Where Is the Citrus Industry Going?*

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During the last 25 years, the world production of citrus has grown approximately 70% while the processing of citrus increased approximately 100%, more than doubling the production of citrus and its by-products (such as aromas and essence oils) during the period.

In this article I'll show where citrus fruits are produced today, the amounts of different citrus fruits processed today and the locations of the major markets for citrus products today. I'll also discuss the future of this industry. I'll suggest where new citrus trees should be planted, and I'll consider the nature and location of the demand for citrus products in the next decades.

* Adapted from the author's presentation in October 1996 at the IFEAT Annual Congress in Tel Aviv, Israel.

World Citrus Production

Citrus fruits are by far the most commonly grown fruit. Total citrus produced worldwide is nearly 80 million metric tons, primarily from Brazil (22%), the Mediterranean region (21%) and the United States (18%). Tables I-V show a breakdown of world citrus production in 1995 by main citrus type (orange, tangerine, lemon/lime, grapefruit) and by producing country.

Table I. World citrus fruit production in 1995 (in thousands of metric tons)

oranges	53,410
tangerines	13,251
lemons/limes	7,653
grapefruits	5,561
Total	**79,875**

Source: FAO and ABECITRUS

Table II. Orange production in 1995 by the main producing countries (in thousands of metric tons)

Brazil	16,300
USA	10,900
Mexico	2,700
Spain	2,500
Egypt	1,900
Italy	1,770
Greece	875
Morocco	870
Turkey	780
Israel	460
others	14,355
Total	**53,410**

Source: FAO and ABECITRUS

Table III. Tangerine production in 1995 by the main producing countries (in thousands of metric tons)

China	4,560
Spain	1,635
Japan	1,500
Brazil	612
Italy	510
Turkey	495
USA	406
Argentina	393
Morocco	372
Egypt	358
Mexico	145
Israel	130
Algeria	111
others	2,024
Total	**13,251**

Source: FAO and ABECITRUS

The Citrus Industry

Approximately 34% of the total 80 million metric tons of citrus fruits produced in the world are processed into citrus juices and their by-products. Table VI shows a breakdown of 1995 world citrus processing by main citrus type.

Nearly 85% of total worldwide orange processing occurs in Brazil and

Table IV. Lemon/lime production in 1995 by the main producing countries (in thousands of metric tons)

USA	937
Mexico	847
Brazil	730
Italy	680
Argentina	650
Spain	428
Turkey	410
Egypt	221
Greece	130
others	2,623
Total	**7,656**

Source: FAO and ABECITRUS

Table V. Grapefruit production in 1995 by the main producing countries (in thousands of metric tons)

USA	2,504
China	460
Israel	387
Cuba	230
Argentina	197
South Africa	154
Mexico	120
Cyprus	100
others	1,409
Total	5,561

Source: FAO and ABECITRUS

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the United States—principally in the state of São Paulo (where 96% of Brazilian orange processing occurs) and Florida (which accounts for 95% of American domestic processing). Tables VII-X summarize citrus processing by main citrus type and by country in 1995.

Citrus Products and By-Products

Table XI shows the total products and by-products recovered from citrus fruits processed worldwide.

From the 27 million metric tons of citrus processed worldwide, orange juice is the main product. Production is nearly 2.4 million metric tons of 65° Brix equivalent concentrated orange juice or 13 billion liters of 11.5° Brix equivalent single strength orange juice. Those oranges also produce approximately 100,000 metric tons of orange peel oil and d-limonene, 38,000 metric tons of water phase essence and 4,500 metric tons of orange oil phase essence.

The total 65° Brix equivalent concentrated tangerine juice produced is around 83,000 metric tons, equivalent to 450 million liters of single strength tangerine juice. Also, 3,000 metric tons of peel oil and d-limonene are recovered from the total of 845,000 metric tons of tangerines processed worldwide.

The total 400 GPL equivalent concentrated lemon juice produced is around 116,000 metric tons; nearly 5,500 metric tons of lemon/lime peel oil also are produced.

From the total of 2 million metric tons of grapefruit processed in the world, 165,000 metric tons of 58° Brix equivalent concentrated grapefruit juice are produced; equivalent to 920 million liters of single strength grapefruit juice. The total grapefruit peel oil produced is around 3,500 metric tons.

World Demand for Processed Citrus Products

The world demand for processed citrus juices today is very close to the world production. Grapefruit juice is probably the only citrus product whose production seems to be a little higher than world consumption. Table XII shows the annual consumption of single-strength equivalent citrus juices worldwide in 1995.

The consumption of orange/tangerine juice in North America, during the past few years, is just following the population growth rate in those countries. The Western European market for orange/tangerine juice, which has grown around 6% per year during the last ten years, will probably keep a growth rate of 3-4% during the next few years. In the Eastern European market, orange juice consumption is growing very quickly. Japan, South Korea and other countries in the Pacific area probably will maintain at least a 10% annual growth in orange juice consumption during the next few years.

