

## THE CITRUS INDUSTRIES OF THE UNITED STATES AND MEXICO AFTER NAFTA

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The United States and Mexico are two of the largest citrus producing and consuming regions in the world. As such, implementation of the North America Free Trade Agreement (NAFTA) was likely to have major implications for the citrus industries of these two countries. The United States protected its processed orange industry with a sizeable tariff on imported orange juice. The United States used smaller, seasonally adjusted tariffs on imported fresh citrus. Mexico imposed a flat ad valorem tariff of 20 percent on most fresh and processed citrus products. With the prospect of these tariffs being eliminated under NAFTA, concern was expressed by citrus producers in both countries.

NAFTA was implemented on January 1, 1994. The likely impact of NAFTA on various sectors of both U.S. and Mexican agriculture was the subject of intensive study by researchers in both the United States and Mexico. One of the more comprehensive volumes was prepared by the American Farm Bureau Federation. Other studies related to the citrus industry include Gomez Cruz and Rindermann (1992); Buxton *et al.* (1994); Gómez Cruz and Rindermann (1994); Spreen and Brown (1994); Spreen *et al.* (1992); and Spreen *et al.* (1996). The implications of the studies vary widely. For example, Buxton *et al.* (1994) projected a major decline in Florida orange production and a major increase in Mexican orange production. Spreen *et al.* (1992) on the other hand, projected that Florida would continue its recovery from freezes of the 1980s, and while Mexican orange juice production would increase, Mexico would not gain a major share of the U.S. orange juice market. Furthermore, the presence of the Mexican fruit fly would inhibit Mexico's ability to export large quantities of fresh citrus to the United States.

The purpose of this paper is to visit the citrus industries of Mexico and the United States, five years after the implementation of NAFTA. The focus of the paper will be on the processed orange market and Persian limes.

### WORLD ORANGE PRODUCTION

World orange production among the major producing countries is shown in Table 1. Brazil is the world's largest

producing country. Its production in the 1997-1998 season was nearly 19 million metric tons or more than 30 percent of total world production. The United States is the second largest producing country production exceeding 12.6 million tons in 1997-1998. Mexico is now ranked as the third largest producing country followed by Spain, China, and Italy. Other significant orange producing countries not shown in Table 1 include South Africa, Israel, Egypt, Iran, Cuba, Costa Rica, Belize, Japan, and Australia.

Orange juice production in the 1996-1997 season among major producing countries is shown in Table 2. Brazil and the United States account for 93 percent of world orange juice production. In particular, the state of Sao Paulo in Brazil and Florida in the United States are the dominant producing areas for orange juice. While Mexico is the third largest orange juice producing country, its share of world orange juice production was 1.5 percent in the 1996-1997 season.

Orange juice consumption among the major consuming countries for 1995 is shown in Figure 1. The United States and the European Union are, by far, the largest markets for orange juice in the world. The United States and the European Union account for nearly 45 and 40 percent, respectively, of world orange juice consumption. Canada is the third largest market with about five percent. The United States and Canada have the highest rates of per capita consumption with approximately 19 liters per person.

Both total consumption and per capita consumption in other countries outside of Europe, Canada, and the United States is small by comparison. Although Mexico is identified as the fifth largest market, its per capita consumption is approximately 1.5 liters. Still, Mexico is the largest processed orange market in Latin America. The likely evolution of citrus consumption in Latin America away from the purchase of fresh oranges, which are juiced at home, toward direct purchase of orange juice represents a major opportunity for citrus processors in Mexico.

TABLE 1. World orange production.

Country	Average		1994-95	1995-96	1996-97	1997-98 Preliminary
	70-71/78-79	80-81/88-89				
	----- 1 000 tons -----					
Brazil	6,083.7	10,530.9	13,460.0	16,520.0	16,973.0	18972.0
Unidad States	8,751.2	7,630.1	10,474.9	10,452.8	11,598.4	12,663.4
Mexico	1,324.4	1,601.9	3,570.0	3,590.0	3,500.0	3,700.0
Spain	1,860.4	1,885.2	2,759.2	2,512.0	2,248.0	2,806.0
China	392.0	407.0	1,633.2	1,727.0	1,850.0	2,806.0
Italy	1,584.2	1,929.4	1,809.0	2,119.0	2,180.8	2,000.0
Others	11,445.5	14,639.2	18,087.5	18,727.7	18,208.3	18,147.8
World Total	31,441.4	38,623.7	51,793.8	55,648.5	56,558.5	60,375.2

