



Economic Research Service
U.S. DEPARTMENT OF AGRICULTURE

Economic
Research
Service

Economic
Information
Bulletin
Number 257

September 2023

The Changing Landscape of U.S. Strawberry and Blueberry Markets: Production, Trade, and Challenges from 2000 to 2020

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Economic Research Service www.ers.usda.gov

Recommended citation format for this publication:

Yeh, D.A., Kramer, J., Calvin, L., & Weber, C. (2023). *The changing landscape of U.S. strawberry and blueberry markets: Production, trade, and challenges from 2000 to 2022* (Report No. EIB-257). U.S. Department of Agriculture, Economic Research Service.



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The Changing Landscape of U.S. Strawberry and Blueberry Markets: Production, Trade, and Challenges from 2000 to 2020

D. Adeline Yeh, Jaclyn Kramer, Linda Calvin, and Catharine Weber

Abstract

Fruits are vital to consumer diets and an important part of the U.S. agricultural industry. Two berries (strawberries and blueberries) are among the most economically important fruits. With more than \$2 billion in annual farm gate sales and accounting for a 13-percent share of the total production value of fruit, strawberries rank third for all fruit produced in the United States in 2020. Blueberries account for 5 percent of the total fruit production value. This report examined changes in domestic production, consumption, prices, and trade for strawberries and blueberries over two decades. This study helps explain how the major berry markets evolved in a short time and examines opportunities and challenges these markets face.

Keywords: Strawberries, blueberries, fruit production, fruit market, berries, trade competition, fresh fruits, processed fruits, organics, berry industry

Acknowledgments

The authors thank Brian Adam, Gregory Astill, Skyler Simnitt, Spiro Stefanou, Utpal Vasavada, Steven Zahniser, and Jayson Beckman of USDA, Economic Research Service (ERS) for their reviews and comments. They also thank Angela Brees, Grant Wall, Jana Goldman, and Elaine Symanski of ERS, Publishing Services Branch (PSB) for editorial assistance, and Adele Wilcoxon of ERS, PSB for design services.

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Contents

Summary	iii
Introduction	1
Strawberry Market	4
Fresh-Market Strawberries	4
Processing-Market Strawberries	13
Blueberry Market	15
Fresh-Market Blueberries	16
Processing-Market Blueberries	24
Challenges of the Domestic Berry Industry	27
Pest and Disease Management	27
Trade Competition	27
Other Challenges	28
Conclusion	29
References	30



The Changing Landscape of U.S. Strawberry and Blueberry Markets: Production, Trade, and Challenges from 2000 to 2020

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What Is the Issue?

Since 2000, the demand for strawberries and blueberries in the United States has increased. In response, both domestic production and imports have also increased substantially. New berry varieties, advancements in technology, and increases in planting acreage led to the growth of the domestic and foreign berries industries. In the past two decades, the increase in imports outpaced the increase in domestic production. Mexico remains the dominant supplier of strawberries to the United States, while Mexico and Peru emerged as the top suppliers of blueberries in the last decade. Advancements in production technologies expanded the production seasons, and the overlap in domestic and foreign supply in the blueberry and strawberry markets has increased year-round berry availability to consumers while raising concerns about foreign competition. These changes also affected the prices that domestic producers receive.



What Did the Study Find?

Strawberries are the most popular berries in the United States in value and volume of production.

- The development and adoption of high-yielding strawberry varieties led to an increase in total domestic production with less acreage.
- Fresh strawberry imports increased significantly in the last two decades, particularly from Mexico. Fresh strawberries imported from Mexico reached a record high of 431 million pounds in 2020. While Mexican strawberries have an almost year-round presence in the U.S. market, approximately 85 percent of Mexico's U.S.-bound shipments enter the market during winter and spring months.
- Most strawberry exports from the United States are for fresh-market consumption and are shipped to Canada. Fresh strawberry exports increased 94 percent in volume during 2018–2020 compared with 2000–2020. Frozen strawberries were exported in smaller quantities and declined in the past decade.

ERS is a primary source of economic research and analysis from the U.S. Department of Agriculture, providing timely information on economic and policy issues related to agriculture, food, the environment, and rural America.

- Organic strawberry production has been increasing at a faster pace than conventional production. In California, which grows more than 75 percent of the domestic organic production, organic strawberry acreage tripled from 2008 to 2019.

Blueberries are the second most popular berry in value and volume of U.S. production.

- The two main types of blueberries are highbush and lowbush. Highbush blueberries are mainly for the fresh market, while lowbush blueberries are primarily used in the processed market.
- While the United States exports some fresh blueberries, it has become a net importer. Imports of fresh highbush blueberries increased from 44 million pounds in 2000–2002 to 450 million pounds in 2018–2020, which accounted for about 62 percent of the domestic fresh blueberries disappearance.
- High prices for fresh market blueberries encouraged growth in global production. With higher prices in the spring and fall months, U.S. growers adopted new cultivars and production practices to extend their season, and imports increased to supplement supplies during those months.
- Between 2010 and 2020, domestic fresh blueberry imports from Peru and Mexico grew from less than 1 percent to over 50 percent as a result of increased planted acres and higher yields, partly driven by suitable production conditions and high profitability.
- U.S. demand for organic blueberries grew rapidly between 2008 and 2019. The value of organic blueberry sales increased more than fivefold to reach \$205 million in 2019.

How Was the Study Conducted?

This report used data from the USDA, National Agricultural Statistics Service and U.S. Department of Commerce, Bureau of the Census through the USDA, Foreign Agricultural Service Global Agricultural Trade System. Authors also accessed movement data and producer and retail prices from USDA, Agricultural Marketing Service and U.S. Department of Labor, Bureau of Labor Statistics. Data gathered from these sources were used to understand changes in production, trade, and prices for strawberries and blueberries over the last two decades. The USDA, Economic Research Service calculated shares of exports and imports, as well as per capita availability, which was used as a proxy for domestic consumption. The authors also discussed the fresh and processed markets with industry representatives for greater understanding.

The Changing Landscape of U.S. Strawberry and Blueberry Markets: Production, Trade, and Challenges from 2000 to 2020

Introduction

Berries were among the highest valued fruit crops produced in the United States in recent years (see box, “Most Berries Are Not True Berries”). In 2020, strawberries accounted for more than \$2 billion in annual farm gate sales and about 12 percent of the total fruit production value, making them the third largest fruit produced in the United States after grapes and apples. Blueberries account for 5 percent of the total fruit production value. Increased consumer awareness of the health benefits of berries and year-round availability increased domestic demand. The annual per capita domestic availability of fresh strawberries and blueberries, a proxy for consumption,¹ soared from 2000–2002 to 2018–2020 (89 percent for strawberries and 574 percent for blueberries; see table 1). The increase in demand was predominately in fresh berries, as frozen berry consumption grew less than 2 percent over this period.

Higher fresh consumption is mostly for strawberries, which dominate U.S. berry production. U.S. consumers nearly doubled the amount of fresh strawberries per capita in 2018–2020 compared with 2000–2002. Imports of fresh strawberries accounted for approximately 19 percent of total consumption in 2018–2020 (table 1). Imports of fresh blueberries accounted for more than 60 percent of U.S. consumption in 2018–2020.

¹ Total annual availability for fresh strawberries and blueberries is calculated as the differences between commodity supplies and nonfood use (i.e., production + imports – exports). Food availability data are often used as proxies for consumption at the national level, but they may overstate the amount of food ingested by humans and also provide little information on whether the foods are used as ingredients in processed food. USDA, Economic Research Service provides documentation online on how food availability is calculated.

Table 1
U.S. fresh-market berry statistics, 2000–2002 to 2018–2020

	Unit	2000–2002	2018–2020	Percent change
Fresh strawberries				
Utilized fresh production	Million pounds	1,040	2,007	93
Imports	Million pounds	79	401	408
Import share of availability	Percent	8.1	18.9	134
Exports	Million pounds	141	276	97
Per capita availability	Pounds per person	3.4	6.5	89
Fresh blueberries				
Utilized fresh production	Million pounds	90	343	283
Imports	Million pounds	44	450	919
Import share of availability	Percent	47.3	61.5	30
Exports	Million pounds	40	62	57
Per capita availability	Pounds per person	0.3	2.2	574

Note: Strawberry production is based on California Strawberry Commission data for 2000–2018 and USDA, National Agricultural Statistics Service for 2019 and 2020.

Source: USDA, Economic Research Service calculations based on USDA, National Agricultural Statistics Service Noncitrus Fruits and Nuts Summary, various issues.

Most Berries Are Not True Berries

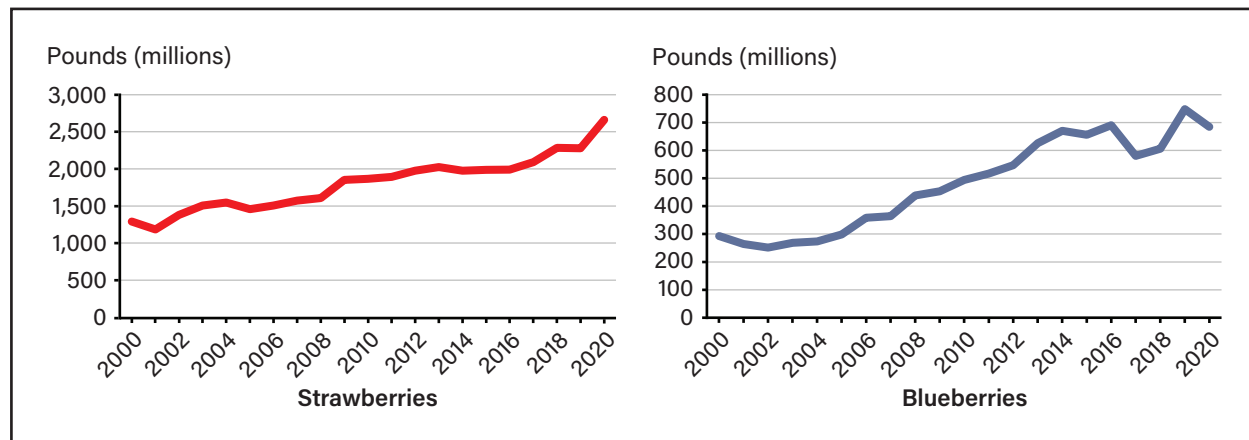
Botanically, many of the fruits commonly referred to as berries are not true berries. A true berry is a fruit produced from a single flower containing one ovary, with an edible pulp and seeds embedded in the common flesh of the ovary. Commonly known berries, however, are regarded as any small, tender, sweet, and bright-colored fruit (Invenire Market Intelligence, 2008). Blueberries are an example of a commonly known berry and a true berry. Strawberries and blackberries are examples that are commonly known as berries but not botanically classified as true berries since they are considered aggregate fruits that are developed from multiple ovaries of a single flower. The Census of Agriculture from USDA, National Agricultural Statistics Service (NASS) notes that aronia berries, blackberries, blueberries, boysenberries, cranberries, currants, elderberries, loganberries, raspberries, and strawberries comprise the berry group (NASS, 2017). NASS publishes annual production statistics for strawberries, blueberries (high-bush and lowbush), and raspberries, while similar data for boysenberries, loganberries, and blackberries were discontinued in 2018 (NASS, 2020).

