

Global economics and marketing of citrus products

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23.1 Introduction

Citrus is grown throughout the tropical and subtropical regions of the world. It is marketed in a variety of outlets, but an important distinction is the utilization of citrus in fresh versus processed form. Processed citrus products include juice, both single-strength and concentrated, and canned citrus products. Processed citrus also yields marketable citrus by-products, including citrus pulp and peel (generally transformed into animal feed), molasses, citrus oils, D-limonene, and essences.

In this chapter, the discussion is organized around the four major varieties of commercial citrus products: sweet oranges, mandarins, grapefruit (including pummelos), and lemons (including limes). The categories are fresh utilization, processed utilization (juice and canned sections), and by-products from juice processing.

The largest citrus producers include (in order) China, Brazil, and the United States. The three largest producing countries have citrus industries that vary greatly. In China, production mostly occurs on small, mixed crop farms and nearly all production is marketed domestically. Brazil is characterized by very large farms, and a large proportion of its production is sent for processing into juice. Nearly all Brazilian produced orange juice is exported to Western Europe and North America. There are small and medium-sized growers in Brazil producing fresh fruit for the domestic market. In both China and Brazil, the domestic market is informal, with little grading of fruit, little or no government inspection and oversight, and a little collection of data on volume and prices.^a The United States has a range of small, medium, and large farms. The most important citrus-producing states (in order) are Florida, California, Texas, and Arizona. Florida orange production is mainly sent for processing into juice, while the other states focus on production for the fresh market. There is a great deal of government oversight in terms of fruit grading, market standards, and data collection compared to China and Brazil.

23.2 Sweet oranges

A list of the leading orange producing countries is shown in [Table 23.1](#) for the period between 2000 and 2016, the most recent year with published data. Among the three largest producing countries, Brazil and the United States have experienced substantial production declines in recent years; the US production declined by nearly 50% over the sample period. Huanglongbing (HLB and also known as citrus greening) is the main contributor to the production decline.

Allocation of sweet orange production between fresh and processed utilization by major producing countries is shown in [Table 23.2](#), based on the most recent data available. Brazil and the United States are the two primary suppliers of orange juice to the world market, although, in recent years, Mexico's share of world supply has grown with the decline in the US production. Other suppliers of orange juice include Costa Rica, Belize, China, Australia, South Africa, Spain, and Italy. Of these smaller producing countries, Costa Rica, Belize, and South Africa export all or nearly all of their production while the others supply their respective domestic markets.^b

a. However, these observations are evolving in Brazil as industry-based organizations have recently released an orange tree census and production estimates; and likewise, in China very recently there has been a substantial increase in e-commerce, bringing with it much higher quality expectations among consumers.

b. In the case of Spain and Italy, "domestic market" is defined as the EU market.

TABLE 23.1 Sweet orange production by major growing countries, selected years, 1999–2000 through 2015–16.

	Million MT					
	1999–2000	2004–05	2009–10	2011–12	2013–14	2015–16
Brazil	16,524	16,606	15,830	20,482	16,850	14,350
China	2,710	4,200	6,500	6,600	7,600	7,000
United States	11,894	8,293	7,478	8,166	6,153	5,371
Mexico	2,881	4,120	4,051	3,666	4,400	3,535
EU-27 ^a	n/a	n/a	6,244	6,023	6,712	6,055
Spain ^a	2,710	2,700	n/a	n/a	n/a	n/a
Italy ^a	1,900	1,007	n/a	n/a	n/a	n/a
Egypt	1,730	1,750	2,401	2,350	2,570	2,750
Turkey	1,050	1,280	1,690	1,650	1,700	1,700
South Africa	1,047	1,120	1,459	1,466	1,620	1,560
Greece ^a	950	820	n/a	n/a	n/a	n/a
World total	43,196	45,434	49,151	53,830	51,008	45,763

^aProduction data for countries of the European Union were aggregated beginning in 2009–10.
<https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

TABLE 23.2 Allocation of sweet orange production between fresh and processed utilization by major growing countries, selected years, 2009–10 through 2015–16.

	Thousand MT				
	2007–08	2009–10	2011–12	2013–14	2015–16
<i>Fresh utilization^a</i>					
Brazil	5,059	5,035	7,262	6,038	5,304
China	5,205	6,298	6,380	6,885	6,300
United States	1,942	1,924	2,102	1,720	1,791
Mexico	3,297	3,171	2,836	3,333	2,800
EU-27	4,974	5,030	4,967	5,076	4,955
Egypt	2,709	2,331	2,350	2,485	2,830
Turkey	1,327	1,590	1,550	1,600	1,700
South Africa	1,114	1,179	1,217	1,252	1,133
Argentina	702	686	461	600	530
Costa Rica	104	135	95	84	105
<i>Processed utilization</i>					
Brazil	11,791	10,795	13,220	11,832	9,058
China	245	202	520	715	600
United States	7,199	5,554	6,064	4,420	3,732
Mexico	1,000	880	830	1,200	1,600

TABLE 23.2 Allocation of sweet orange production between fresh and processed utilization by major growing countries, selected years, 2009–10 through 2015–16—cont'd

	Thousand MT				
	2007–08	2009–10	2011–12	2013–14	2015–16
EU-27	1,518	1,214	1,056	1,474	1,286
Egypt	50	70		85	100
Turkey	100	100	100	100	100
South Africa	412	280	249	471	142
Argentina	238	84	104	200	270
Costa Rica	165	235	275	136	230
<i>Total production</i>					
Brazil	16,850	15,830	20,482	17,870	14,362
China	5,450	6,500	6,900	7,600	6,900
United States	9,141	7,478	8,166	6,140	5,523
Mexico	4,297	4,051	3,666	4,533	4,400
EU-27	6,492	6,244	6,023	6,550	6,241
Egypt	2,759	2,401	2,350	2,570	2,930
Turkey	1,427	1,690	1,650	1,700	1,800
South Africa	1,526	1,459	1,466	1,723	1,275
Argentina	940	770	565	800	800
Costa Rica	269	370	370	220	335

^aIncludes both domestic consumption and net exports.
Source: FAS, USDA.

The market for fresh sweet oranges differs from processed oranges in two distinct ways. First, there are close to 50 countries with commercial fresh market orange production, and production is found on every continent except Antarctica. Supply is much more dispersed across countries with China, Spain, Mexico, and the United States being the largest supplying countries. Second, the proportion of fresh sweet oranges marketed in domestic markets around the world is much higher compared to orange juice. China, Mexico, and the United States are all examples in which a large proportion of fresh produce is sold in the domestic market. Spain ships to other countries in the European Union. The largest exporter of fresh produce, after Spain, is South Africa, which is located in the southern hemisphere and hence does not compete directly with northern hemisphere exporters such as Spain (and to a lesser extent, the United States).

The processed orange market (primarily orange juice) was dominated for years by Florida. The development of frozen concentrated orange juice (FCOJ) occurred soon after the end of World War II. With its ease of shipment and storage, FCOJ spurred a rapid increase in orange juice consumption in the United States during the 1950s and 1960s. Nearly all of this supply originated in Florida. A freeze that struck Florida in 1962 resulted in a reduced crop for that season and future years.

A major Florida processor formed a partnership with a Brazilian entity and FCOJ production was initiated in the state of São Paulo, Brazil. Throughout the remainder of the 1960s and the 1970s, however, Florida remained the primary supplier of FCOJ to the United States and Canada.

In the 1980s, a series of freezes visited Florida with the two most significant events occurring in December 1983 and January 1985. Millions of trees were destroyed, and Florida production was severely impacted. As the industry started to recover, another major freeze struck in December 1989. In the 1989–90 season, Florida orange production was approximately one-half the level realized before the freezes occurred. These events provided a major impetus for the processed orange sector in Brazil to rapidly expand production. Brazil soon became the leading producer and supplier of orange juice to the world market.

In the 1990s, two significant innovations took place, one in São Paulo, Brazil and a second in Florida that changed the world market for orange juice. The first was the development of bulk shipment of FCOJ in tanker ships. Before this innovation, FCOJ was put into lined 55-gal drums before shipment. Drums are bulky and require labor for the loading, off-loading, and eventual transfer of FCOJ to the final destination. Engineers in Brazil developed a system of pumping FCOJ into tanker trucks. FCOJ was hauled to the large port of Santos located near the city of São Paulo. It was pumped from the tanker truck directly to large ships with holds specifically designed for FCOJ. FCOJ at 65°Brix has a relatively high freezing point so that the product could remain frozen for shipment to the United States. Later, Brazilian companies found markets in Europe for orange juice, and bulk shipment helped spur the expansion of the European market by greatly lowering the cost of transport.

The second innovation was the development of aseptic storage of orange juice in the United States. Aseptic storage was pioneered by Tropicana, a large orange juice marketing company based in Florida,^c and it allows the marketing of not-from-concentrate (NFC) orange juice. NFC orange juice consumption grew rapidly in the United States and Canada in the 1990s and the first decade of the 21st century. It now accounts for >50% of the US orange juice consumption. Recently, the US brands such as Tropicana and Minute Maid have begun a push to market NFC orange juice in Europe, supplied from Brazil, shipped in bulk tanker ships with aseptic storage.

23.2.1 Sweet orange industry organization in Brazil

Brazil is the world's largest sweet orange producer, accounting for about one-quarter of global production. Although it has a conspicuous domestic market of over 200 million people for fresh fruit, processed utilization represents >60% of the total produced in the Brazilian territory.

The processed orange industry of the state of São Paulo dominates the world market for orange juice. Brazil itself produces virtually 50% of the orange juice consumed worldwide. In addition, São Paulo-based processors Citrusuco and Cutrale have processing assets also located in the state of Florida, the United States.

In São Paulo, despite the diseases citrus variegated chlorosis (CVC) and more recently, HLB, the combination of abundant land, good soils, and sufficient rainfall to allow reasonable production, little threat of freezes, and lower production and harvesting costs, has allowed the Brazilian citrus industry to become the leader in world sweet orange production.