Table VI. World citrus fruit processing output in 1995 (in thousands of metric tons)

oranges	23,040
tangerines	845
lemons/limes	1,555
grapefruits	1,950
Total	**27,390**

Source: FAO and ABECITRUS

Table VII. Orange processing output in 1995 by the main processing countries (in thousands of metric tons)

Brazil	19,795
USA	8,813
Spain	605
Italy	510
Mexico	440
Australia	243
Greece	220
Israel	200
South Africa	166
Argentina	150
Egypt	126
others	772
Total	**23,040**

Source: FAO and ABECITRUS

Table VIII. Tangerine processing output in 1995 by the main processing countries (in thousands of metric tons)

Brazil	204
Spain	175
USA	161
Japan	90
Turkey	75
others	140
Total	**845**

Source: FAO and ABECITRUS

Table IX. Lemon/lime processing output in 1995 by the main processing countries (in thousands of metric tons)

USA	471
Argentina	450
Italy	235
Mexico	150
Spain	97
others	152
Total	**1,555**

Source: FAO and ABECITRUS

Table X. Grapefruit processing output in 1995 by the main processing countries (in thousands of metric tons)

USA	1,354
Israel	250
Cuba	105
Argentina	63
South Africa	40
others	138
Total	**1,950**

Source: FAO and ABECITRUS

Table XI. Estimated 1995 output of citrus juices and their by-products worldwide (in metric tons)

concentrated orange juice 65° Brix	2,380,000
concentrated tangerine juice 65° Brix	83,000
concentrated lemon juice 400 GPL	116,000
concentrated grapefruit juice 58° Brix	165,000
orange peel oil	68,000
tangerine peel oil	1,500
lemon and lime peel oil	5,440
grapefruit peel oil	3,500
d-limonene	36,000
orange water phase essence	38,000
orange oil phase essence	4,500

In the South American countries, mainly in the Mercosul area (Brazil, Argentina, Uruguay and Paraguay), consumers who are used to drinking large quantities of freshly squeezed orange juice are now drinking more industrialized orange juice.

The increasing demand for orange and tangerine juices in these countries will increase consumption at a level of 4-5% annually during the next few years.

The demand for lemon juice is expected to be stable in developed countries during the next few years, but consumption will increase in developing countries.

Apparently consumption of grapefruit juice will have the lowest growth rate of all processed citrus juices. There will be no increase in consumption of this juice in the traditional consumer market, and the developing countries have no tradition of consuming either grapefruit juice or fresh grapefruit.

Regarding citrus by-products, high prices on the world market last year forced Florida orange processors to improve their oil recovery from processed oranges. This caused higher production worldwide of orange oil and d-limonene, and a consequent price reduction for those products. Should price for those products stay at this low level, processors will have no interest in keeping production levels high.

During 1996, 40,000 metric tons of orange oil/d-limonene were directed to terpenic resin production, leaving about 62,000 metric tons of these products for the regular market. The orange processors now intend to direct part of the remaining portion of these products to the petroleum industry in order to bring orange oil and d-limonene prices to an acceptable level for both producers and consumers.

The production of orange water phase essence today, at a level of 38,000 metric tons, is higher than the world market can handle. During recent years the addition of water phase essence into reconstituted orange juices has been replaced by orange oil phase essence. This caused an excess supply of orange water phase essence. This is a high value product whose utility has yet to be found by aroma and flavor producers.

Table XII. World consumption of processed citrus juices in 1995 (in millions of liters)

	Orange/ tangerine 11.5° Brix	Lime/ lemon 57 GPL	Grapefruit 10° Brix
USA/Canada	6,110	410	402
Western Europe	5,400	360	423
Japan	550	50	58
South Korea	340	10	NA
others	1,050	80	17
Total	**13,450**	**910**	**900**

NA = data not available
Source: FAO

Replacing part of the water phase essence with oil phase essence in reconstituting orange juice, and increasing the production of not-from-concentrated orange juices (to which orange oil phase essence is added to reinforce the flavor) were two factors that worked together to raise the demand for orange oil phase essence to excessive levels during the last few years. Production of 4,500 metric tons is not enough to cover the continuously growing use of this product.

Production of lemon/lime oil probably will not be enough to cover the demand for this product in the near future.

The probable reduction in grapefruit processing will also reduce the production of grapefruit peel oil. This means that there may be a shortage of this product in the near future.

Future Demand

We have seen that the United States, Canada and Western Europe consume more than 85% of the total orange and tangerine juices produced worldwide. In Brazil and other countries that are currently heavy consumers of freshly squeezed citrus juices, consumption habits are changing, and those countries will very soon become great consumers of industrialized citrus juices. Eastern European countries, influenced by their neighbors to the west, also will become great consumers of these juices in a short time.