Strawberries are the top berry produced in the United States. About 2.4 billion pounds of strawberries were produced in 2018–2020, an 87-percent increase from 1.29 billion pounds in 2000–2002 (figure 1). About 2 billion pounds, or 83 percent of total strawberry production, are for the fresh market. Production of blueberries between 2000–2002 and 2018–2020 indicated an even larger increase, about 152 percent, despite year-to-year fluctuations.

The strawberry and blueberry industries have shown different structural changes in domestic production in the past two decades. The Census of Agriculture (NASS, 2017) reported that blueberry farms in the United States rose between 2012 and 2017, while the number of strawberry farms declined during that same period. From 2012 to 2017, the number of blueberry farms increased about 8 percent to 15,933 farms, and the total harvested acreage increased to more than 153,000 acres. In contrast, strawberry harvested area declined slightly in recent years (from 67,467 acres in 2012 to 60,162 acres in 2017), mostly driven by reduced acreage in California, the dominant strawberry-producing State. As production shifts toward higher-yielding varieties such as Monterey and Fronteras, production gains remain achievable under reduced acreage (California Strawberry Commission (CSC), 2020).

Figure 1

U.S. strawberry and blueberry total utilized production, 2000–20



Source: USDA, Economic Research Service calculations using USDA, National Agricultural Statistics Service data.

The increased demand for strawberries and blueberries pushed market prices higher and attracted imports, especially from countries in Latin America. The industry saw rapid changes in domestic and foreign supplies in the last decade, and imports increased to meet the growing domestic demand for year-round fresh berries. Peru, which started exporting fresh blueberries to the United States in 2010, was its number one foreign supplier of fresh blueberries by 2020. Mexico is the main supplier of strawberry exports to the United States.

The United States is the leading global exporter of berries. The rise in domestic production and international demand expanded U.S. exports of fresh-market berries. More than 70 percent of U.S. fresh strawberry and blueberry exports go to Canada. U.S. berry suppliers also export to Japan, South Korea, Mexico, the United Kingdom, and Hong Kong. Asia remains an important market for the entire berry industry in the Western Hemisphere. Access to the Chinese market presents new opportunities for U.S. fresh blueberry growers, with the January 2020 signing of the U.S.-China Economic Trade Agreement (United States Trade Representative, (USTR), 2020a).

This study examined changes in domestic production, consumption, prices, and trade for strawberries and blueberries since 2000. It also increased understanding of how berry markets evolved in the past two decades and examined opportunities and challenges the berry industry face.

Strawberry Market

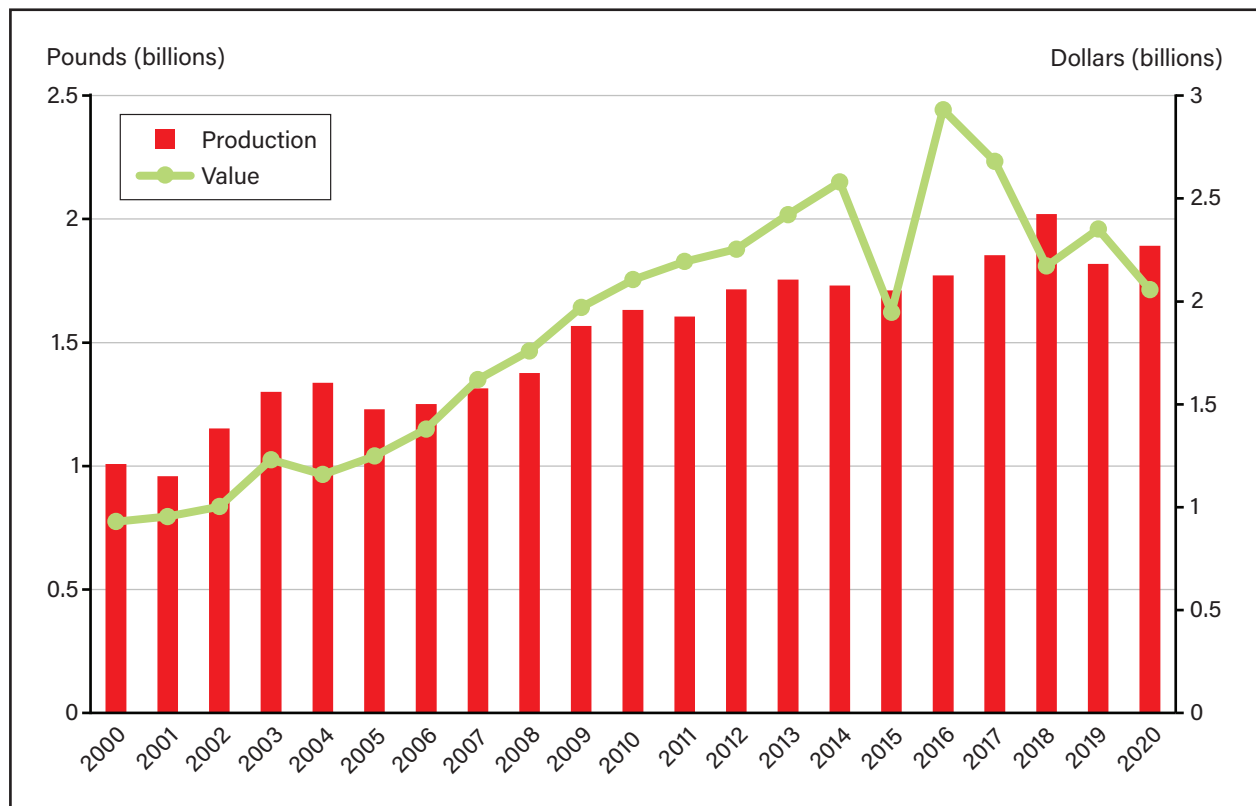
Strawberries are the top consumed and produced berry in the United States in volume and value. Strawberry consumption increased over the last two decades as a result of increased year-round availability and the health benefits consumers have associated with eating berries (Samtani et al., 2019). Fresh strawberries have a larger share of consumption, production, and trade than processed strawberries (including frozen).

Fresh-Market Strawberries

Domestic Production

The volume of U.S. fresh strawberry production trended upward since the early 2000s and reached a record high of approximately 2 billion pounds in 2018 (figure 2). In 2016, the value of U.S. production reached a record high of \$2.9 billion and then declined. The decrease in the value of production from 2016 to 2020 resulted from lower producer prices. The exception to the decreasing trend in the value of production was in 2019, when production volume was lower, but prices were relatively higher. In 2020, the value of domestic fresh strawberry production was \$2.1 billion, slightly lower than \$2.4 billion the previous year.

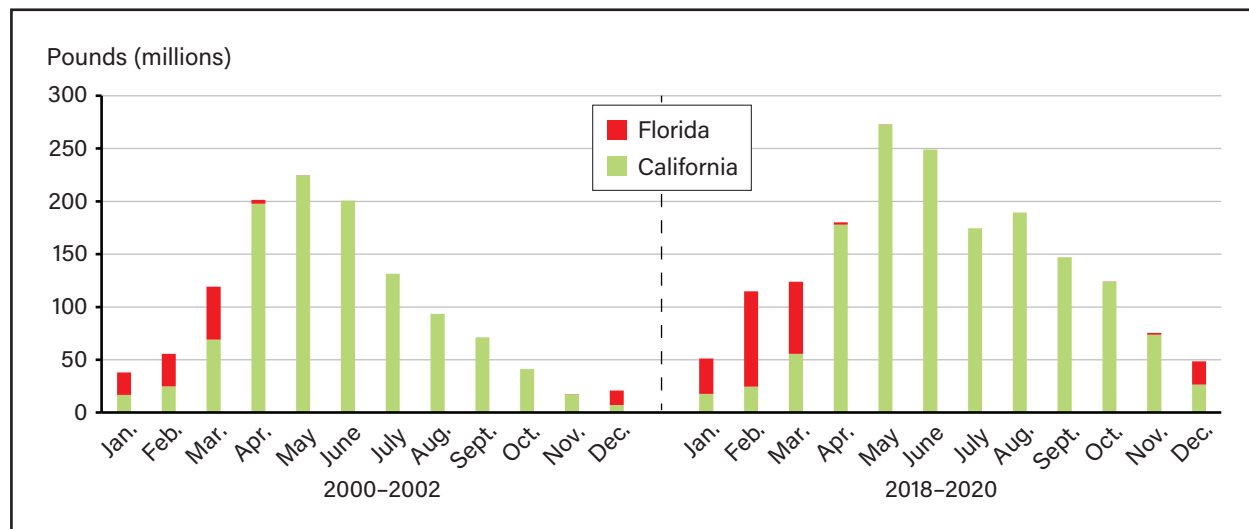
Figure 2
U.S. fresh strawberry production and value, 2000–20



Source: USDA, Economic Research Service calculations using USDA, National Agricultural Statistics Service data.

Between 2000 and 2020, about 90 percent of U.S. fresh strawberries were grown in California. Florida, the second leading State, grew about 9 percent (figure 3). California’s hot and dry summers but mild winters allow for year-round production, explaining the concentration of strawberry production in the State (Samtani et al., 2019). Most of California’s production is harvested between March and October. In other parts of the country, the growing season is significantly shorter than California’s. Florida’s growing season is typically constrained to the winter months, between December and March. Because Florida can produce in the months of low California production between December to March, domestic strawberries are available year-round.