Even suffering threats from a phytosanitary standpoint, such as: the citrus tristeza virus (CTV) in the 1950s; an outbreak of citrus canker in the 1970s; the beginning of CVC in 1987; and the first case of HLB in 2004, São Paulo has adapted to the new scenarios, relying on its ability to switch to more efficient plant control systems and migrate to new production areas. The 2017–18 sweet orange crop is expected to be 15.3 MMT compared to the record crop of 17.3 MMT in 1996–97.

Despite the entry of Citrovita in 1989 and Cambuhy in 1992, a robust process of concentration and consolidation in the processed orange industry of São Paulo occurred in the 1990s. After that decade, more mergers and acquisitions took place, resulting in a degree of concentration in which, by 2017, three companies [Citrusuco, Cutrale, and Louis Dreyfus (a French company)] are responsible for about 85% of total Brazilian orange juice exports.

Processors in São Paulo have developed a highly efficient system of fruit procurement, processing, and logistics, chiefly in bulk transportation of orange juice through trucks and vessels as well as ownership or partnership of port terminals. Therefore, the citrus industry in São Paulo is geared to exporting orange juice. Strategic alliances have been formed between citrus processors and distributors of dairy products, however, especially for NFC distribution in South America, since the demand for NFC products in Brazil has been increasing. With that, small processors started their operations with local brands in the 2010s, whose consumption of pasteurized orange juice in Brazil has increased significantly, utilizing approximately 10 million boxes (408,000 MT), still a small portion of the crop. Unlike Florida, the processed orange industry in São Paulo, however, is not vertically integrated into retail distribution. On the other hand, processors in São Paulo are considerably vertically integrated into fruit production.

São Paulo citrus growers have two major organizations which work for their benefit. Associtrus (The Brazilian Association of Citrus Growers), founded in 1974, which is the only citrus growers' association recognized by CitrusBR (founded in June 2009 by the largest Brazilian producers and exporters of citrus juices and derivatives: Cutrale, Citrusuco, and Louis Dreyfus), although it has few members and lacks representativeness. Fundecitrus (Fund for Citrus Plant Protection), founded in 1977, is an interprofessional organization jointly funded by processors and growers. Processors and

c. Tropicana was an independent company at the time it introduced NFC orange juice to the US market. It is now owned by PepsiCo.

growers pay a per-box rate based on quantities negotiated between them. Fundecitrus is responsible for coordinating the monitoring, eradicating and avoiding the spreading of pests and diseases, such as citrus canker, CVC, and HLB in the citrus area as well as leading the research program on CVC, blight, the sudden death of citrus disease, and more recently, HLB.

Until 2015, the USDA's Foreign Agriculture Service (FAS) was the primary source of Brazil's citrus production data with semiannual publications available in June and December of each year. In 2015, the São Paulo citrus industry empowered Fundecitrus with gathering and publishing a commercial tree census, disaggregated by variety and location using a methodology similar to information published by the National Agricultural Statistics Service (NASS) of the USDA for Florida citrus. Using the tree census data, in May of 2016, an orange production forecast was released by Fundecitrus for the states of São Paulo and lower Minas Gerais. Throughout the 2016–17 season, the forecast was updated several times. This process was repeated in the 2017–18 season.

23.2.2 Sweet orange industry organization in Florida

The organization of the citrus industry in Florida shares similarities and differences compared to São Paulo. The Florida Department of Citrus (FDOC), established in 1935, is an agency of the state of Florida whose prime objective is to promote the state's citrus industry. Operating as a marketing order, The Florida Citrus Commission (FCC), whose members are appointed by the governor of Florida, is tasked with overseeing and guiding the activities of the FDOC, conducting a variety of industry programs, and regulating the quality standards of citrus grown in Florida. The FDOC proposes the budget to fund programs and research each season, and the FCC has the authority to impose a per-box assessment on certified fresh and processed citrus each season based on the volume of citrus produced by the industry. Revenues from the assessments are used to promote the consumption of Florida citrus products, support economic and marketing research, and regulating quality standards for the industry.

Both the Agricultural Research Service (ARS) of the USDA and the University of Florida conduct research programs related to a wide array of issues related to citrus. These include research on new scions and rootstocks, plant protection, irrigation management, production, and development of new technology. The state of Florida has established the Citrus Research and Development Foundation (CRDF) to administer programs that deal with HLB and other diseases afflicting Florida citrus. Outside Florida, other US universities including Texas A & M University and the University of California—Riverside also conduct research related to citrus production. The California Citrus Research Board provides research money to researchers that focus on issues that affect citrus production in California. In Florida, Florida Citrus Mutual is the largest and most influential grower organization responsible for lobbying activities at both the state and federal level to support citrus growers. There are several other substate organizations including the Indian River Citrus League, Gulf Citrus Growers, and Peace River Valley Citrus Growers that work with Florida Citrus Mutual and the FDOC.

The Florida Citrus Processors Association (FCPA) is the association that represents citrus processors in the state. With the influx of foreign-based companies, this organization has undergone considerable change. Consolidation in the Florida processing industry has also reduced its membership; six large processing companies remain in Florida and two are owned by Brazilian companies. FCPA used to be the entity that collected price information on prices paid by processors for fruit delivered to processing plants. The FDOC now collects and publishes this data.

NASS, USDA located in central Florida publishes data on tree number, fruit production, utilization (fresh vs. processed), and farm-level prices (known as “on-tree” prices) on an annual basis. The first crop forecast released in early October is a much-anticipated event. The crop forecast is updated monthly throughout the harvest season with the final figure published in July of the following year.

23.2.3 Trade of fresh sweet oranges

Fresh orange exports by major exporting countries are shown in [Table 23.3](#). The three largest exporting countries are Egypt, South Africa, and the United States. Published data on world exports of fresh oranges can be misleading because it includes intra-EU trade, and fails to accurately depict the role of the EU as an exporter. Noticeably absent from this list is Brazil and Mexico, both major orange producers. In the case of Brazil, their lack of participation in the export market stems from both high utilization of fruit from São Paulo state by the processing sector and high domestic demand for fresh fruit grown in other states. A similar observation is appropriate for Mexico with a domestic fresh market serving as the main user of fresh oranges (processed utilization is approximately 20% of the crop).

Fresh orange imports by major importing countries are shown in [Table 23.4](#). The five leading importing regions are the EU, Russia, Saudi Arabia, Hong Kong, and China. Again, the EU figure is affected by intra-EU trade, but since EU imports

TABLE 23.3 Fresh orange exports by major importing countries, 2006–07 through 2016–17 seasons (MT).

Country	Seasons										
	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
World	3,168,000	3,666,000	3,505,000	3,769,000	3,996,000	3,932,000	3,889,000	4,002,000	4,059,000	4,468,000	4,629,000
Egypt	620,000	850,000	774,000	850,000	1,000,000	900,000	1,000,000	1,100,000	1,200,000	1,464,000	1,520,000
South Africa	934,000	971,000	869,000	1,045,000	942,000	1,088,000	1,162,000	1,144,000	1,160,000	1,064,000	1,120,000
United States	350,000	613,000	493,000	670,000	750,000	695,000	678,000	506,000	522,000	655,000	635,000
Turkey	179,000	155,000	256,000	209,000	339,000	357,000	244,000	349,000	305,000	371,000	395,000
EU	260,000	242,000	236,000	272,000	318,000	279,000	322,000	346,000	297,000	319,000	300,000
Australia	125,000	108,000	134,000	88,000	114,000	133,000	127,000	126,000	156,000	161,000	180,000
Hong Kong	26,000	45,000	53,000	62,000	70,000	67,000	45,000	49,000	74,000	107,000	140,000
Morocco	257,000	296,000	305,000	161,000	175,000	138,000	82,000	111,000	130,000	89,000	120,000
China	79,000	124,000	155,000	158,000	92,000	129,000	83,000	108,000	53,000	74,000	62,000

<https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

TABLE 23.4 Fresh orange imports by major importing countries, 2006–07 through 2016–17 seasons (MT).

Country	Seasons										
	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
World	3,194,000	3,360,000	3,109,000	3,414,000	3,495,000	3,668,000	3,628,000	3,423,000	3,708,000	4,006,000	4,115,000
EU	1,042,000	1,040,000	846,000	959,000	800,000	848,000	883,000	819,000	927,000	972,000	980,000
Russia	500,000	517,000	436,000	478,000	573,000	495,000	512,000	469,000	440,000	473,000	440,000
Saudi Arabia	270,000	280,000	270,000	302,000	312,000	348,000	274,000	274,000	448,000	435,000	435,000
Hong Kong	144,000	177,000	176,000	193,000	200,000	188,000	217,000	230,000	256,000	286,000	320,000
China	36,000	62,000	66,000	80,000	99,000	98,000	88,000	88,000	146,000	220,000	300,000
United Arab Emirates	85,000	106,000	172,000	182,000	167,000	196,000	201,000	220,000	230,000	222,000	220,000
Canada	170,000	214,000	177,000	204,000	211,000	190,000	199,000	183,000	190,000	204,000	195,000
Iraq	10,000	28,000	66,000	70,000	124,000	196,000	169,000	189,000	180,000	189,000	190,000
United States	116,000	77,000	90,000	106,000	102,000	119,000	139,000	143,000	155,000	164,000	185,000
Korea, South	78,000	112,000	71,000	108,000	142,000	173,000	152,000	100,000	111,000	154,000	145,000
Malaysia	91,000	86,000	90,000	83,000	88,000	96,000	104,000	100,000	102,000	101,000	100,000
Japan	90,000	99,000	96,000	104,000	120,000	127,000	113,000	87,000	83,000	100,000	95,000

<https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

exceed EU exports, the EU is a net importer of fresh oranges. The portion of the fresh oranges imported into Hong Kong is likely destined for consumption in south China markets.

