9 627	12 111	31 394	37 150
Honduras	10 289	10 005	9 602	6 370	5 176	9 111	13 385	13 329	17 571	25 275	26 581	26 336
Brazil	114	18	107	54	52	220	230	802	10 233	12 675	16 382	26 367
Cameroon	3 156	3 604	5 747	5 710	2 975	2 098	2 005	3 484	3 963	4 411	8 493	9 291
Guatemala	74	8	12	9	31	73	471	570	3 476	3 255	4 678	3 715
South Africa	2 389	2 502	3 043	3 543	4 641	5 030	5 326	4 855	4 560	4 604	3 404	2 043
Thailand	565	556	747	1 404	1 154	844	1 625	2 158	1 772	1 985	3 359	3 692
Benin	861	320	341	357	591	676	898	936	1 206	1 155	1 333	1 874
Others	16 744	2 794	3 307	4 226	3 080	3 246	2 267	3 596	4 150	3 579	4 069	3 981
Total intra-EU, incl.	**145 602**	**139 250**	**127 659**	**189 707**	**160 238**	**182 877**	**234 559**	**247 772**	**287 963**	**344 425**	**433 840**	**418 164**
Netherlands	11 189	11 387	11 174	22 137	14 011	24 081	26 145	34 814	56 760	81 661	139 341	122 071
Belgium	35 450	30 466	26 890	43 945	38 885	31 545	48 285	50 398	75 128	102 314	117 123	149 027
France	78 775	74 588	67 316	90 343	78 639	86 301	106 340	84 325	75 830	59 748	55 745	32 701
Germany	9 564	8 221	8 891	11 987	12 023	8 915	11 586	25 209	32 052	44 511	47 020	29 535
Spain	5 211	6 810	3 318	4 762	5 795	16 216	13 836	7 812	8 309	12 835	18 211	27 828
Portugal	36	1 050	437	796	2 014	3 786	17 597	27 692	24 965	20 151	14 546	9 648
Italy	4 690	4 707	6 967	11 085	5 452	8 323	7 030	13 801	10 592	7 285	14 486	24 091

Source: Eurostat

concluded at between EUR 1.90 and 2.00 per kg against EUR 2.00 to 2.10 per kg in 2006.

Although their quality was more even, pineapples from **Cameroon** did not sell any better than those from Benin. The problem was the difficulty of really understanding Cameroonian supply. This was very variable, with very high quality fruits at high prices (EUR 1.75 to 1.90 per kg) and other fruit of more irregular quality that affected the overall image of the source and sold in price ranges that were often fairly low—towards EUR 1.60 or even 1.50 per kg.

Shipments from **Ghana** were the most regular in terms of volume. Apart from the fact that they sold at lower prices (smaller freight costs), the fruits from Ghana have a deplorable image but this did not prevent the sale of large quantities.

Supply from **Côte d'Ivoire** was fairly small, considering the production potential of the country. These very limited volumes of fruits displayed quality problems at the beginning of the season and this led operators to reduce supplies until these had been solved. Once quality had been stabilised, they were available in the same price range as those from other sources although better levels were negotiated when supply was small.

Guinea made another brief but noticeable incursion on the air pineapple market. Supplies were very limited in volume. The fruits were well prepared and set in a niche market, released by a company that tries to ensure a degree of control of the marketing of its produce. Unfortunately, the small volumes and quality concerns led to a fairly early stopping of shipments ■

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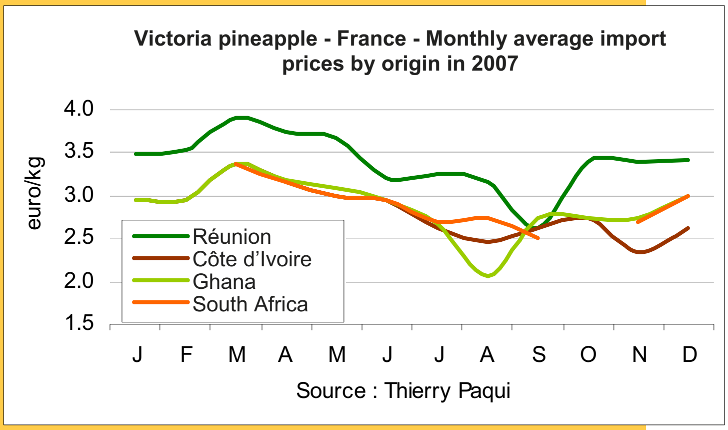
Disappointing Victoria