Figure 3
U.S. strawberry shipments, by top producing States, 2000–2002 and 2018–2020



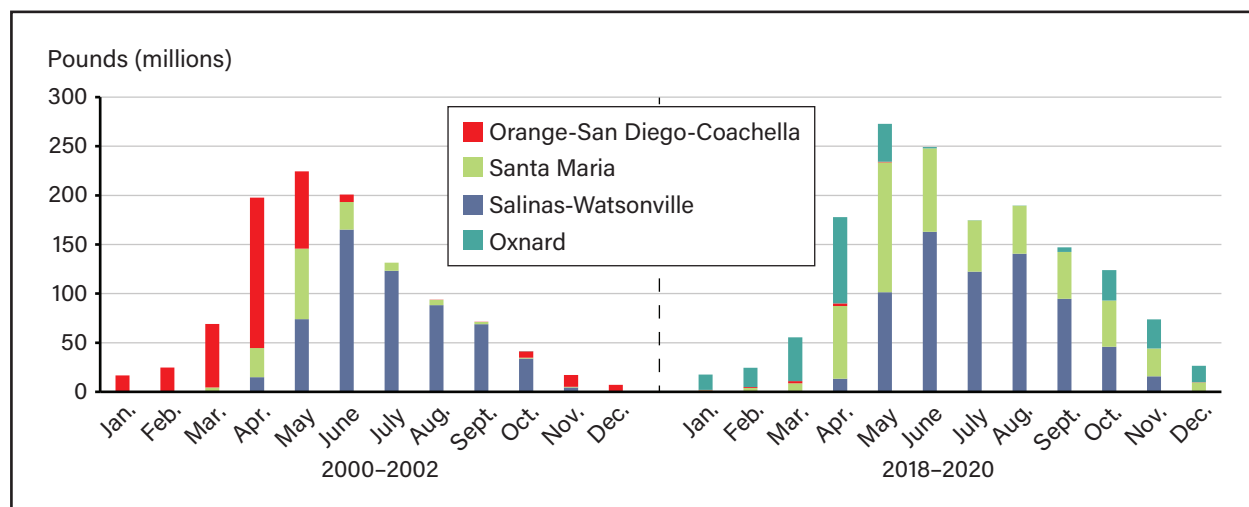
Note: Shipments are for conventional strawberries only.

Source: USDA, Economic Research Service calculations using USDA, Agricultural Marketing Service *Market News* data.

Most strawberry production in California occurs in Central California, such as the Santa Maria and Salinas-Watsonville areas (figure 4). In the early 2000s, production in California typically began in the southern region (Orange, San Diego, and Coachella areas) and moved up to Central California (Santa Maria and Salinas-Watsonville) as temperatures increased. At that time, Oxnard was a very small production area with shipments of less than 0.5 million pounds. By 2018–2020, production increased in the Oxnard district while it declined in the southern district. Many growers reduced plantings in the southern district due to rising land costs, new commercial/residential developments, and increased early season competition from Mexico (Burfield, 2021). In 2018–2020, Oxnard strawberry shipments averaged 290 million pounds; in the southern district, production declined from 370 million pounds in 2000 to 9 million pounds in 2020. The Oxnard and Southern California regions have similar shipment patterns in the winter/spring and fall seasons. They, therefore, face the same competition from Mexico; however, land prices are much lower in the Oxnard area.

Figure 4

Areas of strawberry production in California, 2000–2002 and 2018–2020



Note: Shipments are for conventional strawberries only.

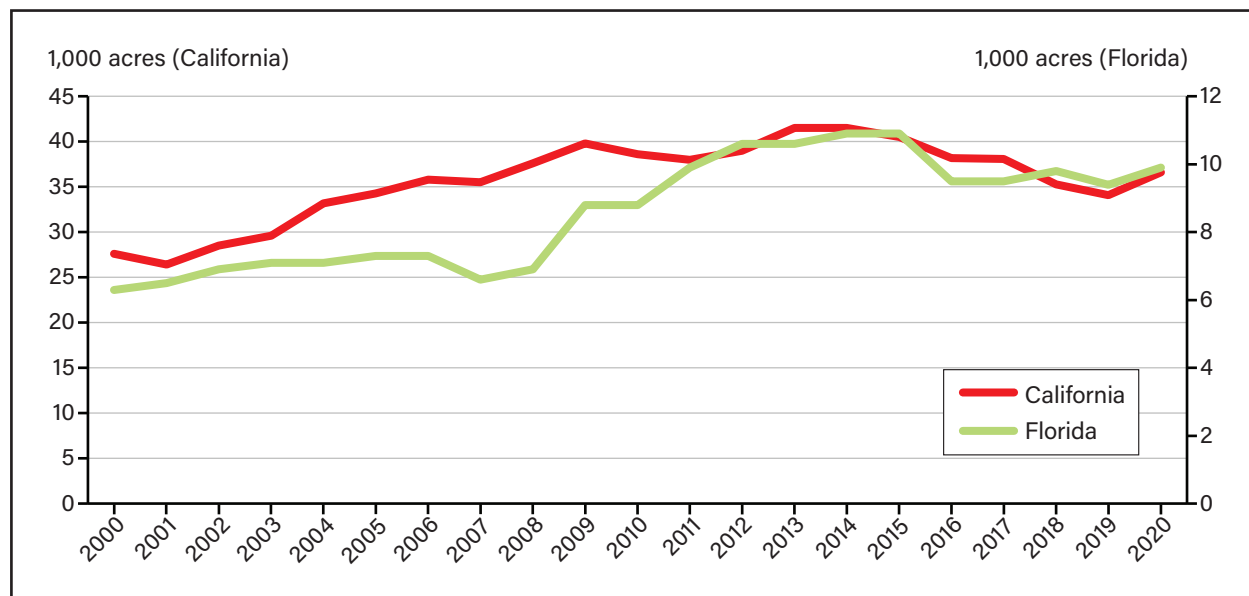
Source: USDA, Economic Research Service calculations using USDA, Agricultural Marketing Service *Market News* data.

The majority of Florida’s strawberry production is around Plant City, which is near Tampa. In 2018–2020, Florida production averaged 240 million pounds, compared with about 190 million pounds from 2000–2002, which was less than 20 percent of U.S. strawberry production. Florida’s strawberry season typically begins in December and ends in March but sometimes extends into April. The University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) breeding program has developed new early-yielding varieties, lengthening Florida’s production season (Aldrich, 2019). For instance, Florida Brilliance, a variety released by the University of Florida Breeding and Genetic program in 2018, provides early yields for strawberry growers from November through January (Whitaker et al., 2018).

Plant breeding played an important role in the U.S. strawberry industry. New strawberry varieties provide growers with a more flexible production window to better control diseases, increase yields, and efficiently manage their production. In California, the Public Strawberry Breeding Program at the University of California, Davis, has released new strawberry varieties to growers since its inception in the 1930s. About 60 percent of California’s strawberry fields are planted with varieties developed by the program (Filmer, 2019). In 2019, the program released two higher-yielding varieties (Moxie and Royal Royce) that may increase strawberry yield by as much as 29 percent over the previous varieties.

The development and adoption of new higher-yielding strawberry varieties in both Florida and California may be among the reasons that both States have shown production acreage declining since 2017 while maintaining production volume. In 2020, California harvested 36,600 acres, down from 40,500 in 2015 (figure 5). Similarly, acreage harvested in Florida reached a record high of 10,900 acres in 2015 but decreased slightly to 9,900 acres in 2020. In addition to the new varietal development, increases in production costs might also contribute to the decline in production acreage.

Figure 5
Strawberry acres harvested, California and Florida, 2000–20



Source: USDA, Economic Research Service calculations using USDA, National Agricultural Statistics Service data.

Harvesting fresh strawberries is labor intensive, given that strawberries are mostly hand-picked, and the field is harvested more than 30 to 50 times during a season. Harvested strawberries are generally not washed before packing and are cooled immediately after harvest to avoid mold growth and premature softening (CSC and California Minor Crops Council [CMCC], 2003). Labor is usually the largest cost item and often represents more than half of the variable production costs for strawberry growers (Rural Migration News Blog, 2020). California strawberry production requires about 1.5 workers per acre and 50,000 to 60,000 workers during the peak season (Rural Migration News Blog, 2020). H-2A workers² are a rising share of labor, partly because of the shortage of domestic labor available to pick the highly perishable fruit. Harvest mechanization is a potential solution to labor constraints and may also reduce the cost of domestic strawberry production. Currently, the common mechanical labor aid for harvesting strawberries is a slow-moving conveyor belt traveling in front of berry pickers. This allows the pickers to place full flats of berries on the belt instead of carrying flats to the end of the row. Conveyor belts are used more in Oxnard, California, than in the Salinas-Watsonville area of California because Oxnard has a relatively flatter terrain and larger fields (Calvin et al., 2022).

Research on mechanizing of strawberry harvesting is ongoing (Vanderhorst, 2018; Zhou et al., 2022). Mechanizing is difficult for strawberry harvesting because the fruit is delicate and fields need to be repicked repeatedly without damaging the plants that produce berries for the rest of the season. The California Strawberry Commission’s 2018 Strawberry Automation Summit assembled researchers and firms to promote harvest mechanization efforts, and a consortium of growers funded two mechanical harvester prototypes. U.S. growers did not adopt one of the machines because it required different planting configurations. The other machine prototype is being tested in Florida (Calvin et al., 2022). Currently, harvester use is limited to early-season berries before the strawberry plant grows more foliage and obscures berries. Fruit clustering is another significant challenge for the mechanical strawberry harvester, as researchers have tried various methods to separate the clustering of ripe and unripe berries without bruising the unripe ones (Zhou et al., 2022).

² The H-2A program allows U.S. employers or U.S. agents who meet specific regulatory requirements to bring foreign nationals to the United States to fill temporary agricultural jobs.

Given that strawberries have a short harvesting interval of 3 days or less at peak season, chemical controls are limited because of restricted-entry intervals (REI)³ and pesticide maximum residual limits (MRLs).⁴ Pest and disease controls for domestic strawberry production vary across growing regions. For larger monoculture of strawberry production in California, strawberries are usually planted in the fall and are raised as an annual crop to avoid the increased risk of pests after the first year. The planting soil in the strawberry fields is usually fumigated before transplanting to control for weeds, soil and plant diseases, and other harmful pathogens.

A major change in the strawberry industry was the phase out of methyl bromide, a soil fumigant that the industry had relied on heavily since the 1960s for soil fumigation (CSC and CMCC, 2003). Methyl bromide made it possible for strawberry growers to plant on the same field repeatedly without much plant damage. However, the Montreal Protocol, an international treaty in 1991, required that methyl bromide be phased out because it was designated as an ozone-depleter. As a result, the U.S. Environmental Protection Agency (EPA) started phasing out methyl bromide in 2005; it is now restricted to mostly nursery uses (CSC and CMCC, 2003; Guthman, 2021). Strawberry growers have widely replaced methyl bromide with chloropicrin as the soil fumigant, but it also faces regulatory restrictions in California. For example, the State requires buffer zones near sensitive sites like hospitals and schools (Samtani et al., 2019). These regulatory restrictions lead to interest in developing alternative production systems, such as a nonfumigated production system or a protected culture structure that minimize disease risk, but these alternative systems are expensive (Samtani et al., 2019; Rural Migration News Blog, 2020).