Russia and the other countries of the former Soviet Union, followed by China and, later, India, also will become consumers of industrialized citrus juices.

Japan, South Korea and other countries in the Pacific Rim also will increase their per capita citrus juice consumption.

Based on all these future consumers, it is not difficult to forecast that consumption of citrus juices will grow at least 4% per year during the next 20 years.

The question is: Will the citrus industry be able to supply this potential growing market with sufficient volume and affordable prices? This projected 4% annual growth rate means that the citrus industry will have to more than double the present volume of citrus fruit production and processing.

Future Supply of Oranges

A look into the near future suggests that the world citrus industry will have some problems meeting the increasing demand for citrus juices, especially orange juice. These problems begin with the two main suppliers of orange juice in the world market: the states of Florida in the United States and São Paulo in Brazil. Low prices paid to orange growers in Florida and Brazil during the last few years, in addition to some problems with diseases in citrus groves in São Paulo, may keep orange production stable or even reduce it in these two areas.

The number of new citrus trees

planted in Florida per year during the last three years is one-third the number of new trees planted every year from 1986 to 1992. This is just enough to replace the old trees that were removed in the same period. This means that, at best, Florida can meet the total needs for orange juice in the United States in the coming years, but it probably will have no orange juice available for export.

In São Paulo there were 200 million orange trees in cultivation several years ago. In theory, those trees could increase orange production to 16 million metric tons in the next few years. However, many orange growers eradicated trees during the past two years. Many other orange growers who did not eradicate their orange trees didn't use good fertilization practices and pest controls in their groves. These growers will find it impossible to restore their orange trees to good fruit production.

Moreover, orange growers in São Paulo are currently facing another serious problem: citrus variegated chlorosis (CVC). This disease first appeared in a few Brazilian citrus groves some years ago. It is now spreading very quickly into many other citrus groves. CVC is caused by a bacteria that provokes the chlorosis of the orange tree leaves. The fruits of the trees with CVC are very small and hard, which makes them unfit both for fresh consumption and for processing into juice. At this moment, the only way to combat this disease is by eradicating sick trees.

The reduction of orange production in Sao Paulo will depend on how long it takes orange growers to find a way to combat this bacteria, or how long it takes to develop orange trees resistant to the bacteria.

Future Plantings of Oranges

Even if the CVC problem is solved, many orange trees will have to be planted to cover the future demand for orange juice. Where will the new citrus groves be planted and, as a consequence, where will the new citrus industries be located?

In theory, any land located in a band between 38° North latitude and 35° South latitude could be used to grow citrus plants since that area has no freeze risk, has good conditions for soil mechanization and has enough rainfall or enough water for irrigation.

If we are specifically considering the production of oranges to be processed into juice, then we need to look at a narrower band between 27° North and 25° South latitude, because oranges produced in this area yield juices with the Brix:acid ratio best accepted by orange juice consumers. This narrower band represents a 30% reduction in the total area available for planting new orange trees.

Furthermore, areas with climate conditions that are too tropical should be avoided. With oranges from very

tropical areas, the Brix:acid ratio is acceptable, but the acidity in the juice drops so quickly during ripening that the crop processing period is extremely short—so short it makes processing costs too high.

Therefore, future plantings of orange trees for use in juice processing should be limited to two narrow bands: between 10° and 27° North latitude and between 10° and 25° South latitude.

Conclusion

Citrus juices, with the ideal combination of acid and sugars and their special aromas and flavors, are the most palatable of all juices, accepted worldwide by consumers of any age.

The total production of citrus today, 80 million metric tons, is produced on 3.5 million hectares of land in many different countries on five continents. Those fruits are harvested from 1 billion citrus trees.

The 6 billion people on Earth consume about 13 kg of citrus fruits per capita per year, the equivalent of 6 liters of citrus juice per capita per year.

Of the total citrus production, 34% is processed into juice and by-products. Worldwide, average consumption of industrialized citrus juices is no more than 2.5 liters per capita per year. Some countries (such as the U.S. and Germany) consume more than 20 liters per capita per year.

It is easy to conclude from those numbers that the world citrus industry has to grow at least 5% annually to supply future demands for citrus juices. At least 16 million citrus trees have be planted every year. More citrus plantings may be required to support a simultaneously increasing demand for fresh citrus fruits. The best places for this production are areas having good climate conditions: hot summers, and mild winters with no freeze risk.

In the northern hemisphere, south Florida will probably continue to lead production. Southern Mexico, some Central American countries and Caribbean Isles, Venezuela and the south of China have the best possibilities to increase their orange plantations for orange juice production.

In the southern hemisphere, São Paulo in Brazil still has the best conditions to keep the leading position in citrus juice production. Some other areas in central Brazil, northern Argentina, Paraguay, some countries in southern Africa and a small part of Australia have good conditions to expand their citrus groves and their citrus processing.

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