23.3 Grapefruit and pummelos

Although grapefruit (both red and white fleshed) and pummelos are not close substitutes, most international organizations [such as the Food and Agricultural Organization (FAO) of the United Nations] aggregate production statistics for these two scion types together. Grapefruit originated in the Caribbean. It is grown for western markets such as North America and Western Europe, although Japan is a high-valued market for fresh grapefruit. Pummelos originated in China and are consumed primarily in East Asian countries such as China, Thailand, and Vietnam. With immigration from these countries to the West, pummelo consumption in the United States and Western Europe has been increasing.

Grapefruit and pummelo production among major producing countries since 2000 is shown in [Table 23.5](#). Note the steep decline in grapefruit production in the United States over the past 10 years. This is a result of several factors. First, CTV found its way to Florida and since a large proportion of the grapefruit planted in Florida was on sour orange rootstock, which is highly susceptible to the CTV, tree numbers began to decline. Second, once citrus canker was found in Florida in the 1990s, an eradication program was initiated by the State of Florida in conjunction with the Animal and Plant Health Inspection Service (APHIS) of the USDA in an attempt to rid the state of the canker disease. Third, four hurricanes visited Florida in 2004 and 2005. Three of the storms passed through the main grapefruit production area along the east coast of Florida, resulting in tree damage. But more importantly, the storms spread citrus canker throughout the state forcing abandonment of the tree eradication program. Fourth, HLB was first identified in Florida in 2005. Grapefruit is one of the most susceptible of citrus scions to HLB. Consequently, grapefruit productivity has plummeted and very few new plantings of grapefruit are occurring.

A similar story can be told regarding plummeting grapefruit production in Cuba, once the third largest producer behind Florida and Israel. The combination of multiple hurricanes and the presence of HLB have drastically reduced grapefruit production in Cuba ([Table 23.5](#)).

Another factor negatively affecting grapefruit is an apparent downward shift in demand, especially by consumers in developed economies such as the United States and Western Europe. Several factors can be identified which have negatively affected grapefruit demand. Among these is the presence in grapefruit of a family of chemicals called furanocoumarins. These compounds interact with statins such as simvastatin (Zocor) and atorvastatin (Lipitor) by increasing the quantity of statins taken up by the bloodstream, creating a potential for negative health consequences; this grapefruit-drug interaction is sometimes referred to as the Grapefruit Juice Effect (GJE). As both fresh and processed grapefruit consumption is concentrated among the older age cohorts of the population, the discovery of the GJE has had a chilling effect on

TABLE 23.5 Production of pummelos and grapefruit by major growing countries, selected years, 1999–2000 through 2015–16.

	Million MT					
	1999–2000	2004–05	2009–10	2011–12	2013–14	2015–16
China	n/a	1,724	2,900	3,200	3,717	4,300
United States	2,530	914	1,123	1,047	955	735
Mexico	165	310	401	415	423	430
South Africa	200	270	343	305	390	330
Israel	365	247	235	245	236	185
Turkey	120	110	191	230	235	200
Argentina	n/a	170	150	160	n/a	n/a
EU-27	n/a	n/a	95	102	113	97
World total	3,662	3,795	5,288	5,544	6,069	6,277

<https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

grapefruit demand. Another factor is that fresh grapefruit is a relatively large fruit, which must be either peeled or sectioned requiring preparation time. Increased availability of other fruits such as bananas, berries, and imported stone fruits has provided convenient alternatives for fresh grapefruit during the winter season in the Northern Hemisphere.

Pummelos have experienced a different supply/demand path over recent years compared to grapefruit. Pummelo production has remained relatively stable as Asian growers have developed techniques to manage HLB which is endemic throughout the region. As immigrants from China and other East Asian countries have moved to the United States and Western Europe, they have brought the consumption habits with them including a fondness for pummelo. Although there is no separate documentation of the growth of pummelo consumption in the West, increased availability of pummelos in supermarkets in the United States is one indication of increased demand outside of East Asia.

Exports of grapefruit/pummelos by major exporting countries are shown in [Table 23.6](#). The four leading exporting countries are South Africa, China, Turkey, and the United States. Note that as recently as the 2011–12 season, the United States held the leading position, but the steep decline in grapefruit production Florida, has led to the decline in the United States position as a supplier of grapefruit to the world market. As noted elsewhere, nearly all of the exports from China are pummelos while the other countries shown in [Table 23.6](#) are exporting grapefruit.

Imports of grapefruit/pummelos by major importing countries are shown in [Table 23.7](#). The three leading importers are the EU, Russia, and Japan. In the case of the EU, most of these imports would come from outside the EU primarily South Africa, Turkey, and the United States, and recently there has also been the importation of pummelos to the EU from China. With the decline of the US production, there has also been a marked decline in the importation of grapefruit worldwide.

While organizations that support the production and marketing of grapefruit/pummelos exist in several countries, the Florida Administrative Committee administers a marketing order that affects the marketing of grapefruit from Florida in the early portion of the season. This organization also collects and disseminates prices and volumes of fresh citrus fruits across oranges, grapefruit, and tangerines that are sold fresh in the US market.

23.4 Mandarins/tangerines

World production, consumption, and trade of mandarins/tangerines have increased significantly from the early 2000s to 2016. Production increased from 14.5 MMT in 2001 to 28.5 MMT in 2016, and consumption increased from 13.260 MMT to 26.5 MMT. Total world exports and imports increased at a faster rate from 2001 to 2016, by 180% for export and 169% for import. Mandarins/tangerines used for processing only increased by 25%, from 1.2 MMT to 1.5 MMT. Despite the increase, the proportion of mandarins/tangerines used for processing to the total production decreased from 8.2% to 5.2%, indicating a worldwide trend of increasing consumption of fresh fruit and vegetables ([Table 23.8](#)).

23.4.1 Production and consumption by country

China is the world largest producer and consumer of mandarins/tangerines, and it is largely responsible for increased global production and fresh consumption of mandarins/tangerines. From 2001 to 2016, mandarin/tangerine production of China increased from 6.3 million tons to 19.3 million tons. During this same period, its share of the total world production increased from 43.3% to 67.7%. Consumption in China increased at a slightly faster rate, from 5.8 MMT in 2001 to 18.1 MMT in 2016, accounting for 43.6% and 67.4% in 2001 and 2016, respectively, of total world fresh consumption. Other than China, the production and fresh consumption of mandarins/tangerines of other countries have remained relatively stable. EU is the second largest producer and consumer of mandarins/tangerines, followed by Japan ([Figs. 23.1 and 23.2](#)). Despite a slight increase in quantity, over the years, both the EU and Japan's share in world total production and fresh consumption declined. EU's and Japan's share of production decreased from 19.8% to 11.3% and 10.6% to 3.5%, respectively, from 2001 to 2016. In the meanwhile, the share of consumption decreased from 20.4% to 11.4% for the EU, and from 10.6% to 3.4% for Japan ([USDA, 2017](#)).

23.4.2 Exports and imports by country

World trade of mandarins/tangerines is more diverse ([Figs. 23.3 and 23.4](#)). China is not only the largest producer, it is also the world's largest exporter in most years. Chinese exports increased from 0.169 MMT in 2001 to 0.8 MMT in 2011, the highest in its export history, and then decreased to 0.6 MMT in 2016. The export of some small producers of mandarins/tangerines is comparable to that of China because of low domestic demand. For instance, Turkey is the second largest exporter of mandarins/tangerines, followed by Morocco, EU, and South Africa. Other than the EU who experienced a decreasing trend of export starting in 2012, the export of Turkey, Morocco, and South Africa kept increasing from 2001 to 2016.

TABLE 23.6 Fresh grapefruit exports by major exporting countries, 2006–07 through 2016–17 seasons (MT).

Country	Seasons										
	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
World	872,000	851,000	825,000	830,000	808,000	800,000	813,000	825,000	736,000	784,000	756,000
South Africa	215,000	196,000	210,000	187,000	217,000	174,000	242,000	217,000	221,000	203,000	235,000
China	51,000	101,000	102,000	119,000	84,000	118,000	130,000	165,000	124,000	159,000	170,000
Turkey	133,000	133,000	128,000	154,000	153,000	177,000	132,000	177,000	145,000	190,000	126,000
United States	332,000	270,000	247,000	242,000	227,000	209,000	184,000	147,000	141,000	124,000	107,000
Israel	81,000	81,000	85,000	84,000	83,000	78,000	79,000	78,000	61,000	61,000	70,000
Mexico	12,000	14,000	11,000	18,000	17,000	19,000	18,000	14,000	19,000	22,000	22,000
EU	17,000	21,000	21,000	22,000	20,000	18,000	21,000	19,000	15,000	14,000	15,000
Hong Kong	2,000	2,000	4,000	4,000	7,000	7,000	7,000	8,000	10,000	11,000	11,000

<https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

TABLE 23.7 Fresh grapefruit imports by major importing countries, 2006–07 through 2016–17 seasons (MT).

Country	Seasons										
	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
World	829,000	840,000	789,000	796,000	752,000	731,000	743,000	752,000	670,000	700,000	688,000
EU	399,000	430,000	399,000	389,000	348,000	341,000	337,000	360,000	339,000	364,000	350,000
Russia	74,000	95,000	86,000	112,000	117,000	113,000	141,000	133,000	101,000	117,000	110,000
Japan	221,000	188,000	180,000	168,000	167,000	149,000	134,000	109,000	100,000	82,000	75,000
China	3,000	3,000	6,000	7,000	12,000	13,000	17,000	26,000	31,000	33,000	42,000
Canada	55,000	51,000	48,000	46,000	45,000	44,000	43,000	42,000	40,000	39,000	38,000
United States	22,000	14,000	12,000	12,000	7,000	1,000	13,000	13,000	10,000	16,000	24,000
Ukraine	15,000	19,000	16,000	21,000	23,000	27,000	30,000	27,000	15,000	18,000	18,000
Hong Kong	13,000	12,000	16,000	18,000	18,000	24,000	15,000	16,000	15,000	16,000	16,000

TABLE 23.8 World mandarins/tangerines distribution from 2001 to 2016 (unit: 1000 MT).