Imports

From 2000 to 2002, around 6 percent of fresh strawberries consumed in the United States were imported. Twenty years later (2018–2020), about 14 percent of consumed fresh strawberries were imported (table 2). Mexico supplies 99 percent of U.S. imports of fresh strawberries and is a leading global strawberry producer (Food and Agricultural Organization of the United Nations [FAOSTAT], 2022). During the winter and early spring, the United States augments supplies with imports from Mexico to accommodate demand. Less than 1 percent of total U.S. fresh strawberry imports came from other countries, including Canada, South Korea, and Turkey. U.S. fresh strawberry imports from Mexico were at a record high in 2020 at 431 million pounds, up 6 percent from the year before and up 500 percent from 2000. While Mexican strawberries have an almost year-round presence in the U.S. market, approximately 85 percent of Mexico's U.S.-bound shipments enter the market during the winter and spring.

³ The restricted-entry interval (REI) is one of the restrictions set by the U.S. Environmental Protection Agency (EPA) to protect workers after pesticide applications. REI is the time immediately after a pesticide application when entry into the treated area is restricted. Some pesticides have one REI for all crops and uses, while other pesticides have different REIs depending on the crop, method of application, or the post-application activity to be performed.

⁴ The maximum residue limits (MRL), also called tolerances, are the maximum amount of a pesticide allowed to remain in or on a food as part of the process of regulating pesticides by EPA.

Table 2

Average monthly and annual volume and share of fresh strawberry shipments from Mexico, 2000–20

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Import volume from Mexico (million pounds)													
2000–2002	7.89	10.50	15.71	19.27	10.26	7.56	1.85	0.08	0.03	0.15	1.06	2.20	76.57
2010–2012	35.76	39.47	48.80	53.06	26.52	16.82	6.26	0.04	0.01	4.14	12.26	20.43	263.59
2018–2020	76.69	77.79	70.74	49.88	24.39	17.81	4.24	0.04	0.21	6.11	21.55	47.43	396.88
Import share from Mexico (percent)													
2000–2002	16.31	15.03	11.39	8.82	4.70	3.86	1.64	0.07	0.10	0.25	5.46	9.22	5.89
2010–2012	37.79	29.37	17.57	12.30	2.95	0.15	0.00	0.00	0.00	3.32	19.13	30.30	9.14
2018–2020	54.69	41.55	31.98	12.39	0.81	0.02	0.00	0.00	0.10	3.96	19.40	44.66	13.70

Note: Import share is percent of shipments from Mexico divided by total shipments.

Source: USDA, Economic Research Service calculations using U.S. Department of Commerce, Bureau of the Census and USDA, Agricultural Marketing Service *Market News* data.

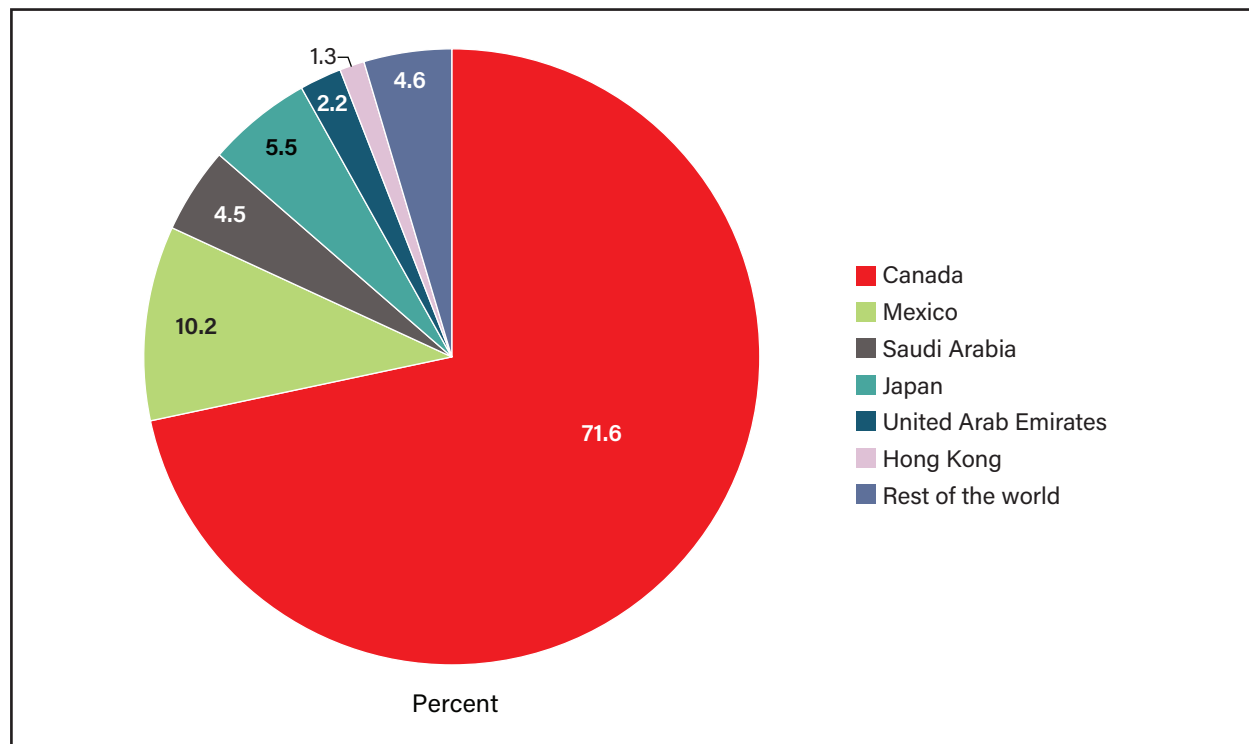
Strawberries are mainly produced in two regions of Mexico: Baja California and Central Mexico (including Michoacán, Guanajuato, Jalisco, and Mexico States) (Wu et al., 2018a). Traditionally, fresh imports from Mexico have come from Baja California, just south of the U.S.-Mexico border. Most of Baja California's strawberry production goes to the fresh export market (USDA, Foreign Agricultural Service [FAS], 2005). This area has mild temperatures, and it is also conveniently located for U.S. firms with operations in Mexico, but it experiences water constraints (Barringer, 2021). Harvest of strawberries in Central Mexico peaks in the winter and thus reaches the market first (USDA, FAS, 2005).

The introduction of protective structures such as high tunnels revolutionized the berry industry in Central Mexico, especially in Michoacán. High tunnels are unheated covered structures that protect the strawberry crop from unfavorable weather conditions such as freeze events and intense heat. In 2016, about 90 percent of the strawberry planting acreage in Central Mexico used protective structures (Wu et al., 2018a). The use of protective structures in Central Mexico increases Mexican strawberry exports to the United States when domestic production is lower. The increased use of high tunnels in Central Mexico might be driven by Mexican government subsidies and investments from U.S. buyers in exchange for strawberry contracts from growers (Wu et al., 2018b).

Exports

Although the majority of U.S. strawberry production is consumed domestically, U.S. fresh strawberry exports increased over the last several years. Fresh strawberry exports reached a record high in 2018 of 310 million pounds, with a value of \$428 million—also an all-time high. On average, 2018–2020 fresh exports were 277 million pounds, up 94 percent in volume from 2000–2002. Canada was the largest importer of U.S. fresh strawberries from 2000 to 2020. In 2018–2020, about 72 percent of U.S. fresh strawberry exports were shipped to Canada, followed by Mexico, Japan, Saudi Arabia, and others (figure 6). As of 2007, consumption was on an upward trend, and there was a large demand for fresh strawberries in Canada (USDA, FAS, 2007). In the last two decades, the United States exported fresh strawberries year-round to Canada, with peak shipments in May right before the harvest in Canada. Quebec is the largest strawberry-producing Province in Canada, followed by Ontario (USDA, FAS, 2007).

Figure 6
Share of the U.S. fresh strawberry exports, 2018–20



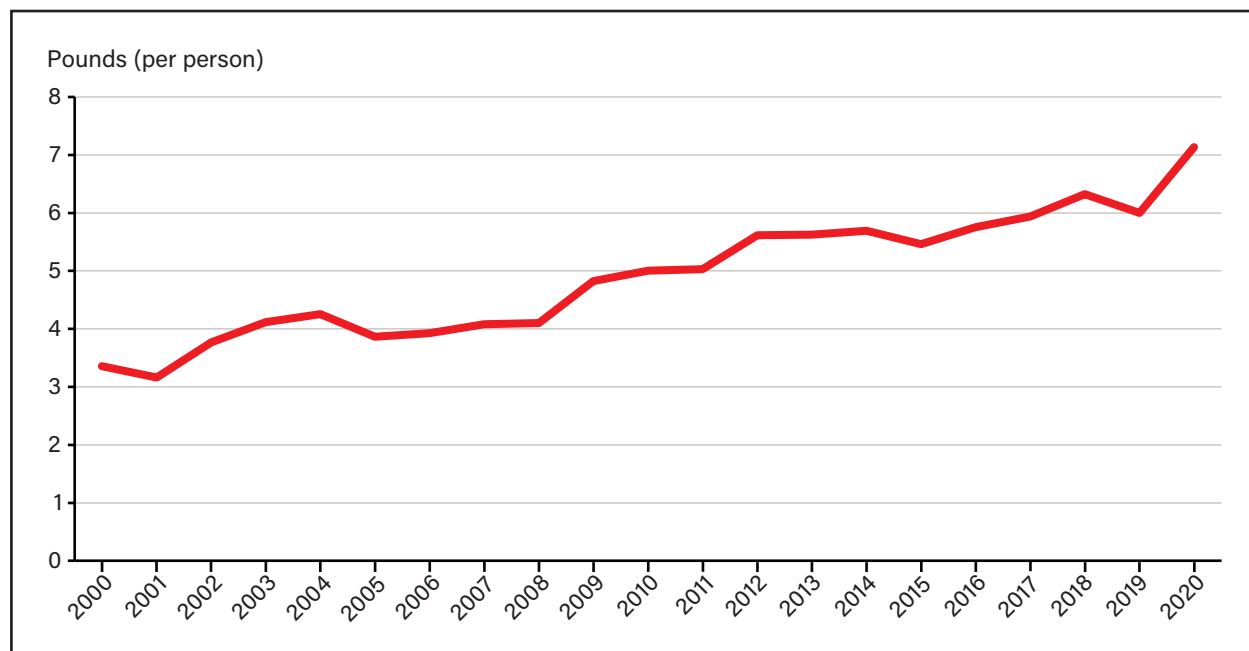
Source: USDA, Economic Research Service calculations using U.S. Department of Commerce, Bureau of the Census data.