Sources: FAO, FASS

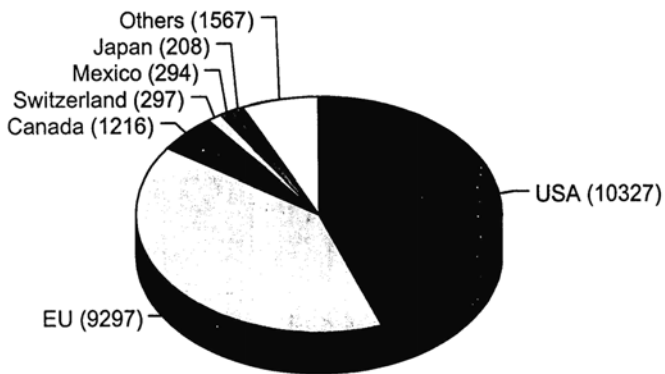


Figure 1. Processed orange consumption in major consuming countries, 1995. Source: FAO (Data in 1000 tons).

TABLE 2. Orange production in major producing countries, 1996-1997

Country	Production (tons) 65 degree brix	Percent of Total (%)
Brazil	1,360,000	53.04
United States	1,029,000	40.13
Mexico	40,000	1.56
Spain	39,000	1.52
Italy	33,858	1.32
Others	62,340	2.43
Total	2,564,198	100.00

Source: FAO

### ORANGE JUICE PRODUCTION IN THE UNITED STATES

While citrus is produced in the states of California, Arizona, Texas, and Florida, Florida is the largest citrus

producing state. In the 1996-1997 season, Florida accounted for more than 75% of all oranges produced in the United States. Florida also produced nearly 80% of all grapefruit grown in the United States. The citrus sector of Florida differs markedly from that found in California, Arizona, and Texas in that citrus producers in California, Arizona, and Texas gear their production for the fresh market. Processed utilization in those states comes almost exclusively that fruit which does not meet fresh market standards. This fruit is called eliminated fruit or simply "eliminations". In Florida, a large proportion of both the orange and grapefruit crop is sent directly from the grove to the processing plant. Processed utilization of oranges in Florida typically exceeds 90%, while processed utilization of grapefruit is approximately 50%.

In Figure 2, the number of bearing orange trees in Florida and the land area occupied by those trees is shown. Note the steep decline in bearing tree numbers between 1980 and 1986 which was a result of a series of damaging freezes which visited Florida during that period; by 1992, bearing tree numbers had recovered to pre-freeze levels. The Florida industry recovered rapidly from a series of freezes which visited the state in the 1980's. In the most recent tree census conducted as of January 1, 1998, there were 78.5 million bearing orange trees in Florida which covered nearly 625,000 acres (253,000 hectares). The record number of orange trees in Florida explains why Florida established a record high level of production 244 million boxes (9.96 million tons) in the 1997-1998 season.

Also note that even though tree numbers in 1998 far exceed tree numbers from the 1970's, the land area planted to orange trees is slightly larger at 625,000 acres compared to 571,000 acres in 1998. These figures confirm that tree density, the number of trees planted per unit of land area, has increased dramatically the past 20 years. Tree density was 82 trees per acre (202 trees per hectare) in the 1978-1979 season, and by the 1997-1998 season,

average reported tree density was 129 trees per acre (319 trees per hectare). A recent survey by the University of Florida suggests that most new plantings are at densities ranging from 145 to 175 trees per acre with some growers planting at densities as high as 250 trees per acre.

Higher tree densities offer the advantage that per acre yields are much higher at younger tree ages compared to lower densities. It is believed that more densely planted young trees make better use of applied fertilizer, and therefore mature more rapidly. A problem is encountered, however, as trees grow, and their canopies begin to grow together. They compete for sunlight and moisture. As more is learned about higher density groves, it is becoming apparent that although per acre yields of high density groves are comparable to low density groves, yield per tree is much lower. This fact has led many to question projections that orange production in Florida will exceed 300 million boxes (12.25 million tons) within 10 years. It is likely, however, that Florida production will continue to expand above current levels as the current tree inventory is still relatively young.