Market year	Production	Consumption	Export	Import	For processing	For processing/production
2001	14,468	13,260	871	853	1190	8.23%
2002	14,478	13,122	1009	912	1259	8.70%
2003	15,244	13,816	1090	1014	1352	8.87%
2004	16,669	15,079	1331	1209	1468	8.81%
2005	17,058	15,589	1288	1346	1527	8.95%
2006	17,120	15,201	1523	1501	1897	11.08%
2007	19,031	17,502	1564	1609	1574	8.27%
2008	20,391	18,846	2020	1863	1388	6.81%
2009	22,125	20,638	1975	1941	1453	6.57%
2010	21,898	20,333	2104	2034	1495	6.83%
2011	23,761	22,177	2389	2216	1411	5.94%
2012	24,489	23,057	2165	2117	1384	5.65%
2013	26,474	24,847	2483	2281	1425	5.38%
2014	28,294	26,527	2330	2177	1614	5.70%
2015	28,730	27,186	2316	2181	1409	4.90%
2016	28,527	26,883	2445	2292	1491	5.23%

<https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

Another country that experienced an increasing trend of export is Israel, which surpassed Argentina in 2014, becoming the world's sixth largest exporter of mandarins/tangerines. Percentagewise, China accounted for 24.1% of world total exports in 2016. The export share of other countries in 2016 was 28.8% for Turkey, 20.9% for Morocco, 9.8% for EU, 8.6% for South Africa, and 4.3% for Israel. From 2001 to 2016, the share of the EU export of mandarins/tangerines in the world's total export decreased from 16.1% to 9.8%, the share of South Africa kept almost unchanged (8.2% vs. 8.6%), while the share of all other four countries increased (USDA, 2017).

Russia is the world's largest importer of mandarins/tangerines. Its import increased fivefold from 150,000 MT in 2001 to 800,000 MT in 2016. Based on the import quantity of 2016, the other two largest importers are the EU and the United States. Canada, Ukraine, Thailand, and Vietnam are in the second-tier countries; Indonesia, Philippines, and Malaysia are in the third-tier countries; and China, Japan, and South Africa are in the fourth-tier countries. All the countries experienced an increase in import from 2001 to 2016. Percentagewise, Russia's share of world total import increased from 18.1% in 2001 to 35.8% in 2016. From 2001 to 2016, the import share changed from 42.0% to 18.8% of EU; from 6.2% to 10.3% for the United States; from 9.7% to 6.5% for Canada; from 4.6% to 6.1% for Ukraine; from 0.1% to 5.2% for Thailand; from 2.1% to 5.5% for Vietnam. Despite the increases in imports, the import share of China, Japan, and South Africa was <1.5% (USDA, 2017).

Changes in the shares of export and import countries imply some significant structural changes in the trade of mandarins/tangerines.^d In 2001, the top four largest mandarin/tangerine exporters were Turkey, China, South Africa, and Argentina, with a total export value of US\$417 million, accounting for 82% of world mandarin/tangerine trade. In 2016, the top four largest mandarins/tangerines exporters were Turkey, China, Morocco, and South Africa, with a total export value of US\$1639 million, also accounting for 82% of world mandarin/tangerine trade (USDA, 2017).

In 2001, the key mandarin/tangerine trade partners of China included the Philippines, Malaysia, Indonesia, Russia, Canada, Vietnam, and Singapore (GTA, 2017). These countries import accounted for 24.3%, 24.0%, 12.5%, 9.8%, 8.6%, 7.3%, and 5.2%, respectively, of China's total export. Turkey's key mandarin/tangerine trade partners were Russia (16.6%),

d. EU is not included in the discussion because the discussion is focused on trade between individual countries.

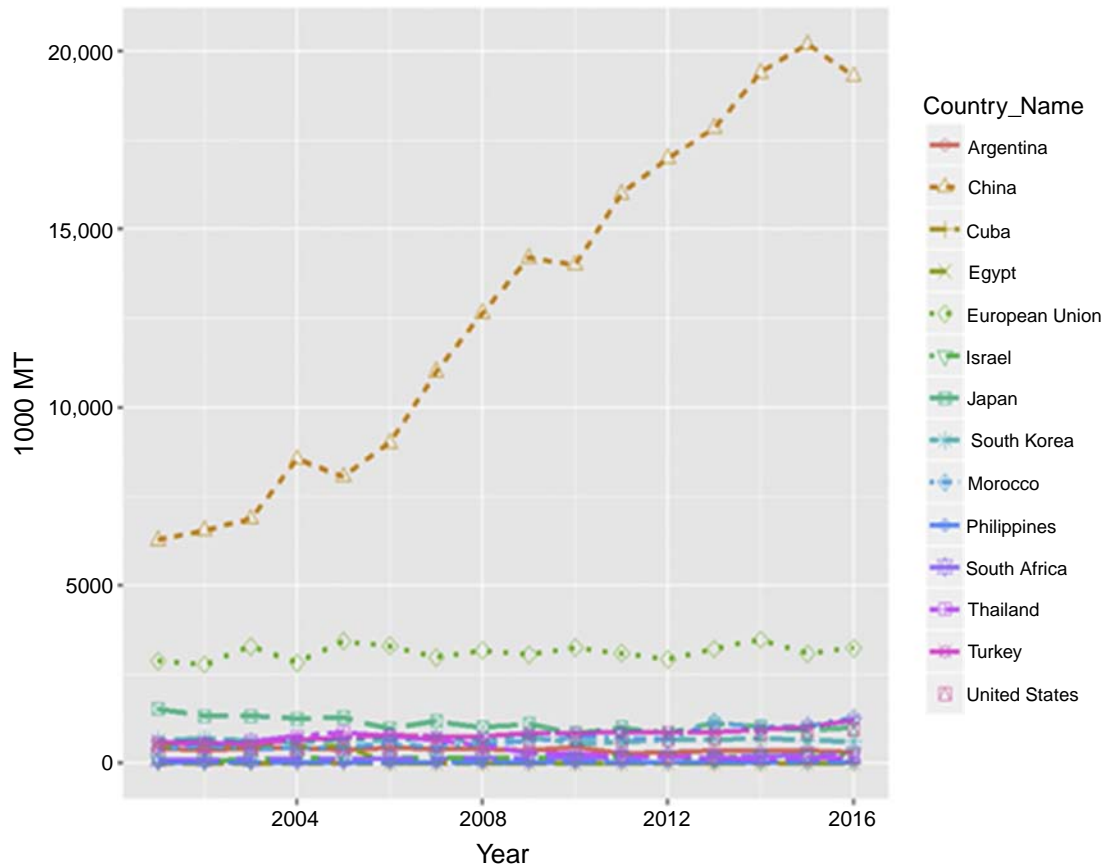


FIG. 23.1 World Mandarin/Tangerine production by country. <https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

Ukraine (15.4%), the United Kingdom (8.8%), Saudi Arabia (7.5%), Australia (7.0%), and Romania (6.9%). For South Africa, the United Kingdom was its dominant mandarin/tangerine importer, accounting for 44.6% of its export. The Netherlands, the United States, Saudi Arabia, and Belgium accounted for 22.3%, 6.1%, 5.7%, 5.6%, respectively, of South Africa's mandarin/tangerine export. The Netherlands, the United Kingdom, Canada, Russia, and the Philippines accounted for 34.2%, 22.3%, 11.0%, 10.8%, and 5.3%, respectively, of Argentina's mandarin/tangerine export.

In 2016, Thailand and Vietnam became the two largest importers of Chinese mandarins/tangerines. The import of Thailand, Vietnam, Malaysia, Russia, Philippines, and Kazakhstan accounted for 20.0%, 18.3%, 14.1%, 13.4%, 6.4%, and 6.0%, respectively, of China's mandarin/tangerine export. In 2016, the importers of Turkey's mandarins/tangerines concentrated to Russia, Iraq, and Ukraine, accounting for 39.5%, 28.3%, and 13.9%, respectively, of Turkey's mandarin/tangerine export. For Morocco, the new major exporter of mandarins/tangerines, Russia, France, Canada, the Netherlands, and the United States accounted for 40.8%, 20.0%, 11.8%, 10.1%, and 6.0%, respectively, of its total export. For South Africa, the United Kingdom, and the Netherlands were still its top two largest mandarin/tangerine importers, accounting for 34.9% and 24.9%, respectively, of its export. Russia and the United States accounted for 7.6% and 5.4%, respectively, of South Africa's export.

23.4.3 Mandarins/tangerines used for processing by country

Most mandarins/tangerines used for processing are for canned mandarins/tangerines. China and the EU dominated the mandarins/tangerines used for processing (Fig. 23.5). Before 2007, the amount of mandarins/tangerines used for processing was comparable between China and the EU. However, in 2008, the EU experienced a significant drop in mandarins/tangerines used for processing, and China surpassed the EU becoming the world largest mandarins/tangerines processor. The third largest mandarins/tangerines processor is the United States, followed by South Korea, Argentina, Japan, and Israel. South Africa, Turkey, and Morocco also process a small account of mandarins/tangerines. In general, the amount of mandarins/tangerines used for processing started keeping at a relatively stable level since 2012 for most countries.