The 'Victoria' market forms the second part of air pineapple supplies. The sources examined in this analysis are those that were present on the market with the greatest regularity. The season was marked by very irregular supply and uneven quality of the batches received. Although Réunion is still the reference for quality, with batches standing out clearly from those from other sources, the volumes from Côte d'Ivoire and sometimes Ghana increased strongly, putting a degree of pressure on sales. Overall, supply of 'Victoria' was small and poorly distributed over the season. The season can be seen in three parts. First, from January to May supply was limited but demand, without being strong, was sufficient to ensure regular sales of the fruits released on the market. This was when operators obtained the best prices. The batches available were fairly irregular as regards quality, often lacking colour. From June, operators' demand was focused mainly on the season's fruits and did not return more strongly to 'Victoria' until the end of the season. Supply was still irregular as regards quality; the fruits were often greyish and found it difficult to gain a position on the market. Sales decreased, as did the prices that were considered to be too high for fruits of uneven quality. Prices continued to fall from June until the end of September. The price recovery observed at the end of the year—from October to December—resulted more from small supply than a recovery of demand. The season finished without either demand or sales making real progress. Prices did not increase in the way they usually do during the Christmas period, even though 'Victoria' is seen as a festive exotic. The season finished with operators being somewhat perplex about the future of trade in this fruit.



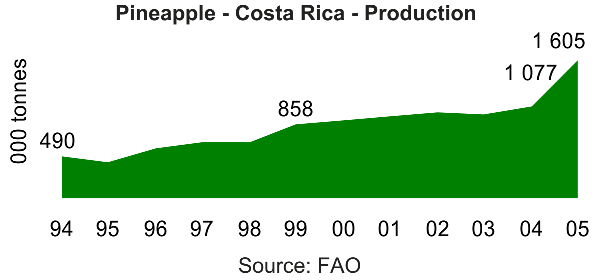
Producer country sheet

Pineapple in Costa Rica

In less than a decade, Costa Rica has become the world's fourth-largest producer and the leading exporter of pineapple. This explosive development is the result of the winning combination of a variety, 'Sweet', well-suited to international trade, and the industrial and commercial strength of Del Monte, a multinational group that has historically been the driving force behind pineapple growing in Costa Rica. The enormous increase in cultivated area and in the number of operators since 2003 in a context of strong increase of international competition has caused a distinct decrease in the profitability of the crop.

Production zones

The plantations, covering some 27 000 ha in 2005, are concentrated mainly in two areas of the large alluvial plain in the north-eastern part of the country. About 23% of national production is from the north of Limon province, around the town of Guacimo. High humidity makes cultivation conditions merely acceptable in this zone where banana growing is traditional, but the existence of infrastructure and the proximity of the port of Limon are strong points. The San Carlos region, further east, inland, has been in the leading position for a few years and accounts for approximately 50% of production. Cultivation conditions are excellent in this pioneer zone traditionally used for extensive livestock farming and where there are numerous small farmers. The zone in which the crop first developed—in Puntarenas province in the south of the country—is the site of about 27% of production. Del Monte is still by far the major stakeholder in this region with the vast PINDECO industrial plantation close to the town of Buenos Aires.