Consumption

Increased strawberry consumption in the United States was helped by greater awareness of the importance of a healthy diet, more year-round availability of fresh fruits (including strawberries) through domestic and foreign supplies, and adoption of new varieties (see box, “Organic Strawberries”). While strawberries account for a majority of berries consumed for fresh use in the United States, the annual U.S. per capita fresh strawberry use has generally trended higher since 2000–2002 (figure 7). The average per capita strawberry use for 2018–2020 was estimated at 6.2 pounds per person, almost double the average during 2000–2002.

Figure 7

U.S. annual fresh strawberry per capita availability, 2000 to 2020

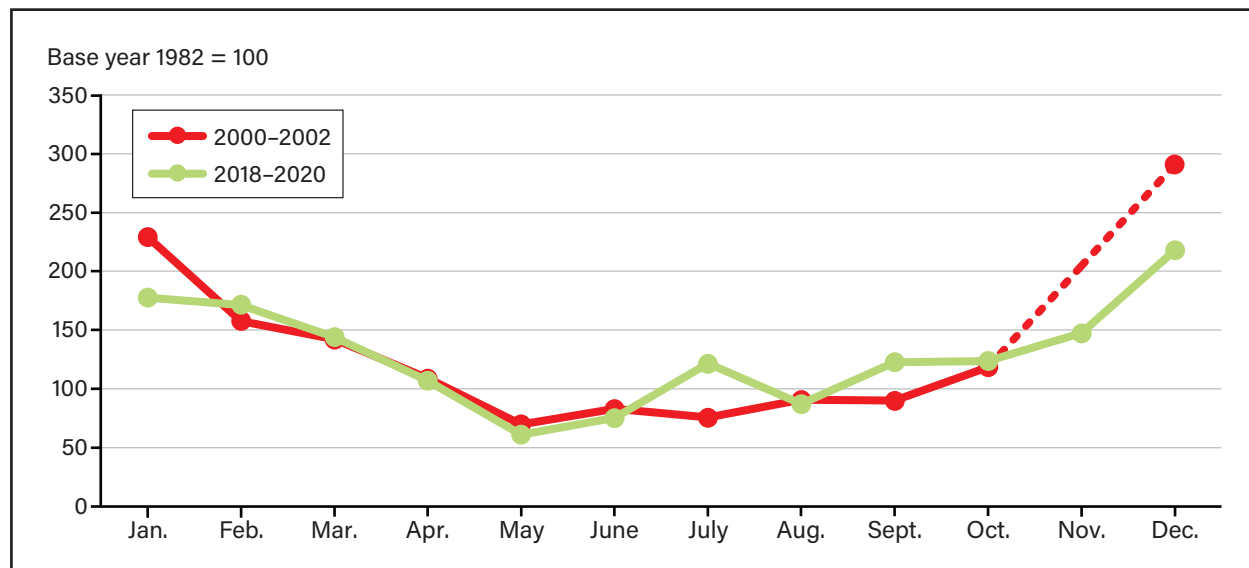


Source: USDA, Economic Research Service (ERS) based on data from ERS Fruit and Tree Nuts Yearbook Tables, 2020.

Prices

Fresh strawberries tend to have strong seasonal price trends, given their relatively short shelf life. Even with immediate cooling after harvest, fresh strawberries last only about 1–2 weeks. Seasonal grower prices increase when there is less supply in the market and demand is high. Consumer prices tend to follow similar patterns. In 2018–2020, producer prices were highest in late November to January when less supply was available and lowest in May when supplies peaked (figure 8). During holiday periods, prices and demand increase. For example, prices for fresh strawberries spike in mid-February leading up to Valentine’s Day, in May for Mother’s Day, and at the end of June and July when there are many graduation parties. Innovations such as high tunnel production help lengthen the season by increasing production earlier in the season. This is beneficial as Mexico’s growers strive to gain higher seasonal prices and market share in the winter months. The increase in winter supplies likely put downward pressure on prices in 2018–2020 compared with prices in 2000–2002.

Figure 8
Strawberry producer price index, 2000–20



Note: November data for 2000–2002 were unavailable.

Source: USDA, Economic Research Service calculations using U.S. Department of Labor, Bureau of Labor Statistics data.

Organic Strawberries

U.S. consumer demand for organic blueberries and organic strawberries drove the growth in domestic and foreign production over the last two decades. Since 2003, food products labeled and sold in the United States as “organic” must follow the USDA organic regulations. Regulations standardize the production and handling requirements for organic products to assure consumers who are willing to pay a price premium for organic produce.

Like conventional strawberry production, organic strawberries are primarily grown in California. Dry California weather provides ideal growing conditions for organic strawberries. California’s organic area harvested increased from 1,178 acres in 2008 to 4,022 acres in 2019. USDA, NASS started reporting organic strawberry production data in 2008. From 2008 to 2019, more than 75 percent of organic strawberry acres harvested in the United States were in California. In 2020, the California Strawberry Commission reported 4,624 acres of organic strawberries, 13 percent of the strawberry acreage in California. The commission reported an increase in both fall and summer plantings from 2019, which coincided with an increase in year-round organic strawberry production.

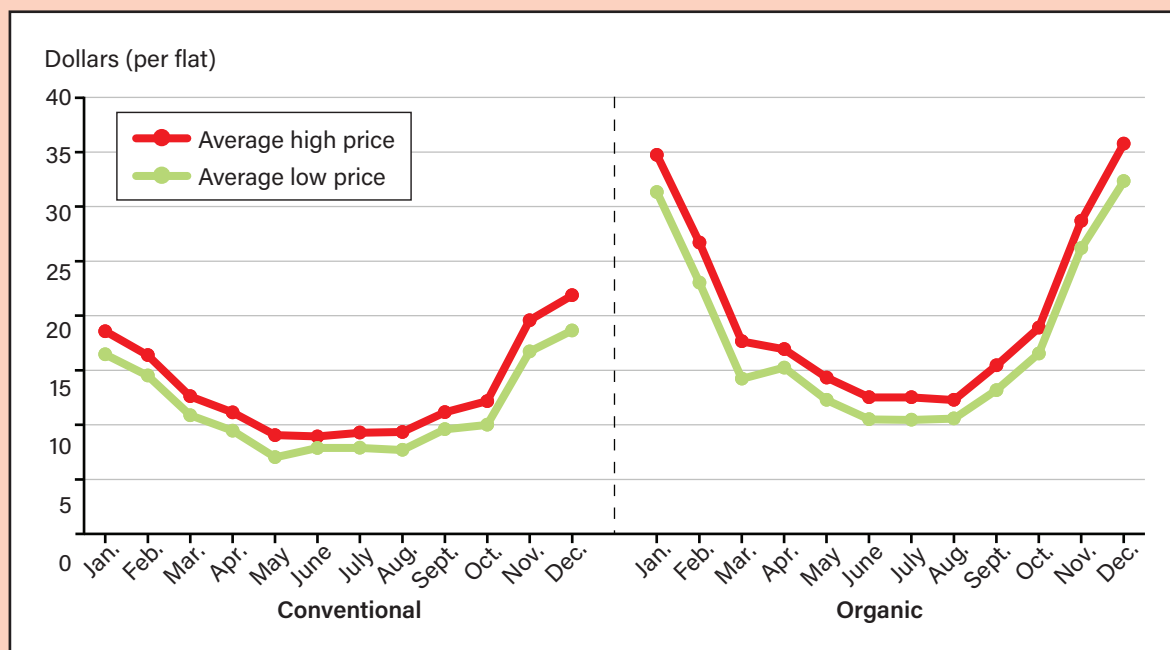
Organic strawberries are a smaller part of production in Florida. In 2019, 680 acres were devoted to organic strawberries in Florida compared with 14 acres in 2008. Overall, U.S. production of organic strawberries increased to support consumer demand (Samtani et al., 2019). The farm value of organic strawberry sales in the United States rose from \$80 million in 2008 to \$300 million in 2019.

Organic strawberry shipping point prices—used to represent farm gate prices—tend to be closely correlated with conventional strawberry shipping point prices. Organic prices, on average, were about 50 percent to 60 percent higher than conventional prices from 2015–2019, with larger price premiums in winter months when domestic supply is low (figure 9). Apart from the price premiums associated with organic berries, organic strawberry production has become a viable marketing option for growers, especially since methyl bromide, a pre-plant soil fumigant, began to be phased out in 2005 (Guthman, 2016).

In mid-2021, a harmonized system (HS) code was created to classify the trade of fresh organic strawberries. USDA, Agricultural Marketing Service (AMS) Market News shipment data show organic strawberry imports from Mexico from 2018–2020. Organic shipments arrive in the winter months like conventional strawberries and peak in March, with increased shipments in January and February in 2019 and 2020. USDA, AMS did not report organic shipments from 2000–2002, likely due to a lack of data.

Figure 9

Conventional and organic average fresh strawberry price per flat, 2015–19



Note: Average of all low prices and average of all high prices. Flat is eight 1-pound containers with lids.

Source: USDA, Economic Research Service calculations using USDA, Agricultural Marketing Service *Market News* data.

Processing-Market Strawberries

The U.S. industry produces strawberries for fresh and processing markets. Growers usually prefer selling to the more profitable fresh market, but if faced with bruised produce, market restrictions, or other impediments to reaching the market of choice, processing becomes the residual market. For instance, during peak production in California, growers may sell strawberries to processing if insufficient demand exists to take all harvested strawberries for fresh market; or when production is toward the end of the season that the harvested berries tend to be smaller and less appealing for the fresh market. Most strawberries for the processing market are frozen whole (individually quick frozen, IQF) or sliced (Pollack et al., 2005). Frozen strawberries are mainly sold to the food service industry but also sold in bulk to manufacturers of jam, ice cream, and bakery products, among other products (Pollack et al., 2005).