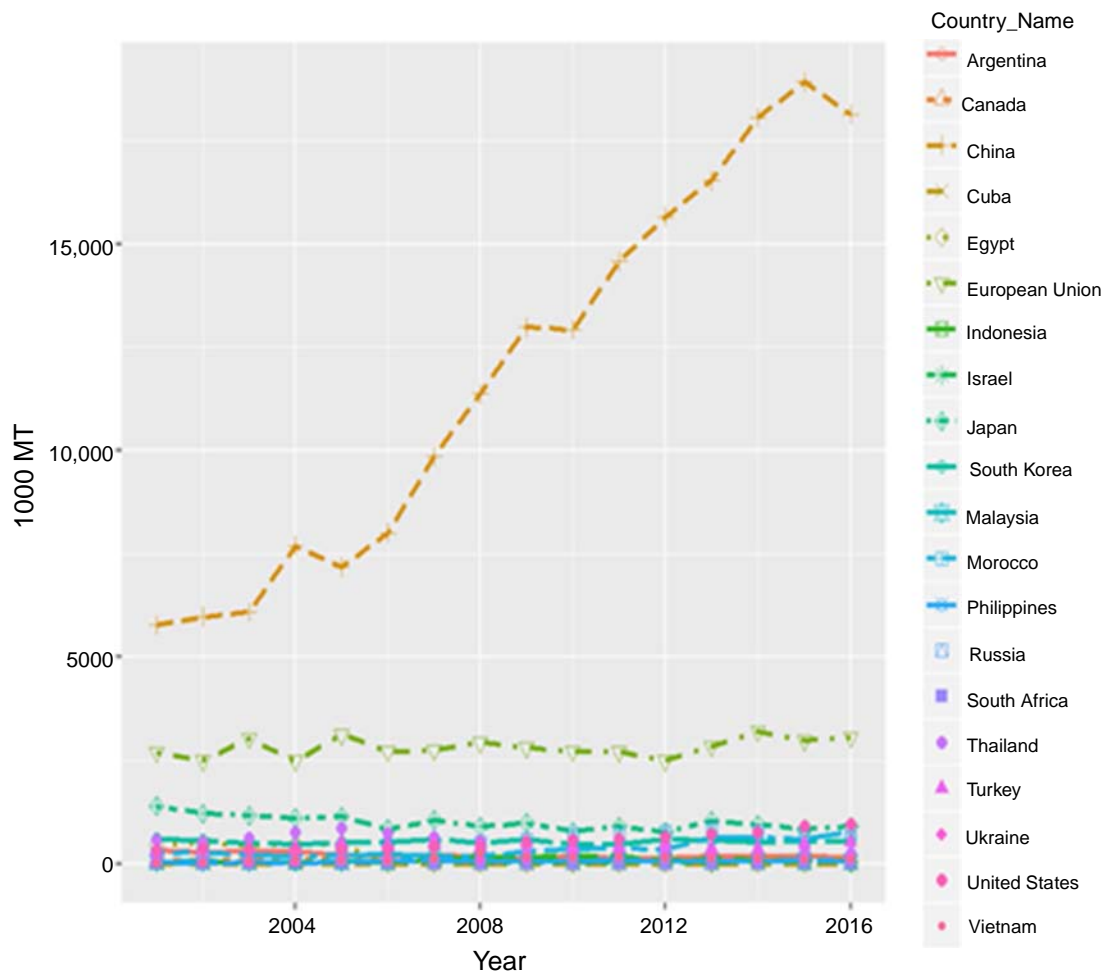


FIG. 23.2 World Mandarin/Tangerine consumption by country. <https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

23.5 Lemons and limes

Lemons and limes are similar to grapefruit and pummelos in that they are imperfect substitutes, but for statistical purposes, their production is aggregated by the FAO and other organizations that report world production statistics. World lemon/lime production in major producing countries is shown in Table 23.9. It is well-known that Mexico, the largest producing country primarily grows Persian (seedless) and Mexican (or Key) (seedy) limes. Other lime producing countries are found primarily in the tropical portion of the Western Hemisphere including the Bahamas, Brazil, and Guatemala even though lime production can be found scattered across the world. The other countries shown in Table 23.9 grow primarily lemons. Argentina is the largest producer of lemons, followed closely by Spain (whose production is now reported with the other EU countries). South Africa has also seen its production grow in recent years while production in Turkey and the United States (California and Arizona) has remained flat. As seen in Table 23.9, there has been a steady increase in world production of lemons and limes.

Lemons and limes differ from other citrus varieties in that they are almost always consumed in association with other foods as a flavor enhancer, garnish, or with alcoholic and nonalcoholic beverages.

Exports of lemons/limes by major exporting countries are shown in Table 23.10. The leading exporting countries are Mexico, Turkey, South Africa, and Argentina. Mexico's exports are nearly exclusively limes while the other countries export lemons. Note the strong growth in exports exhibited by Mexico, Turkey, and South Africa. In the case of Mexico, it has benefited from the demise of the Florida lime industry as a result of citrus canker. Mexico, however, has good markets in other countries besides the United States including Japan and the EU. With stagnating lemon production with the EU, Turkey has become a major supplier to both the EU and Russia. South Africa exports lemon to many destinations including the EU, Saudi Arabia, and Russia.

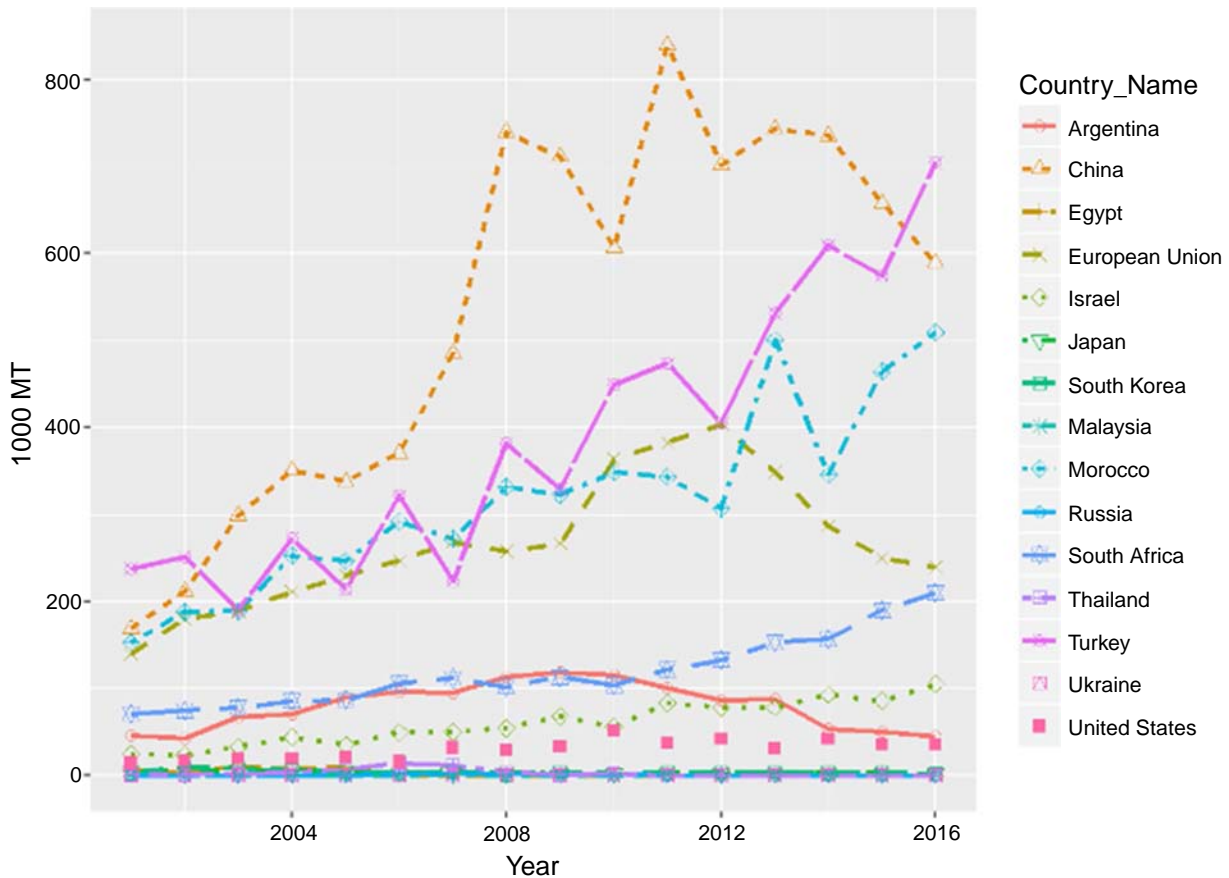


FIG. 23.3 World Mandarin/Tangerine export by country. <https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

Imports of lemons/limes by major importing countries are shown in [Table 23.11](#). The four largest importing countries are the United States, the EU, Russia, and Saudi Arabia. The US imports are mostly limes from Mexico as the US is a net exporter of lemons. As noted elsewhere, the EU, Russia, and Saudi Arabia are sourcing lemons from Turkey, South Africa, and Argentina.

23.6 Price Determination for citrus

Pricing of citrus differs by country and use (fresh vs. processed). In many less developed countries, the fruit may be sold at the orchard or at local markets. In the former case, a broker visits the orchard site and will offer to buy all of the fruit for a fixed price regardless of the volume of fruit harvested. The broker arranges harvest and transport to a regional market or a packinghouse where the fruit is sorted. A portion of the fruit will be deemed suitable for the fresh market, the remaining fruit may be processed or sent to a lower price outlet.

In the latter case, the grower is responsible for harvest and transport to the local market. At that point, the fruit may be sold to households or purchased by brokers who then transport the fruit to larger regional markets. In some countries, ownership of the fruit may change several times before eventually purchased by the final user.

In most developed countries, a more formal market is likely to exist. Smaller growers may market their fruit in a manner similar to that found in less developed countries. Larger growers, however, may have contracts with supermarkets or other larger purchasers. These growers may have their own harvesters or contract with harvest providers to complete harvest and transport to a packinghouse facility. At the packinghouse, the fruit is sorted and graded. Fruit meeting fresh market standards is then sent to retail outlets (after washing and packing into transport containers generally referred to as cartons). Poorer quality fruit is sent to the processing plant or sold in lower value markets. The grower receives proceeds from both high quality and lower quality fruit. His/her final price per unit depends on the proportion of fruit allocated among high and low quality.