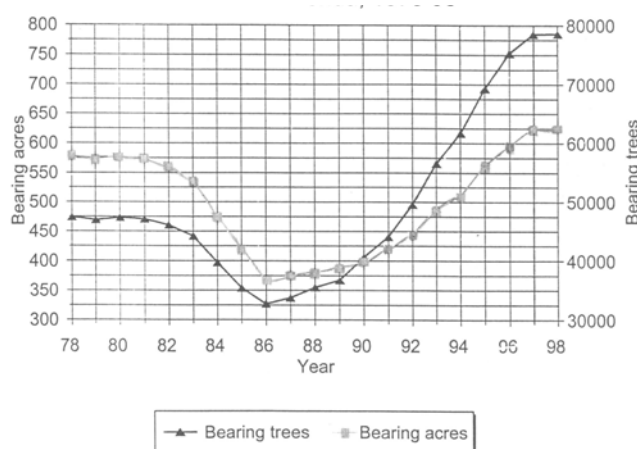


Figure 2. Orange bearing trees and acres in Florida, 1978-98. Source: Florida Agricultural Statistics Service.

## THE ROLE OF SAO PAULO IN THE WORLD MARKET

In the world orange juice market, the main competitor to Florida is the state of Sao Paulo in Brazil. Orange juice production from the 1980-1981 season through the 1997-1998 season with forecasted production for the 1998-1999 season for both Florida and Sao Paulo is shown in Table 3. One can see from this table that Florida lost its position as the world's largest orange juice producing region in the early 1980's. Production in Florida reached a low point of 542 million SSE gallons in the freeze affected year of 1989-1990. Since that time, production has increased rapidly, reaching a record level of 1.49 billion SSE gallons in the 1997-1998 season.

Spurred by high world prices for orange juice resulting from decreased Florida production in the 1980's, production in Sao Paulo expanded rapidly, more than doubling

the level produced in the 1980-1981 season. Sao Paulo orange juice production peaked at 1.89 billion SSE gallons in the 1997-1998 season. Inclement weather from El Niño decreased Sao Paulo production in the 1998-1999 season, but a recently released production forecast for the 1999-2000 season indicates that Sao Paulo will remain the world's largest producer of oranges and orange juice.

TABLE 3. Orange juice production in Florida, U.S.A. and Sao Paulo, Brazil

Season	Florida	Sao Paulo
----- Million SSE gallons -----		
1980-81	857	685
1981-82	643	839
1982-83	801	791
1983-84	593	865
1984-85	569	1092
1985-86	638	1198
1986-87	707	824
1987-88	831	961
1988-89	886	961
1989-90	542	1427
1990-91	841	1167
1991-92	811	1281
1992-93	1131	1532
1993-94	1057	1483
1994-95	1206	1546
1995-96	1213	1479
1996-97	1350	1546
1997-98	1487	1884
1998-99	*1188	1462

\* Forecast  
Source: Florida Department of Citrus

## THE U.S. ORANGE JUICE IMPORT MARKET

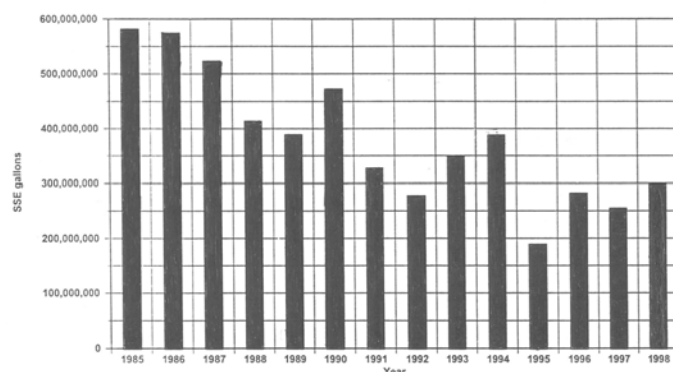
In Figure 3, U.S.A. imports of orange juice are shown. After peaking at nearly 600 million SSE gallons in 1985, U.S.A. orange imports declined as orange production in Florida recovered. By 1995, U.S.A. orange juice imports were less than 200 million SSE gallons. Since that year, imports have increased and were nearly 300 million SSE gallons in 1998. It is likely that imports in 1999 will also range between 250 and 300 million SSE gallons. U.S.A. orange juice exports have grown strongly in the 1990's. In 1997, U.S.A. exports were nearly 200 million SSE gallons which that its net imports were less than 100 million SSE gallons.