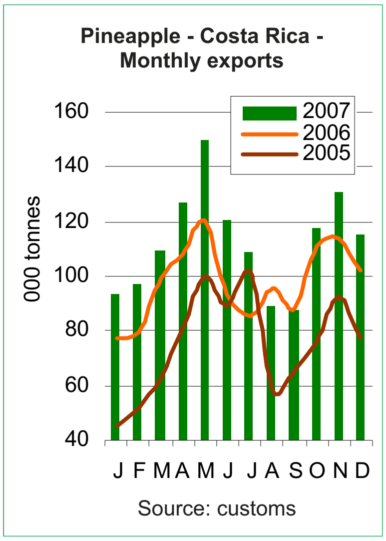


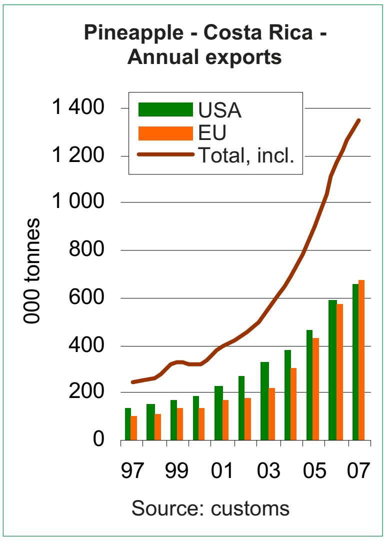
Pineapple - Costa Rica - Exports				
Tonnes	Total, incl.	United States	EU	Others
1997	**244 880**	134 898	103 271	6 712
1998	**264 563**	149 135	106 678	8 749
1999	**327 187**	170 730	136 224	20 232
2000	**323 064**	183 417	136 161	3 486
2001	**396 645**	227 016	165 963	3 666
2002	**454 672**	271 339	177 784	5 549
2003	**555 407**	331 601	221 548	2 259
2004	**694 140**	383 519	307 142	3 479
2005	**900 963**	466 755	432 517	1 691
2006	**1 175 697**	589 635	577 437	8 624
2007	**1 346 326**	655 095	677 209	14 022

Source: national customs

Production and exports

The emergence of the Costa Rican pineapple industry is recent and closely linked to the name Del Monte. The first stage in development was the setting up in 1978 of the PINDECO estate, a thoroughly modern industrial plantation devoted to exports of the 'Champaka' variety. Production reached 450 000 t at the end of the 1980s and then went no further as the skin of the variety remains green when ripe and it did not gain a good foothold on certain major markets. The introduction in the PINDECO estate of 'Sweet' (or 'MD-2'), with low acidity and well-suited to shipping by sea, combined with the power of a multinational company in production and marketing, was the beginning of an exemplary success story that radically changed the world market. Production began to increase rapidly in 1996 in response to clear commercial success in both the United States and Europe and approached a million tonnes at the beginning of the 2000s. The official entry of the variety in the public domain in 2003 caused a staggering increase in planted areas and the number of exporters—both in Costa Rica and in other Latin American countries. The volumes exported increased steadily, reaching 550 000 t in 2003, and have rocketed in the last three years, approaching 1.4 million tonnes in 2007. The area under 'Sweet' is still increasing in north-eastern Costa Rica in spite of the decrease in profitability and average quality in recent years.





Pineapple - Costa Rica - Monthly exports in 2007

	Total, incl.	USA	EU	Others
Jan.	93 338	48 114	43 669	1 555
Feb.	97 354	45 948	50 092	1 314
March	109 214	55 646	52 744	824
April	127 251	61 139	64 562	1 550
May	150 015	68 039	80 197	1 779
June	120 291	59 995	59 372	923
July	108 444	58 351	49 023	1 070
August	88 772	44 683	43 725	365
Sept.	87 642	49 395	37 469	778
Oct.	117 840	59 563	56 945	1 332
Nov.	130 863	51 147	78 215	1 501
Dec.	115 302	53 075	61 197	1 030
Total	**1 346 326**	**655 095**	**677 209**	**14 022**

Logistics

The fruits travel by road to the port of Limon, from where they are exported in specialised ships or containers to the two major markets—the United States and Europe (shipping time approximately 10 to 14 days to the EU in specialised ships).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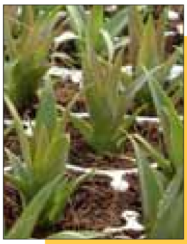

Pineapple growing

This article is drawn from three main sources:
- *'Crop management sequence - Pineapple', PIP, 52 pages. www.coleacp.org*
- *'L'ananas', Alain Guyot, ISTOM lectures*
- *'L'ananas, sa culture, ses produits', Claude Py & Claude Teisson, 568 pages, Maisonneuve et Larose*

The pineapple, *Ananas comosus*, a member of the Bromeliaceae family, originated in South America. Cultivated pineapple still has several traits of this parentage:

- its root system is extremely fragile and the plant prefers light, well-tilled soil;
- it tolerates very dry spells by strongly reducing growth but still surviving;
- the base of the leaves is the most efficient zone for uptake of nutrients and it responds well to foliar fertilisation;
- flowering is induced by low temperatures and short days and is erratic under natural conditions. This gives rise to the most remarkable feature of cultivation—flowering induced artificially by a cultural operation.