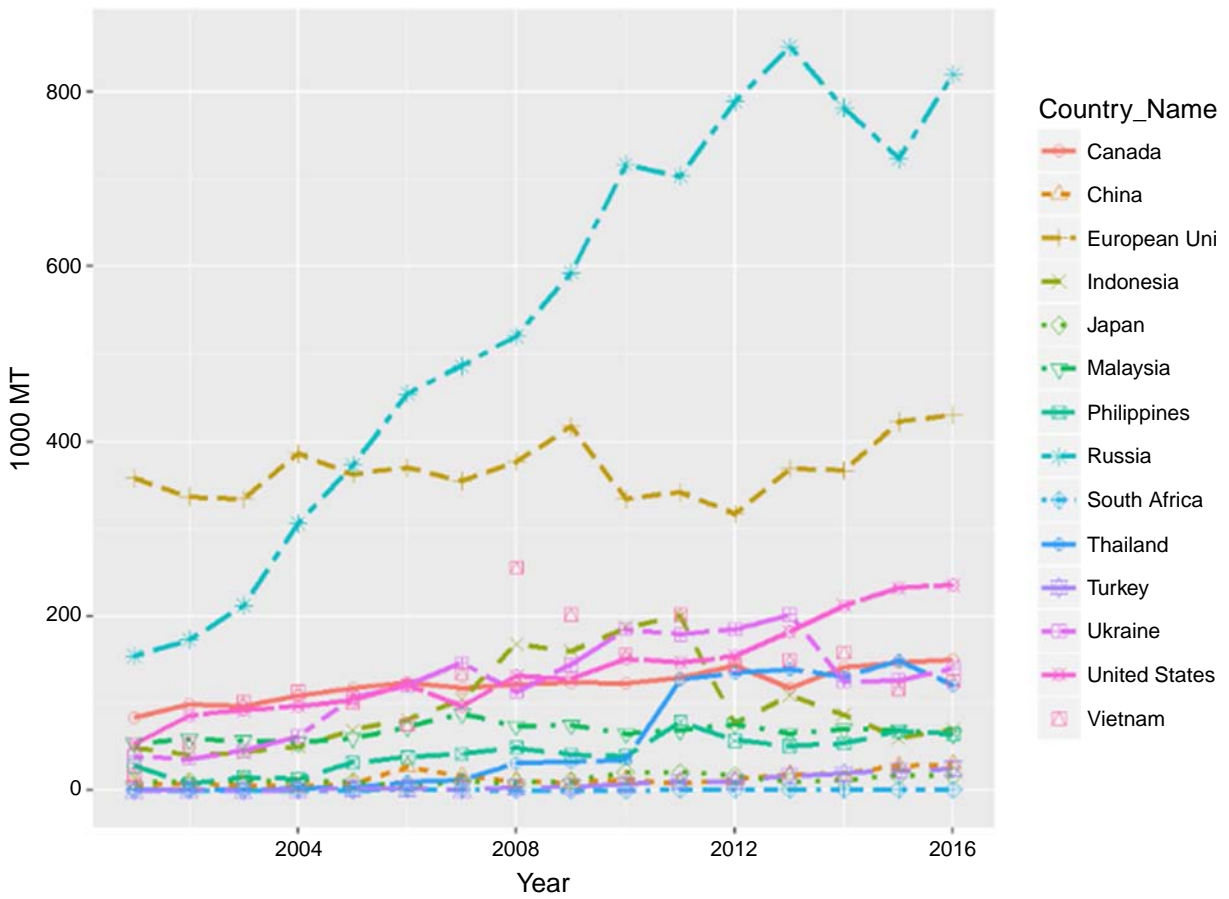


FIG. 23.4 World Mandarin/Tangerine import by country. <https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

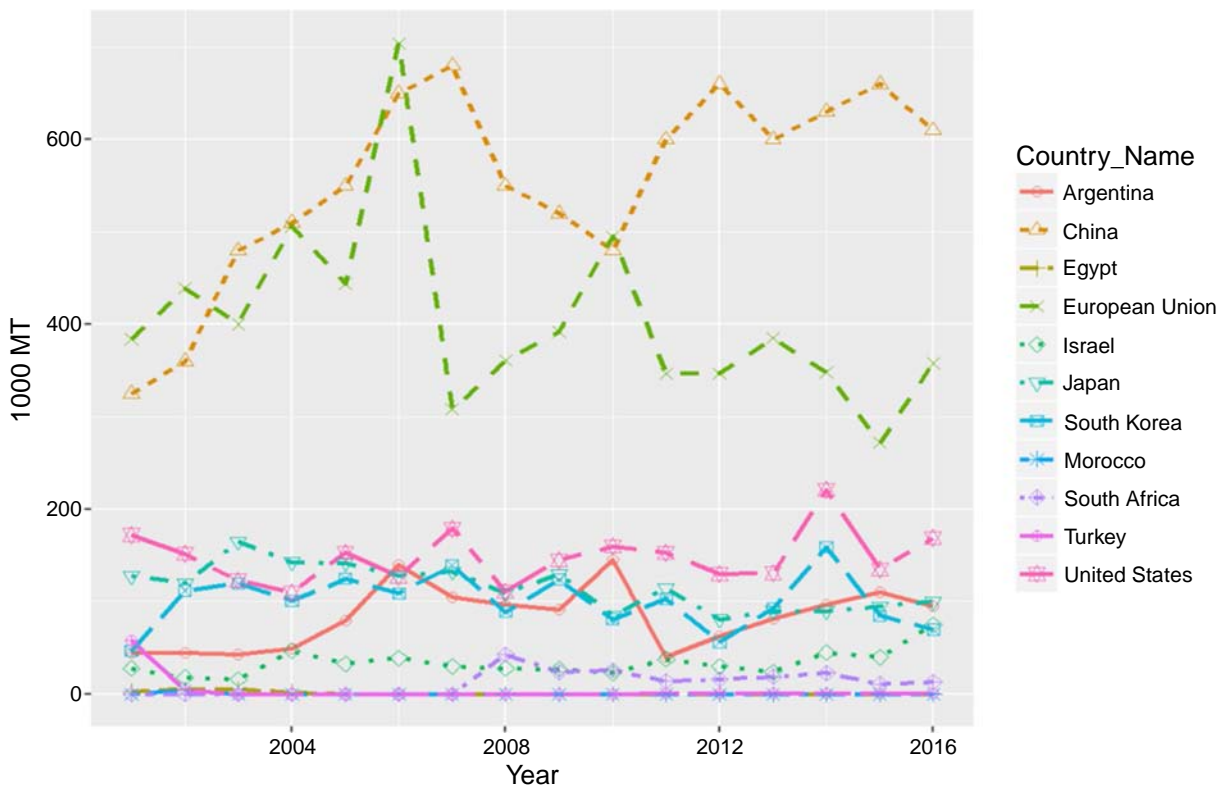


FIG. 23.5 Mandarin/Tangerine used for processing by country.

TABLE 23.9 Production of lemons and limes by major growing countries, selected years, 1999–2000 through 2015–16.

	Million MT					
	1999–2000	2004–05	2009–10	2011–12	2013–14	2015–16
Argentina	1,050	1,300	1,000	1,200	780	1,500
Spain ^a	899	900	n/a	n/a	n/a	n/a
United States	797	738	800	771	748	847
Mexico	1,230	1,890	1,850	2,055	2,167	2,270
EU-27 ^a	n/a	n/a	1,160	1,264	1,308	1,260
Turkey	500	535	783	750	760	670
South Africa	110	180	216	260	312	345
World total	4,101	4,323	5,951	6,524	6,216	7,001

^aProduction data for countries of the European Union were aggregated beginning in 2009–10.
<https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

Another payment system exists for both fresh and processed fruit, although it is more common in fresh fruit marketing. This system is called “participation.” The term derives from the fact that the grower “participates” in the marketing process and is not paid until the fruit is sold, either to a broker or a supermarket. Generally, participation is organized through a packinghouse.^e The packinghouse organizes the harvest, de-greens the fruit (if necessary), sorts and grades, packs the fruit into cartons (or other containers such as poly bags if desired by the next buyer), and may store the fruit if it is advantageous to do so. Fruit not suitable for the fresh market is sent to a processing plant. This fruit is called “eliminations” since it has been “eliminated” from the fresh marketing channel. Once the fruit is sold, the costs of the services provided by the packinghouse are deducted from the proceeds including harvest and transport to the packinghouse, and the remainder is paid to the grower. A disadvantage of this approach is that the grower must wait until the end of the harvest season for payment. An advantage is that middlemen in the marketing channel are avoided; it is likely the grower will receive a higher price.

A variation of participation arrangements is cooperatives. In the United States, cooperatives are found across a wide range of commodities including grains, dairy, sugar, and many types of fruit including citrus. The two most important cooperatives are Florida’s Natural Growers, a processing cooperative located in central Florida, and Sunkist, a fresh fruit cooperative based in California. Florida’s Natural Growers is known as a federated cooperative since it is owned by several fresh fruit cooperatives. In its early years, then known as Citrus World, it mainly processed eliminations from the fresh fruit cooperatives. With the advent of FCOJ and later NFC, Florida’s Natural Growers became one of the three national brands of orange juice (competing with Tropicana and Minute Maid). An individual grower can belong to one of the fresh fruit cooperatives or belong to an entity that only delivers fruit to the processing plant. A pool is calculated for early and midseason oranges and another pool is computed for late (Valencia) oranges. There are also separate pools for red and white seedless processed grapefruit and for specialty varieties including tangerines.

Sunkist is a nonstock cooperative. Growers contract with packinghouses to pack fruit. Sunkist then oversees marketing, both domestic and international. Sunkist markets navel and Valencia oranges, lemons, and more recently mandarins from 6000 growers located in California and Arizona. Separate pools are computed for each variety of fruit.