Almost all U.S. processed strawberries are produced in California, and approximately 18 percent of California's strawberry crop in 2020 was sold frozen. Frozen strawberry supply declined from 426 million pounds in 2000–2002 to 386 million pounds in 2018–2020. According to USDA, NASS cold storage data, there were, on average, about 226 million pounds of frozen strawberries in cold storage in 2018–2020. The

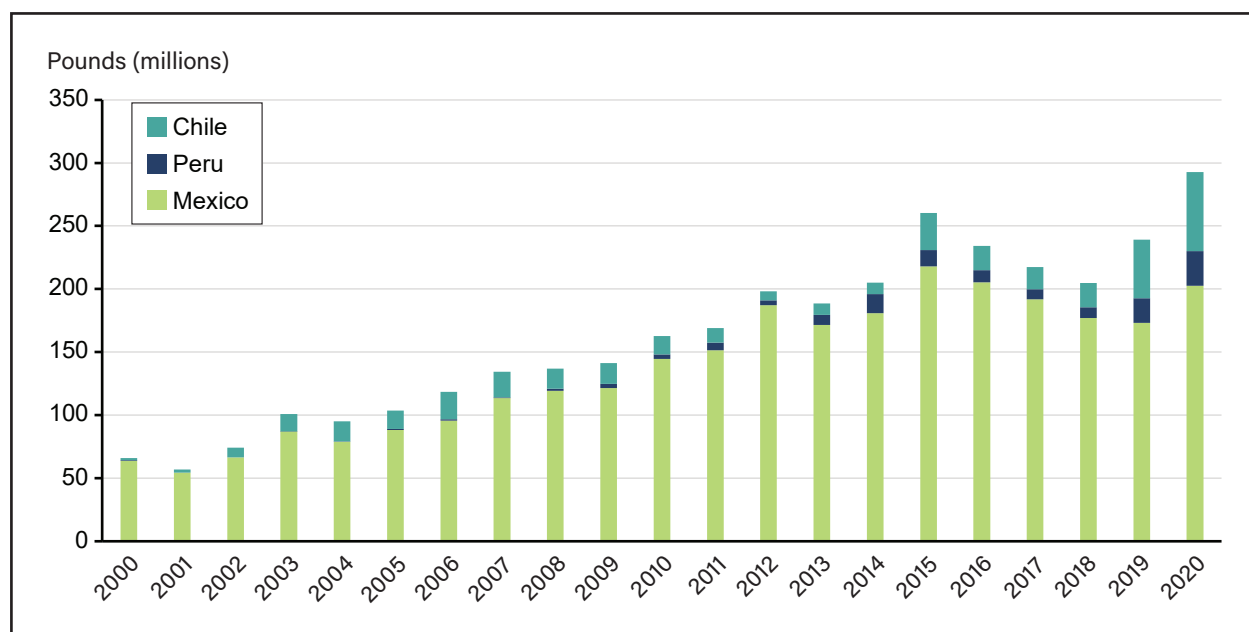
monthly cold storage stock of frozen strawberries correlates with the production season. July and August tend to have the highest cold storage stocks; March and April have the lowest. The annual U.S. per capita consumption of frozen strawberries increased slightly from approximately 1.49 pounds in 2000–2002 to 1.84 pounds in 2018–2020.

Imports

As with fresh market strawberries, the strawberry processing industry faces increased import competition. Imports of frozen strawberries reached a record high in 2020 of 351 million pounds from 78 million pounds in 2000. Imports increased by 221 percent from 2000–2002 to 2018–2020, and the import share of supply more than doubled from 19 percent to more than 40 percent. The increase in frozen strawberry imports is likely due to the reduction of domestic frozen strawberries and a slight increase in demand. With a rise in imports in 2020 compared with 2019, the market saw a 28-percent decline in real frozen strawberry prices in 2020 from the previous year (from \$52.80 to \$38.10 per hundredweight).

On average, Mexico supplies 70 percent of U.S. frozen strawberries. U.S. frozen imports averaged 285 million pounds between 2018–2020, a 221-percent increase from 2000–2002. In 2020, Chile and Peru’s frozen strawberry exports increased as demand rose. Peru and Chile’s market share of U.S. frozen strawberry imports grew to 8 percent and 18 percent, respectively. Conversely, Mexico’s share declined slightly to 60 percent (figure 10). The United States is the main market for frozen strawberries from Peru.

Figure 10
U.S. frozen strawberry imports from top suppliers, 2000 to 2020



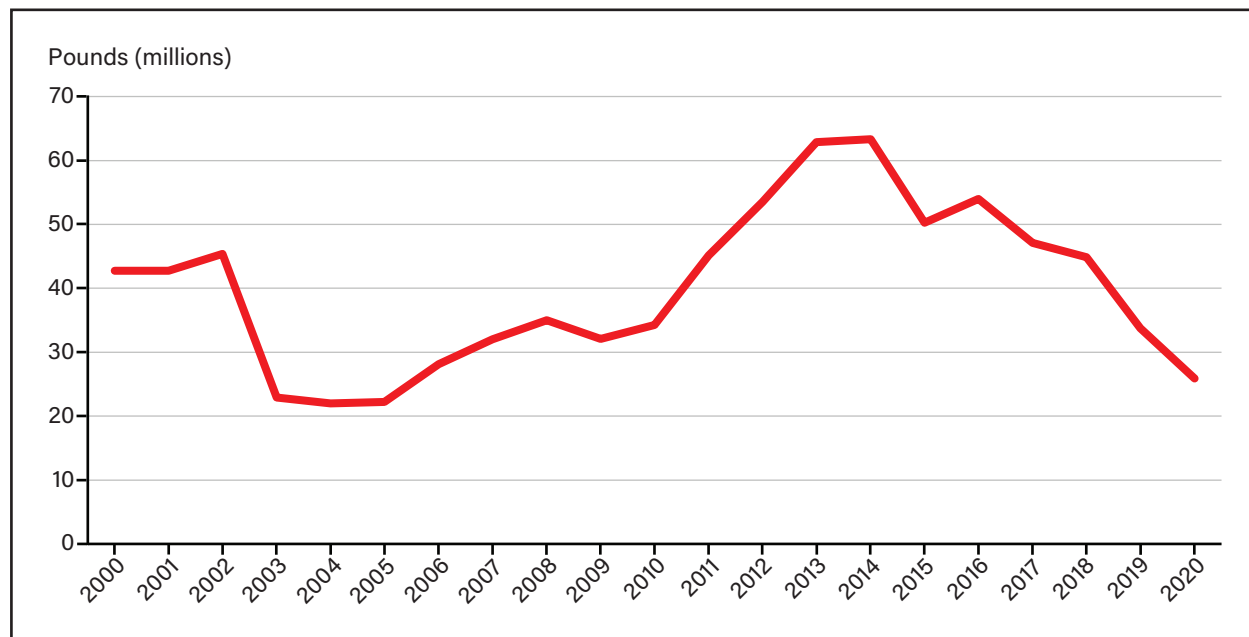
Source: USDA, Economic Research Service calculations using U.S. Department of Commerce, Bureau of the Census data.

Exports

While exports of fresh strawberries increased over the years, frozen exports generally decreased over the past 7 years (figure 11). U.S. frozen strawberry exports reached a record high of 63 million pounds in 2014 and have declined since. In 2020, total frozen strawberry exports were about 26 million pounds. The export decline might be partially due to the increase of frozen strawberries staying in the domestic market. In 2018–2020,

Canada received more than 35 percent of U.S. frozen exports, followed by Japan (18 percent), South Korea (14 percent), and Mexico (8 percent).

Figure 11
U.S. frozen strawberry exports, 2000 to 2020



Source: USDA, Economic Research Service calculations using U.S. Department of Commerce, Bureau of the Census data.

Blueberry Market

The two main types of blueberries are highbush and lowbush. Each requires different management practices depending on the geographic location and the cultivar planted. Highbush blueberries are mainly for the fresh market. Lowbush blueberries are primarily used in the processed market. Lowbush blueberries are also called wild blueberries and sometimes grow naturally, but the lowbush blueberry fields still must be managed for commercial production. About 90 percent of total domestic blueberry supplies are highbush; the remaining 10 percent are lowbush.

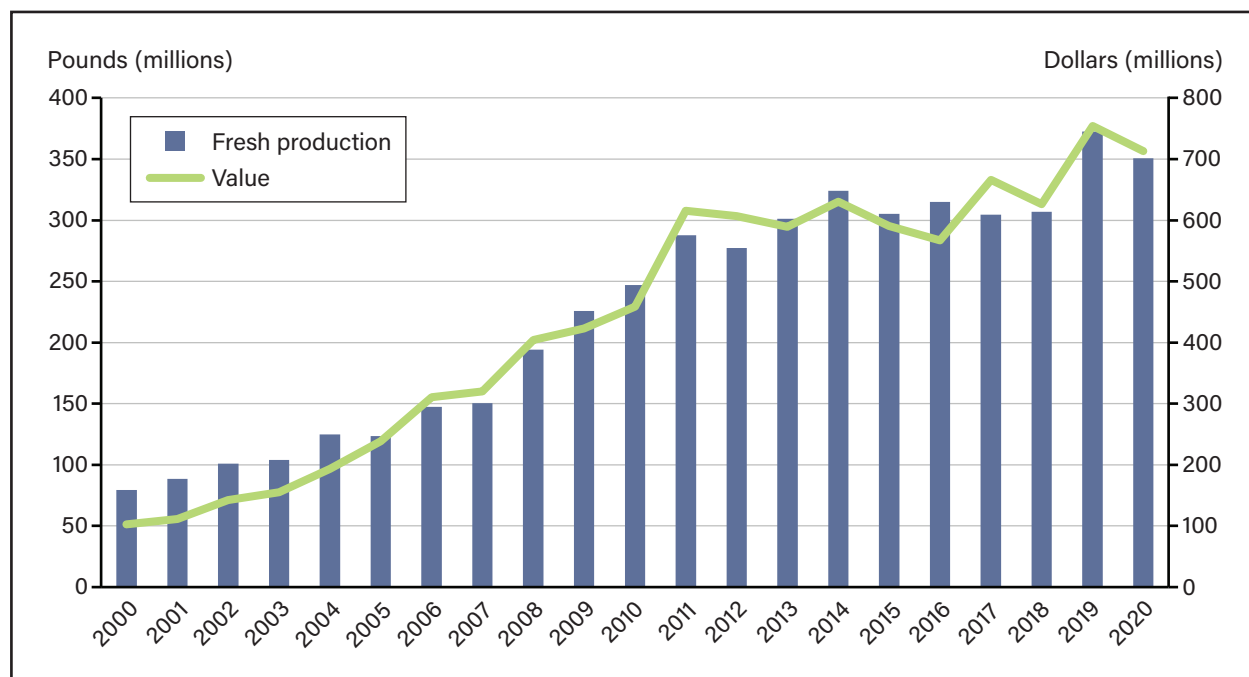
The U.S. blueberry market has changed dramatically since the early 2000s, and now blueberries are available year-round in large volumes. In 2019, the total blueberry utilized production (highbush and lowbush) reached a record-high 748 million pounds, with the majority being highbush blueberries. Production decreased slightly in 2020 to 685 million pounds. The value of production has trended upward since the early 2000s as production volume rose. Unlike strawberries that are grown in just a few States and imports that come almost exclusively from Mexico, blueberry supplies are more geographically diverse in U.S. and foreign areas. Driven by demand, foreign production expanded rapidly, while growth in U.S. blueberry production has been gradual.