Growers can thus—almost at their wish—control harvest date and yield as fruit weight depends on the size of the plant at the moment at which flowering is induced artificially. Fruit quality is determined essentially by sugar content and acidity and varies considerably according to weather conditions and the fertilisation applied. In simple terms, nitrogen nutrition determines weight and potassium nutrition determines quality. It is an extremely heterogeneous compound fruit whose base is always at a later stage of development than the upper part. Pineapple is not climacteric and after harvesting the main change in the fruit is a gradual loss of its qualities. This deterioration must therefore be limited in the fresh fruit packing and transport chain—fast transport and sales with no breaks in the cold chain. When the fruit is processed, this must be performed as quickly as possible.

Cycle of the plant

Pineapple displays three main phases:

- **the vegetative phase** from planting to the differentiation of the inflorescence (flowering);
- **the fruiting phase** running from differentiation to harvesting of the fruits;
- **the sucker growth phase**: from fruit harvesting to the destruction of the plant.

The parts of an adult pineapple plant are as follows:

- **stalk**: a short club-shaped stem that contains starch reserves and has a fibrous structure that makes mechanical destruction difficult;
- **leaves**: with a maximum of 70 to 80, these can be more than 1 m long and 7 cm broad. Their appearance indicates the state of health of the plant and growth vigour;
- **fruit**: a compound fruit that is the equivalent of a fused, compressed bunch. Its weight depends on plant size at floral induction and the nutritional state of the plant at that stage. It is determined first of all by the number of eyes;
- **crown**: a leafy part topping the fruit;
- **roots**: underground and aerial. The underground roots are fragile and the slightest discontinuity of the soil profile strongly disturbs growth. The roots are put out in the first month after planting. They then just lengthen and no new root emission takes place before the fourth or fifth month;
- **shoots**: these are of two types—slips, that grow on the stalk beneath the fruit and true shoots that grow at the leaf insertion point on the stalk.

Cultivation

- **Soil**: alluvial or volcanic at an elevation of less than 600 metres. Deep soil. Good drainage. Gentle slopes (less than 4%). As 'Sweet' is susceptible to *Phytophthora* (a fungal disease), the ideal soil pH range is 5.0 to 6.5.
- **Plants**: 50 000 to 70 000 plants per hectare. The quality of planting material is of fundamental importance: genetically pure 'Sweet' material with no defects (spines, diseases, etc.), of uniform size (calibrated in 100 g categories), propagules must be as heavy as possible to shorten the cultivation period (but not too heavy as natural flowering should be avoided) and treated with registered pesticides to prevent the spread of pests and diseases.
- **Post-harvest**: 'Sweet' is susceptible to bruising.
- **Nutrition**: fertiliser is applied by spraying every two weeks. The fertilisation programme starts after the harvest.
- **Weeds**: these can reduce yields and harbour pests and diseases that attack planted fields if they are not eradicated in time.

Control of flowering

When the plant reaches the appropriate stage of development it becomes sensitive to climatic factors and meteorological factors (day-length, decrease of minimum temperature and cloud cover) that determine the differentiation of the inflorescence. Natural flowering then occurs that is not compatible with the commercial management of a plantation. Floral induction treatment (FIT) consists of changing the natural cycle of the plant for the following purposes:

- homogenisation of flowing;
- control of production;
- control of average fruit weight;
- harvest planning.

The date of FIT is determined according to:

- the harvest date desired;
- the FIT to harvest time for the period (historical or calculated from the sums of temperatures);
- plant weight (a good indicator being the weight of leaf 'D') that determines that of the fruit.