U.S.A. orange juice imports disaggregated by country of origin for 1996 through 1998 are shown in Table 4. Brazil remains the largest import supplier to the U.S.A.

market. With recent investment by the four largest processing companies<sup>1</sup> based in Brazil in Florida, a new relationship between Florida and Sao Paulo has been formed. It is likely, therefore, that these companies will look to their plants in Brazil as their first choice to meet blending needs in the United States.

Mexico is the second largest import supplier to the United States. In 1998, Mexican citrus processors shipped 67.8 million SSE gallons to the United States, a level well above that observed in the previous two years. The higher level of exports in 1998 was due to both the large orange crop in Mexico during the 1997-1998 season and the high prices that persisted in the U.S.A. market throughout 1998 despite the record high crop in Florida in the 1997-1998 season. In December 1997, orange juice prices in the United States jumped after industry sources in Brazil suggested that the Sao Paulo orange crop would be substantially smaller in the 1998-1999 season. The USDA Brazilian crop forecast released in June 1998 confirmed the expectation that the Sao Paulo crop would be 25 percent smaller than the previous season. The Sao Paulo 1998-1999 season ended in January, and preliminary data indicates that while the orange crop was substantially smaller, the decline in Sao Paulo orange juice production was less than 25 percent (Table 4). Consequently, U.S.A. orange juice prices have declined substantially to date in 1999.

The other major import suppliers of orange juice to the United States are Costa Rica, Belize, and Honduras which enjoy duty-free access to the U.S. market under the Caribbean Basin Economic Recovery Act (CBERA), also known as the Caribbean Basin Initiative (CBI). Orange production in both Costa Rica and Belize has increased substantially in recent with both new plantings and new investment in citrus processing facilities. The citrus industry of Honduras, however, was devastated by Hurricane Mitch in 1998. Therefore, orange juice production in Central America will decline as Honduras attempts to rebuild its north coast.



**Figure 3. U.S.A. imports of orange juice 1985 through 1998.**  
Source: U.S.A. Department of Commerce.

<sup>1</sup> At the time of their investment, the companies used were the four largest citrus processing companies operating in Brazil. In the past year, Citrovita and Cambuey merged, and the combined company likely ranks as third largest citrus processor in Brazil behind Cutrale and Citrosuco.

**TABLE 4. U.S.A. imports of orange juice by country of origin.**

Country	1996	1997	1998
	-----	Million gallons	-----
Brazil	201.7	155.9	188.7
Mexico	49.7	50.9	67.8
CBERA	28.5	45.9	40.6
Others	1.6	1.3	1.8
Total	281.5	254.0	298.9

CBERA Caribbean Basin Economic Recovery Act  
Source: U. S.A. Department of Commerce

### RECENT TRENDS IN U.S.A. ORANGE JUICE CONSUMPTION

Orange juice sales in the United States by product category over the 1993-1994 through 1997-1998 period are shown in Table 5. Frozen or FCOJ had been the predominant form in which U.S.A. consumers purchased orange juice in the 1970s and early 1980s. Reconstituted chilled orange juice, known simply as "recon", grew in importance beginning in the mid-1980's. By 1990, it had supplanted FCOJ as the most popular product form in the U.S.A. market. By 1993-1994, not-from-concentrate (NFC) orange juice was becoming increasingly more important in the U.S.A. market. In the 1997-1998 season, chilled orange juice which includes both recon and NFC accounted for more than 75 percent of orange juice sales in the United States. Both product categories continue to grow at the expense of FCOJ.

The increasing importance of NFC has significant implications for Mexican citrus processing companies. As discussed elsewhere in this paper, the new alliances formed between Florida-based and Sao Paul-based citrus processing companies suggest that Brazil will continue to be the largest import supplier to the U.S. market. Due to high transportation costs, Brazil is unlikely to supply NFC to the United States. Given Mexico's proximity to the central and western United States, it is logical to argue that Mexico could well become an alternative source of NFC for the U.S.A. market.