Fresh-Market Blueberries

Domestic Production

U.S. fresh blueberries supplies in 2020 were 351 million pounds, a slight decline from 2019's record high 372 million pounds (figure 12). Over 99 percent of fresh blueberries are highbush. U.S. production increased 283 percent between 2000–2002 and 2018–2020. The value of production increased over the last two decades to \$713 million in 2020.

Figure 12
U.S. fresh blueberry production and value, 2000 to 2020

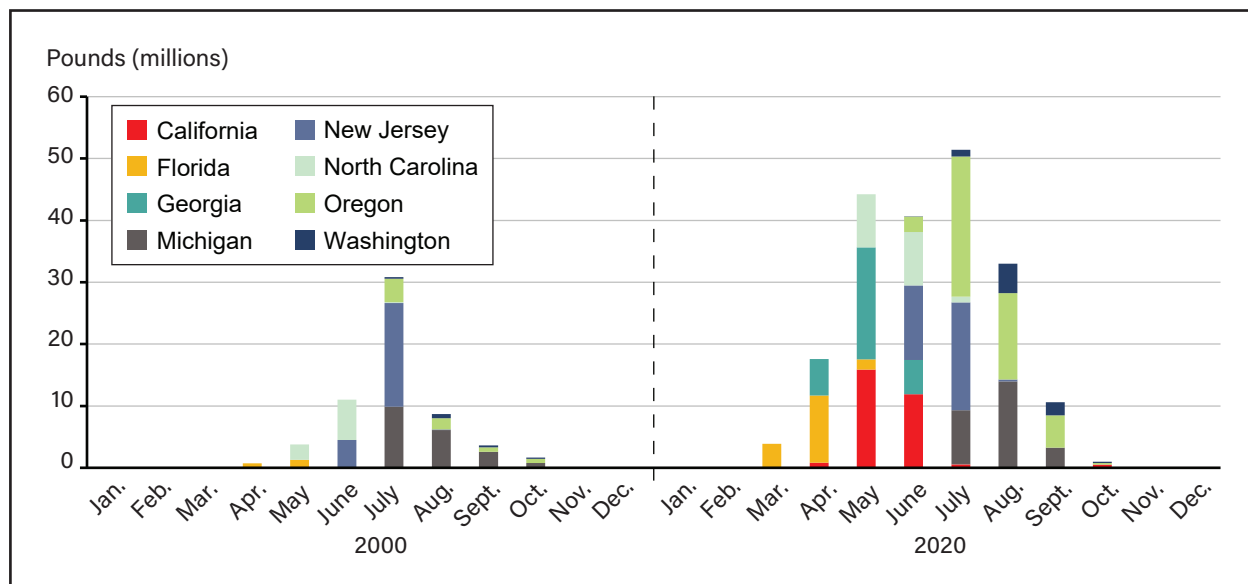


Source: USDA, Economic Research Service calculations using USDA, National Agricultural Statistics Service data.

According to USDA, Agricultural Marketing Service, the top eight States producing fresh blueberries in 2020 were California, Florida, Georgia, Michigan, New Jersey, North Carolina, Oregon, and Washington (figure 13). Compared with production in 2000, the biggest U.S. producers of fresh-market blueberries were New Jersey and Michigan; California, Washington, and Florida were smaller production States. According to 2020 USDA, Agricultural Marketing Service movement reports (USDA, AMS, 2020), Oregon was the largest blueberry shipping State, with approximately 20 percent of total domestic shipments, followed by California and Georgia with about 15 percent of total shipments each.

Figure 13

U.S. blueberry shipments by top producing States, 2000 and 2020



Note: Shipments are for conventional blueberries only.

Source: USDA, Economic Research Service calculations using USDA, Agricultural Marketing Service *Market News* data.

The area harvested for total highbush blueberries expanded from 70,510 acres in 2010 to 96,200 acres in 2020. Yields also increased. In 2020, the average yield was 6,740 pounds per acre for highbush blueberries, up from 5,830 in 2010. Yields vary substantially by State, with 2020 yields ranging from 11,660 pounds per acre in California (followed closely by Oregon with 11,400 pounds per acre and Washington with 8,440 pounds per acre) to 4,290 pounds per acre in Michigan and 3,980 pounds per acre in Florida, where freezing winter weather can lower yields.

The geographic diversity is due to advancements in new varieties of blueberries that can be grown in different climates (Strik et al., 2014). Northern highbush blueberries typically require more chill hours⁵ and milder summers. The rabbiteye variety, native to Georgia, benefits from hot summer weather in the Southeast. Southern highbush, a hybrid of northern highbush and rabbiteye, also thrives in hot, humid weather and ripens earlier than rabbiteye. Most southern highbush blueberry varieties planted in Florida were developed by the University of Florida’s blueberry breeding program. Snowchaser is one of the earliest-ripening southern highbush varieties released in 2005 (University of Florida, Institute of Food and Agricultural Sciences, 2021). Optimus and Magnus are early maturing varieties released in 2017, which allow Florida growers to market blueberries earlier in the year when less supply is available.

The Florida crop typically arrives in the market in March and ends in May. Georgia enters the market in mid-to-late April, followed by other major producing States that come into production through the summer. California’s peak harvest period is May to June, with smaller supplies throughout the year. Florida growers used to have very small production in March but have since increased production in March using the low-chill southern highbush blueberry varieties.

⁵ Chill hours are defined as the minimum number of hours in the winter under 45 degrees F that a variety requires for production.

In addition, blueberry production in southern Florida has increased. The Georgia season now starts in April. Growers in Georgia use both southern highbush and rabbiteye varieties to extend their season by starting earlier. In eastern Washington, dry growing conditions and relatively little pest pressure led to growth in blueberry production. While the harvest ends in September for most growers throughout the United States, those in California, Washington, Michigan, and Oregon are able to ship into October with the use of controlled atmosphere environment storage.

Pest controls for blueberry production depend on geographic location but generally involve prevention, monitoring, and suppression. Scouting blueberry fields during the early season is essential to prevent and monitor potential pests and issues. Most fungal threats can be controlled with proper planting techniques and fungicides, including rotating the chemicals to avoid building resistance. Insect controls, however, often require insecticide applications for suppression, especially closer to harvest. The effectiveness of insecticide applications depends on the choice of active ingredients and the optimal timing of the treatments. Some common blueberry pests include blueberry maggot, spotted wing drosophila, and spotted lanternfly. The Agricultural Chemical Use Survey from USDA, NASS reported that domestic blueberry production has shown an increasing pesticide application rate in the past decade (USDA, NASS, 2020).

One advancement in production is growing blueberries under high tunnels, covered structures that allows growers to better control the environment. The high tunnel reduces the risk of frost and may yield an earlier harvest. Tunnels are used in Florida (on a relatively small scale) and California, as well as in Mexico and Chile. Another production advancement is the mechanical harvester, primarily used for blueberries destined for the processing or frozen market. Most fresh-market blueberries are still hand harvested, as mechanical harvesters often bruise the berries. For processed blueberries, appearance of the fruit is relatively less important for marketability (Takeda et al., 2021).

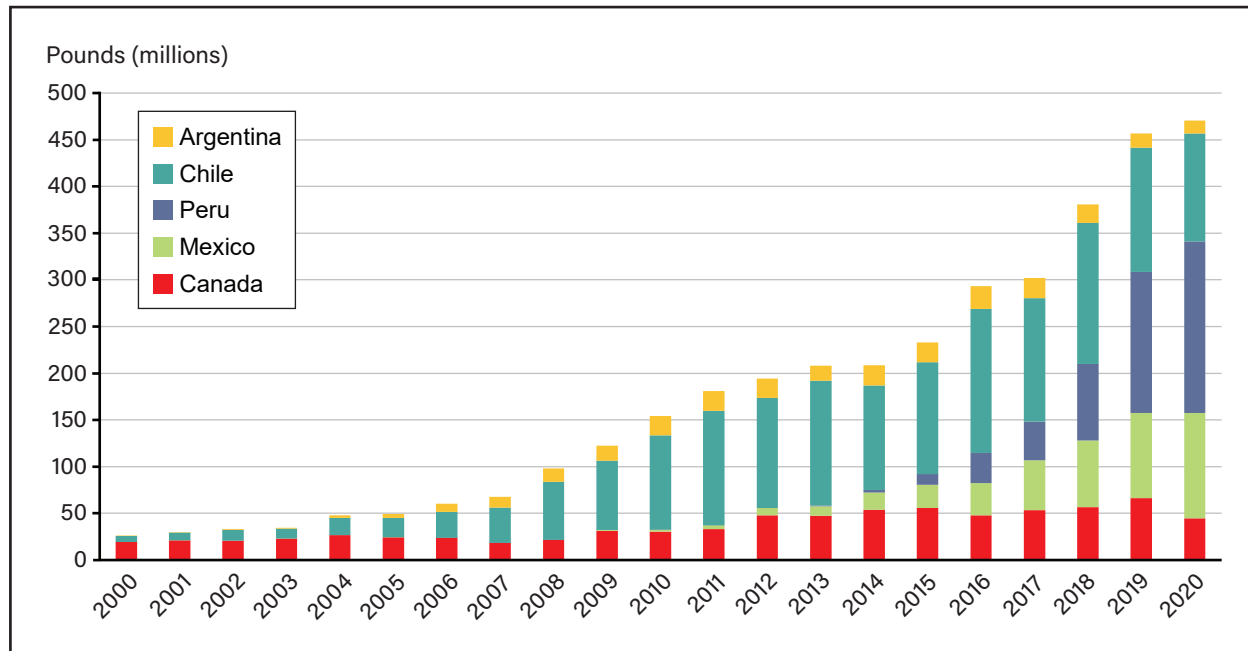
However, with better harvesters being designed for fresh-market blueberries, some growers have harvested mechanically later in the season to reduce labor costs since late-season blueberry prices are usually lower and growers cannot meet high labor costs. While the mechanical harvester may be cost-effective, growers still need to have proper plating configurations to minimize fruit loss. The industry would benefit from a more advanced mechanical harvester to handle delicate fresh-market berries and from newer blueberry varieties that do not bruise as easily (Takeda et al., 2021).

Imports

While the United States exports and imports blueberries, the United States has become a net importer. Fresh imports of fresh highbush blueberries increased by more than 900 percent between 2000–2002 to 2018–2020 (44 million to 450 million pounds) and accounted for about 62 percent of the domestic supply. In 2000, blueberry supplies came from Chile, Argentina, and Canada (figure 14). Since then, Mexico and Peru have become major suppliers, where recent plantings resulted in rapid production expansion geared toward the export market. Chile, Peru, Mexico, and Canada made up more than 97 percent of the U.S. import share for blueberries in 2020. Chile has shipped blueberries to the United States since before 2000 and had been the main supplier until 2018. In 2019, Peru became the largest supplier with 33 percent of total U.S. blueberry imports, outranking Chile (29 percent). Mexico was close behind, with 20 percent of the total import share growing from less than 1 percent in 2000.