Three floral induction substances are used:

- acetylene in calcium carbide form: grains are placed in the centre of the floral rosette or mixed with water to make an acetylene solution;
- ethylene gas: less dangerous than acetylene, treatment with an ethylene solution can be mechanised;
- ethephon (Ethrel®): this is an ethylene generator. It is much easier to use than the first two alternatives but the results are often mediocre, especially in very hot conditions.

Protection from sunscald

This seasonal phenomenon occurs above all during very sunny periods. Fruits that have lodged, whose stalks are too long or that have a deficient leaf system are those most exposed to sunscald. Several protective methods can be used: tying the leaves in a bunch over the fruit or the whole crop ridge, mulching with grass, lifting up lodged fruits.

Degreening treatment

This is performed by application of Ethrel and is to achieve homogeneous fruit colour and reduce the number of picking operations. Ethrel releases ethylene as it breaks down. It does not have an effect on all maturation phenomena but mainly targets colour. It must be applied fairly close to natural fruit maturity in order to be effective with no major disadvantages. Fruits treated in this way are easy to recognise as their colour is not scaled from bottom to top but uniform in the whole shell.

Ethephon maximum 0.5 mg/kg: the date is approaching

It is planned to lower the maximum residue limit (MRL) for ethephon in EU fresh pineapple imports by 75% from 2 to 0.5 mg/kg. Both Latin American and African producers expressed their concern to the European Commission when this drastic decrease was announced and criticised the analyses that led to setting the level. Supported by PIP (Programme Initiative Pesticides), they have requested, and apparently obtained, a re-examination of the situation. The Bayer company that manufactures the product should be able to make such a request to EFSA (European Food Security Authority) that will deliver its opinion to the European Commission. MRLs are to be harmonised in Europe on 1 September 2008 and this could include the new MRL for pineapple.

Sunscald

Potassium deficiency

Sunscald

Phosphorus deficiency

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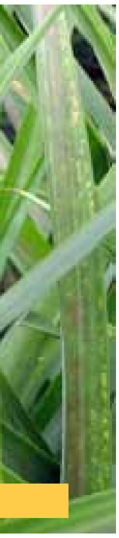
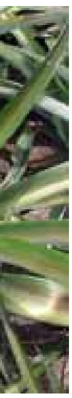
Magnesium deficiency





Nutritional deficiency			
	Required amounts	**Symptoms**	**Critical level and analysis**
Nitrogen	High	• Pale colour. General yellowing of leaves. • Older leaves show first symptoms. • Reddish edges. • Narrow leaves. • Poor and stunted growth. • Delayed fruiting.	Deficiency detected by visual observations. **Critical level**: 0.10 % dry weight. Sample the centre portion of the D leaf for analysis.
Potassium	High	• In young plants leaves have dark green colour. • In older plants leaves are yellow. • Crown growth is excessive. • Siamese crowns are produced. • Slow growth of slips. • Tips of old leaves die off.	**Critical level**: 0.3% dry weight. Sample the basal portion of the D leaf for chemical analysis.
Magnesium	Medium	• Older leaves have bright yellow colouring. • There are less leaves per plant. • Leaves are weak and necrotic. • Plants have short stems. • Appearance of leaves resembles sunburn. • Poor root system. • Poor fruit development.	**Critical level**: 0.025% fresh weight. Sample the basal portion of the D leaf. Visual symptoms are difficult to observe and laboratory analyses are necessary to assess deficiencies.
Phosphorus	Medium and small	• Poor root growth. • Delayed growth. • Older leaves have purple/red colouring. • Leaves have yellow edges. • Poor fruit development.	Visual symptoms are rarely observed with normal fertiliser practice. The symptoms can be noticed only when the deficiencies are severe. For this reason leaf tissue analysis is required for diagnosis. **Critical level**: 0.020 % fresh weight. Sample: basal portion of the D leaf. Excess of phosphorus can reduce plant growth.
Calcium	It is required in large amounts when used as an amendment to the soil, but not in direct foliar sprays to the plant except for planting material production.	• Growth is stunted. • Corky leaves. • Short leaves. • Stems are malformed. • Fruit is abnormal (Siamese, multiple, fasciated). • Plant has yucca appearance.	**Critical level**: 0.010% fresh weight. Sample the basal portion of the D leaf for analysis because the colour of the leaves is not a key guide in determining deficiencies. Check pH of soil periodically.
Iron	Small	• Leaves are yellowish with green mottling. • Tips of leaves become necrotic. • Fruit is small. • Fruit has red skin and is hard. • Crowns have yellowish colour. • Fruit shows cracks.	**Critical level**: 3 ppm fresh tissue. Sample the middle portion of D leaf. Visual symptoms are used as a diagnosis for deficiencies and laboratory analysis is not always representative of the deficiency.
Zinc	Small	• Crooked neck on young plants. • The heart leaf becomes hard and brittle. • Blisters appear on the upper surface of leaves. • The crowns are small and rosette. • The plants become bunchy.	**Critical level**: Only the sampling of the tip of the stem will provide a reliable indication of the zinc content. Leaf analysis is not reliable. Look for visual symptoms.
Boron	Small	• Peel will develop corky tissue. • Corky flesh develops on and in between eyes. • Cracks develop on and between fruitlets.	**Critical level**: The symptoms are unknown. Deficient plants will not have any symptoms in leaves, stems or roots. Check fruit visually for symptoms of deficiency.