**TABLE 5. U.S.A. orange juice sales by product category**

Product form	93-94	94-95	95-96	96-97	97-98
	Million gallons				
Frozen	260.9	239.7	214.4	194.3	175.3
Refrigerated NFC	192.7	211.0	218.0	229.2	267.5
Refrigerated recon	337.6	346.1	343.8	371.9	365.2
Total refrigerated	530.3	557.1	561.8	601.1	632.7
Shelf stable	12.1	10.8	10.2	9.5	9.1
Total	803.3	807.6	786.4	804.9	817.1

Source: Nielsen (retail stores \$2 million and greater, representing 60-70% of whole market)

## ORANGE PRODUCTION TRENDS IN MEXICO

The number of bearing orange trees and the land area occupied by those trees over the 1989-1990 to 1998-1999 seasons is shown in Table 6. Both bearing tree numbers and bearing area have nearly doubled over the past nine seasons. The economic factors which spurred the expansion of the orange industry in Mexico include freezes which devastated Florida also caused widespread damage in Nuevo Leon. Decreased production in Nuevo Leon resulted in higher prices in the domestic market in Mexico. Combined with high world prices for orange juice, it is not surprising that tree numbers in Mexico grew rapidly through the decade of the 1990's. It is also possible that Mexican orange growers expanded production in anticipation of increased access to the U.S.A. market resulting from the implementation of NAFTA.

Unlike their counterparts in Florida, Mexican orange growers did not substantially increase tree density during the rapid expansion of the industry. Over the nine-year period depicted in Table 6, tree density increased slightly from 200 to 202 trees per hectare.

Orange production in the United States and Mexico over the period 1985-1986 through 1997-1998 is shown in Table 7. United States production is disaggregated into Florida and the other citrus producing states of California, Arizona, and Texas. Note that production in Mexico has increased by 178 percent over this period, while production in the United States has grown by 85 percent. Nearly all of the growth in the United States has occurred in Florida. Except for the 1997-1998 season, production in the other U.S.A. states has been flat.

Utilization of oranges in Mexico over the 1985-1986 through 1997-1998 period is shown in Table 8. Nearly all of the increase in domestic production has been absorbed by the domestic market as fresh fruit. Exports of fresh fruit have remained virtually unchanged, while imports show a large percent of growth, but remain small compared to domestic production. The increase in imports of fresh oranges coincides with the implementation of NAFTA which eased restrictions on imports of oranges from California and Arizona<sup>2</sup>

As orange production in Mexico has expanded, processed utilization in Mexico has not kept pace. The relationship between total orange production and processed utilization is depicted in Figure 4. As shown in this graph, processed utilization as a percentage of total utilization has declined. For example, in the 1985-1986 season, processed utilization was 20 percent of total utilization,

and in the 1997-1998 season, processed utilization was 16.7 percent.

Why has the processing sector in Mexico failed to flourish, even with the reduction of the U.S. orange juice tariff negotiated under NAFTA? First, as shown in Table 9, the phased reduction in the U.S.A. tariff on imports of orange juice negotiated under NAFTA is scheduled to take place over a 15-year period. A tariff-rate quota on the first 40 million SSE gallons of FCOJ and the first four million SSE gallons of single-strength orange juice was established. The tariff charged under the tariff-rate quota is one-half of the tariff prevailing at the time that the agreement was signed, which was \$0.35 per SSE gallon for FCOJ and \$0.20 per gallon for single strength orange juice<sup>3</sup>. The over-quota tariff rate is being reduced over a 15-year period, but 85 percent of the most-favored nation (MFN) tariff will still be applied in 2003, the 10th year of the NAFTA.

Another factor which has a negative influence on the Mexican processing sector is poor coordination between growers and processors. The Mexican citrus industry is oriented toward serving the domestic market with oranges that are juiced at home. The processing sector appears to be content to be a residual buyer of oranges. The domestic market for fresh oranges has remained relatively strong despite the economic recession that Mexico endured resulting from the sharp currency devaluation in late 1994.

A third factor is the domestic market for oranges in Mexico is still a fresh market. Mexican citrus processors have made little progress in developing a domestic market for orange juice purchased in processed form. During the author's visit in May 1999, a wider variety of both pure orange juice and blended orange juice products were available in supermarkets. These products are sold in one liter tetra packs which do not need refrigeration until the package is opened. Prices for these products, however, were quite high, especially when compared to retail prices for orange juice in the United States. As seen in Table 10, most of the orange juice produced in Mexico is exported, and the largest export destination is the United States. Other destinations for Mexican orange juice include Europe and Japan.

In summary, the processing sector in Mexico remains underdeveloped. It has not yet found either domestic or export markets for orange juice which are large enough to encourage increased processed utilization of oranges in Mexico.