The main difference between a cooperative and a private entity that offers fruit purchase through a participation plan is that growers own the physical assets in a cooperative. In the case of Florida’s Natural Growers, the fresh fruit cooperatives “own” the processing plant operated by the cooperative.

For processed utilization, especially processed utilization of oranges, growers sell fruit to processing plants. This may be accomplished directly or through an intermediary. In the case of direct sale, in both Brazil and Florida, medium-term contracts extending 3–5 years are widely used. The contract may be a fixed price over the life of the contract. There may also be provisions to allow the price to escalate if supply–demand conditions warrant. This contract is characterized as a floor price with a rise tied to a third-party reporting service. In Brazil, the FCOJ futures contract traded at the New York

e. Although the grower may own the packinghouse individually or jointly with other growers. In the latter case, the growers may form a cooperative to jointly own the packinghouse and coordinate the harvest.

TABLE 23.10 Fresh lemon/lime exports by major exporting countries, 2006–07 through 2016–17 seasons (MT).

Country	Seasons										
	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
World	1,460,000	1,526,000	1,371,000	1,474,000	1,489,000	1,689,000	1,552,000	1,591,000	1,722,000	1,822,000	1,891,000
Mexico	436,000	508,000	445,000	456,000	432,000	625,000	523,000	519,000	610,000	662,000	680,000
Turkey	328,000	220,000	351,000	434,000	457,000	429,000	369,000	426,000	433,000	434,000	494,000
South Africa	110,000	166,000	130,000	145,000	162,000	165,000	175,000	220,000	246,000	237,000	270,000
Argentina	360,000	400,000	250,000	264,000	255,000	267,000	280,000	150,000	185,000	280,000	220,000
United States	120,000	157,000	93,000	93,000	102,000	95,000	110,000	127,000	114,000	110,000	115,000
EU	92,000	59,000	87,000	67,000	68,000	92,000	77,000	101,000	105,000	68,000	75,000
Hong Kong	5,000	4,000	8,000	6,000	7,000	8,000	7,000	33,000	18,000	17,000	20,000
Morocco	0	0	0	6,000	5,000	7,000	10,000	10,000	7,000	9,000	12,000

<https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

TABLE 23.11 Fresh lemon/lime imports by major importing countries, 2006 through 2016-17 seasons (MT).

Country	Seasons										
	2006/2007	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
World	13,53,000	14,50,000	13,61,000	14,50,000	14,25,000	14,97,000	15,26,000	15,17,000	16,02,000	18,12,000	18,05,000
United States	3,91,000	4,24,000	3,98,000	4,01,000	3,94,000	4,75,000	4,78,000	4,81,000	5,63,000	6,15,000	6,85,000
EU	4,18,000	5,15,000	4,05,000	4,71,000	4,21,000	4,40,000	4,26,000	3,80,000	3,99,000	5,57,000	4,50,000
Russia	2,05,000	1,91,000	2,03,000	2,11,000	2,22,000	2,00,000	2,12,000	2,09,000	2,07,000	1,86,000	2,10,000
Saudi Arabia	79,000	60,000	1,00,000	1,03,000	1,04,000	85,000	88,000	85,000	1,03,000	1,21,000	1,25,000
Canada	58,000	58,000	58,000	65,000	78,000	88,000	1,00,000	99,000	87,000	1,02,000	1,00,000
United Arab Emirates	44,000	51,000	44,000	54,000	55,000	63,000	78,000	85,000	94,000	91,000	90,000
Japan	68,000	62,000	52,000	53,000	57,000	55,000	51,000	51,000	51,000	51,000	52,000
Ukraine	60,000	55,000	58,000	62,000	64,000	62,000	63,000	54,000	44,000	41,000	45,000
Hong Kong	25,000	19,000	27,000	21,000	26,000	25,000	26,000	66,000	48,000	37,000	40,000

<https://www.fas.usda.gov/databases/production-supply-and-distribution-online-psd>

Board of Trade (NYBOT) is often used as the reference price. In Florida, where a large proportion of the crop is used to produce NFC orange juice, the FCOJ futures contract is not as useful. In its place, the FDOC post-estimate price is often used. A price collected by Florida Citrus Mutual, the largest grower organization in Florida, called the Mutual Mostlys price, may also be used.

Intermediaries are found in the three largest processed orange producers: Brazil, the United States, and Mexico. In Florida, the term “bird dog” is used to describe intermediaries. Bird dogs make contracts with small and medium growers to purchase fruit and then sell in larger lots to processors. They charge a small fee for their service. They may also provide harvesting and hauling activities as a part of their service. In Mexico, which lacks publicly available data on fruit production and prices, these intermediaries are called “coyotes.” This term has a negative connotation, but coyotes in Mexico play a role quite similar to bird dogs in Florida.

An important distinction regarding pricing in the processed orange market in the United States compared to Brazil and Mexico is the unit of measurement. In Brazil and Mexico, most fruit purchased from growers is priced based on the weight of the fruit. Brazil has adopted the Florida system of using 90-pound (40.8 kg) boxes as the unit of measurement while Mexico uses metric tons. In Florida, growers are paid based on the juice content of the fruit which is measured in pound solids (or soluble solids). The State of Florida has test houses located at all processing plants which test a sample of each load of fruit delivered to establish its pound solids content. This use of a government entity to serve as a third-party arbiter is unique in the world.

23.7 Trade agreements and citrus

Trade agreements implemented over the past 50 years have affected the patterns of trade among citrus exporters and importers. The largest and most important agreement is the EU. Other agreements include the North American Free Trade Agreement (NAFTA), the Southern Common Market also known as MERCOSUR, the US–Japan Beef and Citrus Agreement, the Caribbean Basin Economic Recovery Act (CBERA) also known as the Caribbean Basin Initiative (CBI), and preferences offered by the EU to select countries including Israel and Egypt. Recently, the United States and South Korea entered into a free trade agreement and that will affect the US exports of fresh and processed citrus to South Korea.

The EU, since its inception, has adopted a stance of supporting domestic agriculture. This posture also extends to citrus that is grown in Spain, Portugal, Italy, and Greece. Growers are provided ample production subsidies that are not found in other major citrus producing countries apart from China. In addition, the EU imposes seasonal tariffs to limit imports from competing countries. The EU also imposes a relatively small tariff on imported orange juice.

The NAFTA was implemented in 1994. It formed a free trade zone among Canada, the United States, and Mexico. Tariffs were phased out for most agricultural products in fresh and processed citrus. This meant that the US orange juice tariff was eliminated on imports from Mexico with total elimination occurring in 2001. Canada has never imposed a tariff on orange juice. Mexico also limited restrictions on the importation of fresh citrus from the United States. Phytosanitary-based restrictions remained in place, however, limiting imports of fresh oranges and tangerines from Mexico because of the Mexican fruit fly.

The Southern Common Market also known as MERCOSUR includes Brazil, Argentina, Uruguay, and Paraguay. It has facilitated trade in citrus products among these countries also phytosanitary concerns limit trade in fresh citrus products.

The US–Japan Beef and Citrus Agreement was signed in 1984. It led to an expansion of Japanese imports of beef and citrus products from the United States. Exports of fresh grapefruit from Florida and fresh oranges from California expanded rapidly. Japan became the largest importer of Florida grapefruit.

The CBERA, more commonly called the CBI was signed in 1983. It reduced tariffs for a wide range of products including most agricultural products among not only Caribbean countries such as Jamaica and the Dominican Republic, but also several Central American countries, including Belize, Costa Rica, Honduras, and the United States. The intention of the act was to expand trade among the small economies of the Caribbean countries and the United States. The US tariff on imported orange juice was eliminated for countries participating in the agreement. Costa Rica, Belize, Honduras, and the Dominican Republic all established plantings of sweet orange trees intended for processing as well as the construction of processing plants.

In March 2012, the US–South Korea Free Trade Agreement went into effect. One impact of the agreement was to loosen restrictions imposed by South Korea on the importation of both fresh and processed citrus products from the United States. The result has been expanded imports of fresh orange and grapefruit as well as increased importation of the US produced orange juice.

Other agreements affect citrus trade. Notably, the EU grants trade preferences to selected exports including Israel (grapefruit), Egypt (fresh oranges), Belize (orange juice), and Mexico (orange juice).

23.8 Marketing and promotion of citrus

Advertising and promotional activities have long served an important role in maintaining consumer demand for citrus products. Fresh and processed citrus products are considered cooperative goods as these commodities cannot be readily differentiated. Generic advertising and promotional activities have traditionally focused on the common attributes of citrus products that cannot be differentiated from one brand or another, such as nutritional content, origin, or safety (Forker and Ward, 1993; Ward, 2009). Generic promotional programs may increase total demand for a commodity and have been shown to provide positive net returns to industry stakeholders (Ward, 1997; Brown and Lee, 2002; Ward et al., 2015; Heng et al., 2018). Brand advertising, on the other hand, generally highlights many of the same generic attributes while seeking to differentiate the brand-specific products to compete within the category (Ward and Kilmer, 1989). Brand advertising may serve to increase demand, but also has an impact on capturing market share. Generic advertising can serve to collectively represent stakeholders of a homogenous commodity, such as producers of agricultural goods.

The structure and reach of advertising and promotional programs vary from market to market and vary across the fresh and processed sectors of the citrus industry. The introduction of new citrus varieties on the fresh market, for example, has reduced to a slight degree the homogeneity of the market for mandarin varieties, as indicative of the branding efforts associated with some new mandarin varieties, at least in the United States.