Source: PIP

The main pineapple varieties

'Smooth Cayenne' was for a long time practically the only variety exported fresh and canned. The Hawaiian hybrid 'MD-2' took over its position on the fresh pineapple market, mainly as a result of its extraordinary capacity for withstanding cold and transport. The robustness of this fruit after harvesting was hitherto unknown and is opening up new prospects in the breeding of new varieties by hybridisation. Other varieties with good taste qualities are preferred on domestic markets but do not keep at all well: 'Perola' in Brazil and 'Queen' in Asia and the Indian Ocean.

Sweet

Leaf edges: spines occur irregularly along both margins
Fruit shape: cylindrical
Fruit colour: green & yellow
Fruit eye diameter: medium
Fruit eye profile: flat
Flesh colour: yellow
Flesh firmness: medium
Flesh texture: smooth
Weight without crown: 1 300 g
Height without crown: 143.4 mm
Diameter: 115.7 mm
°Brix : between 12.8 and 13.7
Acidity (meq%ml): between 6.15 and 10.10
Sugar/acid ratio: between 1.31 and 2.11
Flesh maturity homogeneity from the bottom to the top: homogeneous
Agronomic potential: high yielding. Maturation more rapid than Smooth Cayenne (- 4 to - 5 days)
Susceptibility: low susceptibility to core rot, very susceptible to *Phytophthora*, average susceptibility to soil pests
Post-harvest potential: good, not susceptible to internal browning

Smooth Cayenne

Leaf edges: spines behind tip only
Fruit shape: cylindrical
Fruit colour: green & yellow
Fruit eye diameter: medium
Fruit eye profile: slightly proeminent
Flesh colour: pale yellow
Flesh firmness: medium
Flesh texture: smooth
Weight without crown: 1 410 g
Height without crown: 148.2 mm
Diameter: 120.7 mm
°Brix : between 14.5 and 16.5
Acidity (meq%ml): between 13.5 and 15.0
Sugar/acid ratio: between 1.0 and 1.2
Flesh maturity homogeneity from the bottom to the top: with a gradient
Agronomic potential: high yielding
Susceptibility: susceptible to core rot, susceptible to *Phytophthora*, susceptible to soil pests
Post-harvest potential: good, susceptible to internal browning

Victoria

Leaf edges: spines along all margins
Fruit shape: trapezoid
Fruit colour: golden yellow
Fruit eye diameter: small
Fruit eye profile: proeminent
Flesh colour: yellow
Flesh firmness: medium
Flesh texture: crisp
Weight without crown: 1 200 g
Height without crown: 171.6 mm
Diameter: 107.6 mm
°Brix : 14.8
Acidity (meq%ml): 10.9
Sugar/acid ratio: 1.36
Flesh maturity homogeneity from the bottom to the top: with a medium gradient
Agronomic potential: good yielding. Maturation more rapid than Smooth Cayenne (- 10 to - 15 days)
Susceptibility: very susceptible to core rot, susceptible to *Phytophthora*, susceptible to soil pests
Post-harvest potential: very susceptible to internal browning

Note: under production conditions in Martinique, source Cirad