<sup>2</sup> Imports of fresh citrus from Florida has been limited by a phytosanitary restriction imposed by the Government of Mexico over concerns of the Caribbean fruit fly.

<sup>3</sup> With the tariff reductions negotiated under the Uruguay Round of GATT, the tariff imposed by the United States on FCOJ imports is being reduced by 15 percent over a six-year period beginning in 1995. For more information, see Spreen and Mondragón, (1996).

**TABLE 6. Orange bearing trees and bearing area in Mexico**

Crop year	Hectáres	1000 Trees
1989-90	160,000	32,000
1990-91	170,000	34,000
1991-92	185,000	37,000
1992-93	215,000	43,000
1993-94	260,000	50,000
1994-95	273,000	55,000
1995-96	270,000	54,000
1996-97	307,000	62,100
1997-98	314,000	63,430
1998-99	315,000	63,630

Source: Foreign Agricultural Service, USDA

**TABLE 7. Orange production in the United States and Mexico**

Crop year	United States			Mexico
	Florida	Other States	Total	
	----- 1000 tons -----			
85-86	4868	1917	6784	1400
86-87	4888	2096	6985	1680
87-88	5635	2124	7760	1942
88-89	5986	2134	8121	2268
89-90	4500	2528	7028	1900
90-91	6191	931	7122	2300
91-92	5709	2376	8084	2100
92-93	7620	2355	9975	2700
93-94	7123	2250	9373	3174
94-95	8392	1982	10374	3570
95-96	8302	2066	10368	3590
96-97	9237	2267	11504	3917
97-98	9964	2611	12574	3900

Source: Florida Agricultural Statistical Service; Foreign Agricultural Service, USDA

**TABLE 8. Production and utilization of oranges in Mexico**

Season	Availability			Utilization	
	Production	imports	Exports	Fresh	Proc- essed
	----- 1000 tons -----				
8546	1410	0	11	1119	291
8647	1683	0	11	1340	343
8748	1942	0	9	1542	400

The citrus industries...

8849	2269	1	8	1925	344
89-90	1903	3	3	1433	470
90-91	2301	1	25	1911	390
91-92	2101	1	10	1951	150
92-93	2701	1	3	2481	220
93-94	3175	1	2	2835	340
94-95	3571	1	10	2821	750
95-96	3600	10	8	3150	450
96-97	3931	14	11	3481	450
97-98	3915	15	9	3265	650

Source: Foreign Agricultural Service, USDA

**TABLE 9. Tariff rate quota schedule for imported mexican orange juice under NAFTA.**

Year	FCOJ <sup>z</sup>		SSOJ <sup>y</sup>			
	In-quota <sup>x</sup>	Over-quota	Snap-back <sup>w</sup>	In-quota	Over-quota	Snap-back <sup>w</sup>
	cents per SSE gallon					
1994	17.5	34.1	35.0	10.0	18.7	18.7
1995	17.5	33.3	34.1	10.0	17.4	17.4
1996	17.5	32.4	33.2	10.0	16.1	17.0
1997	17.5	31.5	32.4	10.0	14.7	17.0
1998	17.5	30.6	31.5	10.0	13.4	17.0
1999	17.5	29.8	30.6	10.0	12.0	17.0
2000	17.5	29.7	29.7	10.0	10.7	17.0
2001	17.5	29.7	29.7	9.4	9.4	17.0
2002	17.5	29.7	29.7	8.0	8.0	17.0
2003	17.5	29.7	29.7	6.7	6.7	17.0
2004	17.5	23.5	29.7	5.3	5.3	17.0
2005	17.5	17.8	29.7	4.0	4.0	17.0
2006	17.5	11.9	29.7	2.7	2.7	17.0
2007	5.9	5.9	29.7	1.3	1.3	17.0
2008	0	0	29.7	0	0	17.0

<sup>z</sup> Denotes frozen concentrated orange juice<sup>y</sup> Denotes single strength orange juice<sup>x</sup> Tariff applied to first 40 million SSE gallons of FCOJ imports from Mexico<sup>w</sup> Tariff applied to imports from Mexico exceeding 70 million SSE gallons from 1994 through 2002 and to imports from Mexico exceeding 90 million SSE gallons from 2003 through 2008 Tariff applied to first 4 million gallons of SSOJ imports from Mexico

Source: North American Free Trade Agreement, Office of the U.S. Trade Representative