Advertising and promotion programs for 100% orange juice, while varying across regions, have served to enhance the category as a whole (Ward, 1997). In recent years, advertising and promotional activities for 100% orange juice and grapefruit juice have an increased focus on public relations and issues management activities to reflect the increase in consumer engagement across social media platforms. Historically, the Florida citrus industry's extensive investment in communicating the nutritional benefits and other attributes of citrus to consumers on both the domestic and international markets across several decades through television and print advertisements expanded the market for citrus products, especially in the United States. Educating and reinforcing consumers' knowledge of the health and wellness benefits of citrus products will remain an ongoing effort in an era where the information available is plentiful, but often, misleading, distorted, or altogether false. Two organizations heavily involved in generic promotional activities for orange juice are the FDOC and CitrusBR, based in São Paulo, Brazil. In recent years, both organizations have integrated proactive public relations and issues management programs into marketing activities.

The citrus industries in Florida and Brazil have undertaken proactive efforts to maintain the positive public opinion of citrus products in prominent markets around the world. Programs are designed to educate and reach key demographics and trusted influencers/nutrition experts who garner widespread reach alike. Programs are centered around reinforcing consumer awareness of the positive attributes of citrus, such as taste and nutritional benefits. Affinity for both raw and processed citrus product among younger consumers was identified as a critical issue to monitor and foster in the coming years. As with all industries, public relations activities have increased in relevance within the organizational structure over the last decade as consumers' access to media and information spans across more channels, including television, internet, and social networks. Although spending on social advertising has increased in recent years, investing in public relations activities has helped organizations with limited budgets reduce the need for paid media. Consumers are increasingly becoming exposed to new media across various platforms, such as television to digital media. In 2017, 81% of the US citizens had a social media profile, representing a 5% growth compared to the previous year (Kepios, 2017). The leading social network sites in 2017 were Facebook (2.06 billion active users), YouTube (1.5 billion active users), WhatsApp (1.3 billion active users), and Facebook Messenger (1.3 billion active users). Blogging services, such as Tumblr, also extend the reach of digital content (Kepios, 2017).

Consumers exposed to media across all platforms recall that the messages are positive, which can be attributed to the historical generic and brand advertising programs communicating the positive attributes of citrus, such as nutritional content or origin. Figure 23.6 illustrates the response of consumers' perception of the media they have seen, heard, or read about orange juice. The marginal decline in positive perception in November 2016 and March 2017 occurred following a 1-month lag when a spike in news media surrounds the release of the USDA citrus crop forecast.

Consumers who engage in social media were more likely to purchase 100% orange juice than those consumers who did not engage in social media, signifying a need to maintain a social media presence for both brand and generic programs (Figs. 23.6 and 23.7).

As the citrus industry grapples with the impact of HLB on the world supply of fresh and processed citrus products, maintaining consumers' affinity for citrus products has never been more crucial. The impact of a decline in supply in the United States includes a decline in distribution, higher prices at retail and food service, and a loss of shelf space at retail. Generic advertising and promotional programs have sought to provide perspective to consumers on the benefits of citrus and shore up demand for the long-term viability of the industry.

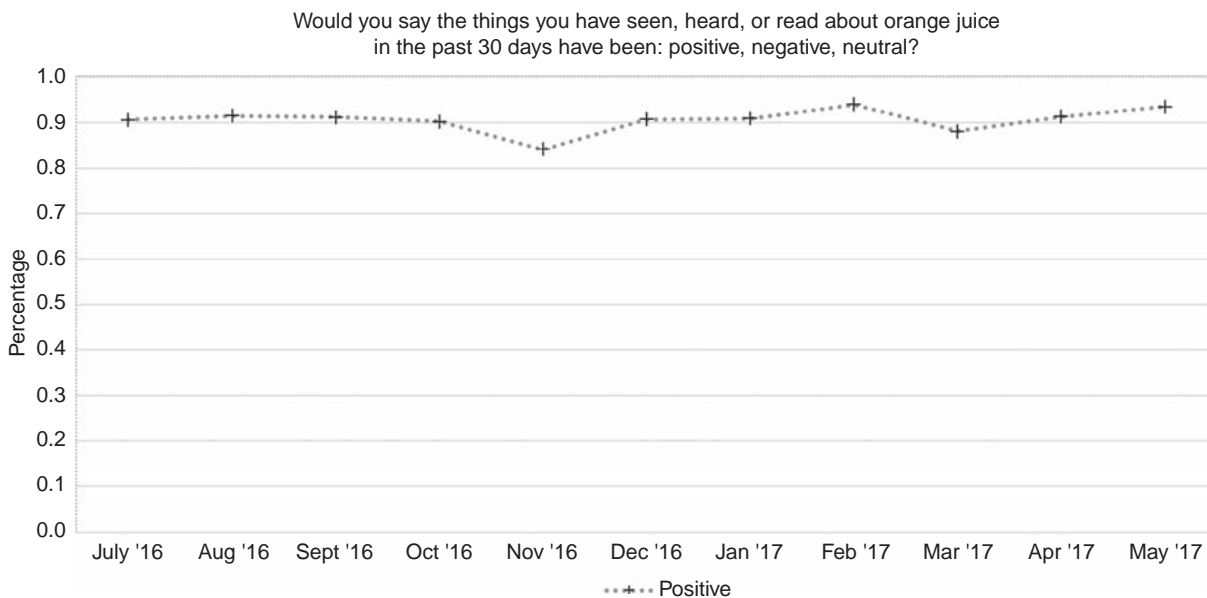


FIG. 23.6 Consumers' perception of media about orange juice is largely positive. Florida Department of Citrus. n.d. OJ consumer tracking database. Unpublished.

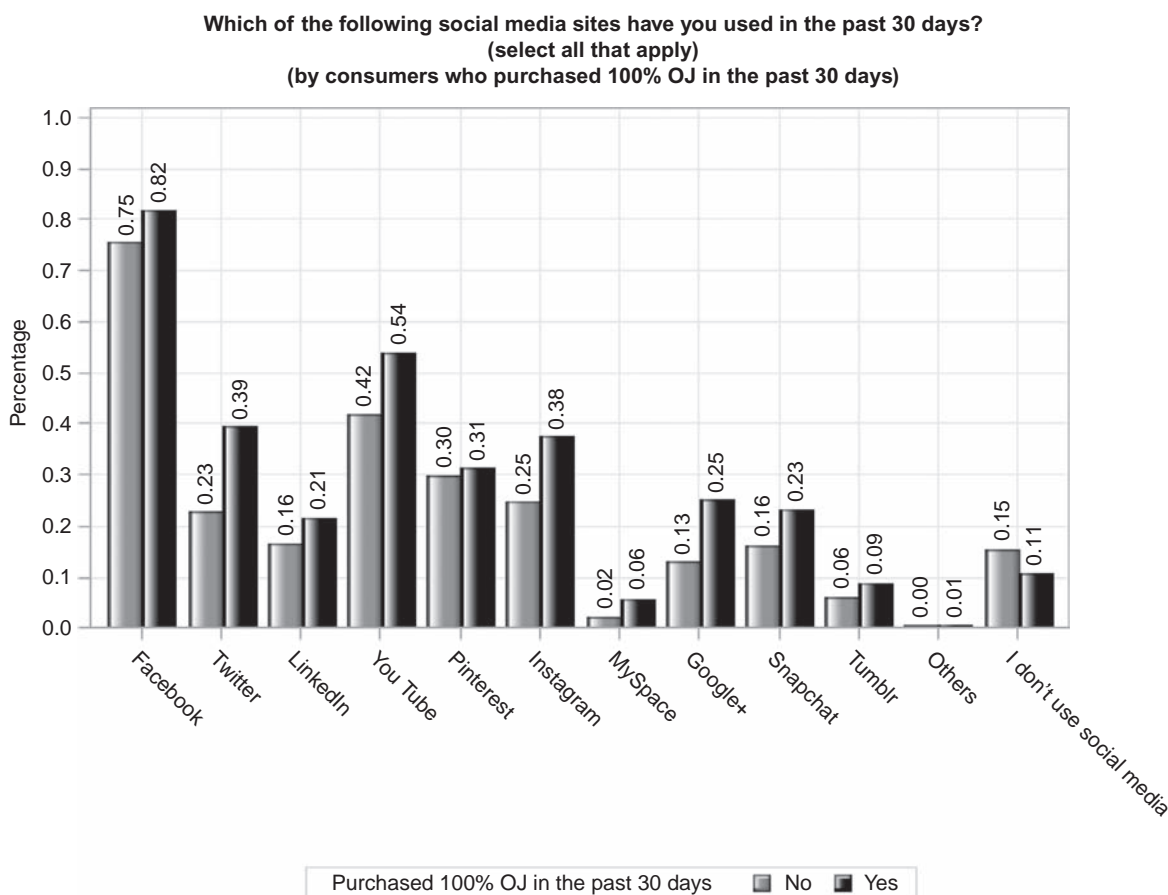


FIG. 23.7 Consumers engaged in social media were more likely to purchase 100% orange juice than consumers who did not engage in social media.

23.9 By-products from citrus processing

Several by-products are obtained through processing citrus fruit into juice. By weight, the most important by-product is pulp and peel. Depending on volume, the pulp and peel are further processed and transformed into a dehydrated product known as citrus pellets. Citrus pellets are used as animal feed. But surprisingly, the largest market for citrus pellets is Europe where they are used in rations for dairy cattle because of high fiber content. Citrus pellets enter the EU under a reduced tariff arrangement which makes them attractive relative to corn (either domestic or imported).

Analysis of citrus by-products is hampered by the lack of data. The FDOC collects data on the volume of citrus pellets and molasses produced in Florida, but does not collect data on peel oil or d-limonene, a high-valued solvent used in a variety of applications. Citrus essence production is also not reported.

Peel oil is collected from all varieties of citrus that are processed. The attributes of the peel oil are unique to the variety from which it was produced. Lemon oil is notable in that it is an important ingredient for soft drinks. In some countries, lemon oil is the primary product and lemon juice is the by-product. Citrus oils are used in a wide array of applications. For further discussion see [Braddock \(1999\)](#).

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Further reading

Florida Department of Citrus, 2018. OJ Consumer Tracking Database, unpublished.