**TABLE 10. Mexican orange juice utilization**

Utilization	1991	1992	1993	1994	1995	1996	1997
	Tons (65°Brix)						
Domestic consumption	1,400	2,000	2,000	2,000	2,280	2,126	3,201
Exports	33,810	51,700	20,200	37,216	62,095	42,875	42,300



U.S.	33,384	41,816	14,588	31,303	45,685	31,604	35,943
Other	426	9,884	5,612	5,913	16,410	11,271	6,357
Total	69,020	105,400	42,400	76,432	126,470	87,876	87,801

Source: Foreign Agricultural Service, USDA

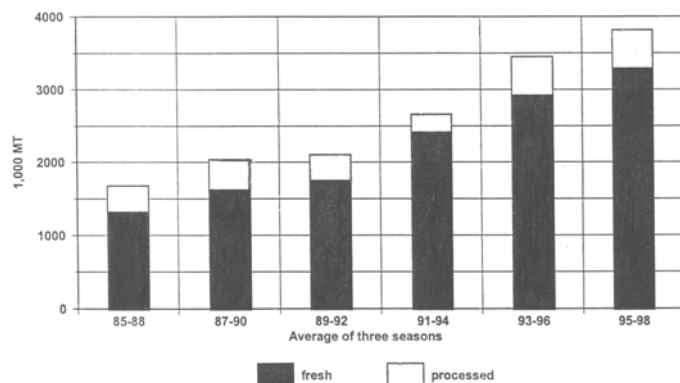


Figure 4. Production/utilization of oranges in Mexico.

### PERSIAN LIMES IN THE UNITED STATES AND MEXICO

Two varieties of limes are produced and consumed in the United States and Mexico. The Mexican lime, known as key limes in the United States, is the most popular lime in Mexico. Persian limes, also called Tahiti limes in the United States, are the most popular lime in the United States. Persian limes are generally larger and contain more juice than Mexican limes. Mexican limes have a longer shelf life, which is attractive in Mexico with its lack of refrigeration.

Lime production in the United States is restricted to extreme south Florida and parts of southern California because limes are highly sensitive to freezing weather. Therefore, the United States has been a net importer of limes for many years. In 1992, Hurricane Andrew struck the main lime producing area of Florida, Dade County, and destroyed most of its lime industry.

Florida lime production, on-tree price, and oil-tree value over the period spanning 1984-1985 through 1997-1998 is shown in Table 11. One can see the devastating impact of Hurricane Andrew on the lime industry of Dade County. In the 1980's, production fluctuated between 1.2 and 1.7 million boxes<sup>4</sup>. The year after the hurricane, production fell to 200,000 boxes. While production has recovered somewhat to 440,000 boxes in the 1997-1998 season, prices have not. The oil-tree value of the industry of \$2.2 million is one-fifth of that realized before the hurricane.

In Figure 5, per capita lime consumption in the United States from 1980 to 1998 is shown. This graph offers a sharp contrast to the plight of the Florida lime industry.

Per capita consumption has shown steady growth, from less than 0.4 pounds in 1980 to more than 1.4 pounds in 1998, and an increase of more than 250%. In comparison, per capita lemon (Italian lemons) consumption in the United States has remained relatively flat at 2.75 pounds.

As shown in Figure 6, the large increase in limes consumption in the United States has been supported by a rapid expansion of lime exports from Mexico. In 1985, Florida limes had the largest share of the U.S.A. lime market. Mexico was the second largest supplier, followed by California, and imports from other countries, primarily the Bahamas and Jamaica. By 1998, however, Florida production was substantially smaller, and California production had nearly vanished. Imports from other countries have also diminished. Thus Mexico is now the dominant supplier of limes to the U.S.A. market, accounting for approximately 90 percent of total U.S.A. consumption. Nearly all lime consumption in the United States is of the Persian variety.

The outlook for Mexican-produced Persian limes in the U.S.A. market remains strong. While bearing tree numbers in south Florida have recovered to 410,000 trees in the 1997-1998 season compared to a low of 256,000 trees in the 1994-1995 season, this figure is well below the 983,000 bearing trees that were present before Hurricane Andrew struck in August 1992. The prime lime production area in Florida is located near the metropolitan Miami area and is subject to competition for land and water from both population growth and increased environmental concerns. Furthermore, as lime prices in the 1997-1998 season were at historically low levels, it is unlikely that Florida lime production will recover to its pre-Hurricane Andrew level.

Low lime prices for Florida lime growers also mean low lime prices for Mexican lime growers. It is likely that the Mexican lime industry has expanded too quickly in its efforts to supply the U.S.A. market. While Europe (especially France) and Japan are alternative export markets for Persian limes from Mexico, these markets are small relative to the U.S.A. market. For more information on the Persian lime industry in Mexico and the United States, see Roy *et al.* (1996).

TABLE 11. Florida limes: utilization, season average on-tree price, and value

Crop Year	Utilization	On-tree price	Value
	1000 Boxes	\$ per box	thousand \$
1984-85	1,640	7.27	11,927
1985-86	1,725	7.94	13,692
1986-87	1,450	8.57	12,424
1987-88	1,300	12.69	16,493
1988-89	1,250	11.29	14,112
1989-90	1,650	8.26	13,634
1990-91	1,450	13.99	20,289

<sup>4</sup> One box of limes in Florida weighs 88 pounds.

1991-92	1,600	9.12	14,589
1992-93	1,000	1.02	2,540
1993-94	200	12.70	2,540
1994-95	230	8.65	1,989
1995-96	300	8.05	2,414
1996-97	320	6.93	2,216
1997-98	440	5.02	2,210

Source: Florida Agricultural Statistics Services

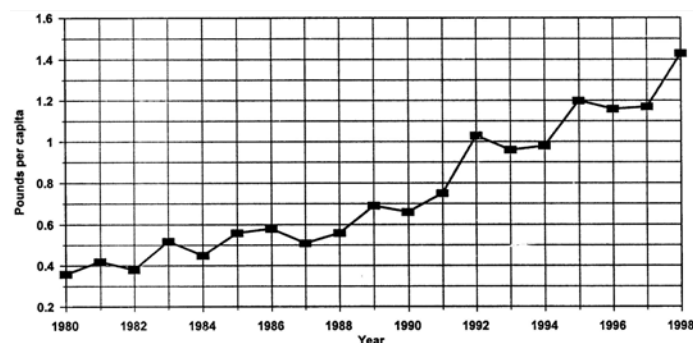


Figure 5. U.S. Persian lime per capita consumption. Source: Lime Administrative Committee.

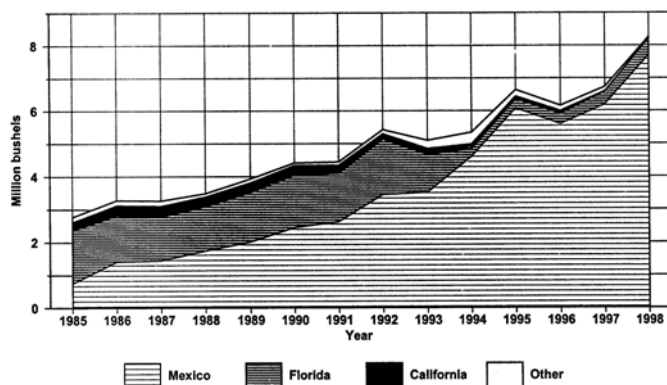


Figure 6. Persian lime volume by origin. Source: Lime Administration Committee.

## CONCLUDING COMMENTS

The citrus industries of the United States and Mexico are the second and third largest, respectively, citrus producing countries in the world. With few exceptions, citrus production in both countries is geared to serve their respective markets, with exports not playing a major role. The domestic markets of two countries are quite different. The United States is predominantly a processed orange market; it has the highest per capita consumption of orange juice in the world. In Mexico, consumers buy oranges in fresh form and produce juice at home. As such, the quality characteristics of the citrus sold in the two countries are quite different. Not surprisingly, the implementation of NAFTA has not resulted

in a substantial increase in trade in citrus products between the two countries. Orange juice consumption in Mexico has increased marginally. There have been increases in fresh citrus between the two countries, but the level of trade remains quite small relative to total consumption.

The exception to this observation is Persian lime exports from Mexico. Persian lime exports to the United States were on an upward path before the implementation of NAFTA. Although NAFTA resulted in elimination of the U.S.A. tariff on lime imports from Mexico, this tariff was relatively small. Thus, NAFTA has probably acted as a small stimulus for Persian lime trade.

As NAFTA continues to promote economic integration of the United States and Mexico, it is likely that consumer preferences for citrus products may converge. In that scenario, increased citrus trade between the two countries will result. That scenario, however, may be many years on the future.

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