Figure 14

U.S. fresh blueberry imports by top five countries, 2000 to 2020

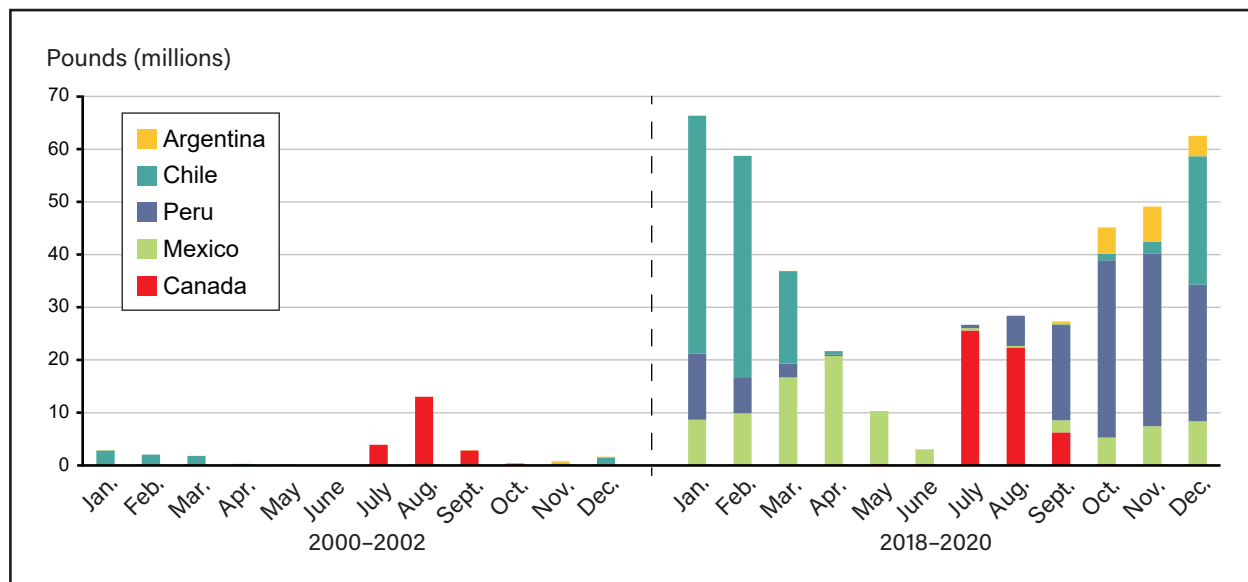


Source: USDA, Economic Research Service calculations using U.S. Department of Commerce, Bureau of the Census data.

Chile has been the Latin American blueberry production powerhouse. Chilean growers have the advantage of being able to ship fruit into the United States during the winter months (figure 15). Growers in Canada ship from July through September. Argentina growers ship small amounts in the fall months. Shipments from Peru in recent years began in the fall when there is less supply in the market, ending with blueberries from Mexico in late fall to early spring, ending in May and June.

Figure 15

U.S. fresh blueberry monthly imports by top five countries, 2000-2002 and 2018-2020



Source: USDA, Economic Research Service calculations using U.S. Department of Commerce, Bureau of the Census data.

Canadian highbush blueberry production is concentrated in British Columbia, accounting for more than 95 percent of national production in any given year (USDA, Foreign Agricultural Service [FAS], 2017a). The Canadian season overlaps with the Michigan, Oregon, and Washington seasons. The United States imported about 98 percent of Canadian fresh blueberry exports in 2017, and 84 percent of U.S. exports went to Canada. While Canadian blueberry exports to the United States fluctuated in the past two decades, they more than doubled in 2020 compared with 2000.

Peru started exporting blueberries in 2010. Since then, its industry increased rapidly, becoming the number one supplier to the United States in 2019. Between 2010 and 2020, Peru's blueberry production grew from nearly zero to over 300 million pounds (USDA, FAS, 2023). Peru's blueberry industry was bolstered by the Peru-U.S. Free Trade Agreement, allowing Peru to export blueberries to the United States tariff free (USDA, FAS, 2017b). Peru's northern coastal region's hot and dry climate provides excellent year-round growing conditions for blueberries; approximately 50 percent of Peru's blueberry fields are centered there (USDA, FAS, 2023). Peru's blueberry production intended for the export market increased quickly with the use of new varieties, investments in drip irrigation systems, and Peruvian and foreign investments (USDA, FAS, 2017b & 2023). Although establishing blueberry production demands high investment, the estimated return on investment can be made in as little as 2 years (USDA, FAS, 2023). Peru's blueberry industry has high market concentration, with large firms' decisions significantly affecting the total volume of production—a likely reason for the rapid growth. In 2020, blueberries were Peru's second most valuable fresh fruit export (USDA, FAS, 2021). Peru exports most blueberries during the fall, but it has a wide production window, and future exports might be able to be shipped in other seasons (USDA, FAS, 2017).

In the last decade, Mexico became a major supplier of blueberries to the United States. Mexico first exported blueberries in 1996, although it took several years for the industry to develop. Since 2006, U.S. imports from Mexico have increased every year and soared to a record high of about 113 million pounds in 2020, compared with 2 million pounds in 2010.

The United States is the main importer of Mexico's blueberries. One of Mexico's advantages is proximity to the United States, which maintains the freshness and quality of the blueberries. Mexico's Blueberry production is located mainly in Central Mexico. Like its strawberry industry, a large amount of blueberries are grown under protective structures, which may have been partially subsidized by the Mexican government (Wu and Guan, 2021). Growth in production is also a result of increases in new plantings, suitable weather, and high grower prices. Mexico produces blueberries year-round, with peak supplies in the winter and early spring months, and mainly competes with Florida for high early-season prices in the United States.

Chile has been the main exporter of blueberries for the last two decades. The export season for Chile is November through May, with minuscule quantities in other months. Chile can compete over a long distance because blueberries have a long shelf life compared with other fresh berries and can be shipped by sea freight to the United States. New plantings replacing older varieties helped increase production since the Chilean industry is older than other Latin American counterparts (James, 2019).

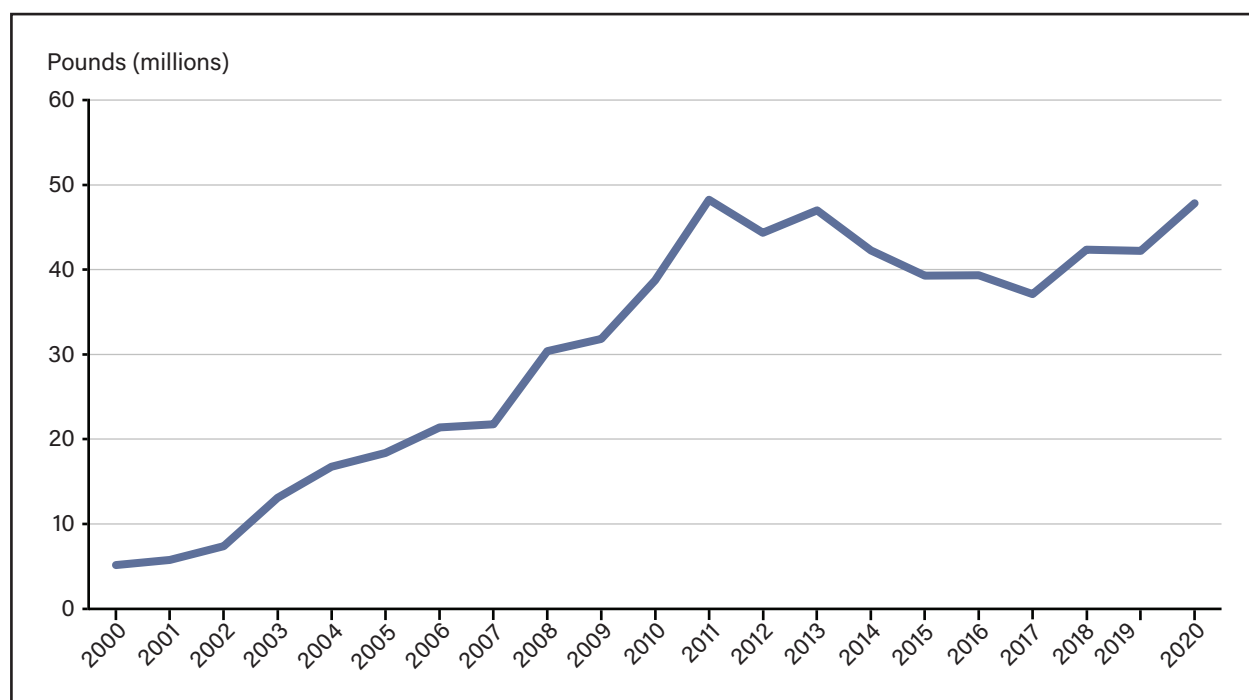
Most of Argentina's shipments concentrate in the winter months. In 2016, U.S. blueberry imports from Argentina reached a high of more than 24 million pounds, and since, then have been trending downward annually to about 14 million pounds in 2020. Higher shipment costs are a challenge for Argentina's blueberry exports to the United States, as most are shipped by air. Firms are trying to increase sea shipments to reduce transportation costs because they face larger competition in the fall season with lower prices and a lack of air shipping space (Blueberry Consulting, 2022).

Exports

With expanding domestic production and increasing international demand, U.S. exports of fresh highbush blueberries have grown more than 800 percent since 2000, reaching 48 million pounds in 2020 (figure 16). Though rising sharply, the export growth of fresh blueberries has not kept pace with the enormous growth in imports. Nonetheless, market opportunities for U.S. blueberries continue to spread globally. Generating over \$100 million annually in 2018–2020, U.S. fresh blueberries reach more than 30 countries, with more than 90 percent of the total export volume shipped to Canada in 2018–2020. Other top countries and areas that imported U.S. fresh berries include Taiwan, Japan, and South Korea. The exporting pattern of U.S. fresh blueberries is expected to shift with expanded market access to Asia after the U.S.–China Economic Trade Agreement that was signed in January 2020. Previously, China only permitted imports of dried and frozen U.S. highbush blueberries (Office of the U.S. Trade Agreement [USTR], 2020a).

Figure 16

U.S. fresh blueberry exports, 2000 to 2020



Source: USDA, Economic Research Service calculations using U.S. Department of Commerce, Bureau of the Census data.

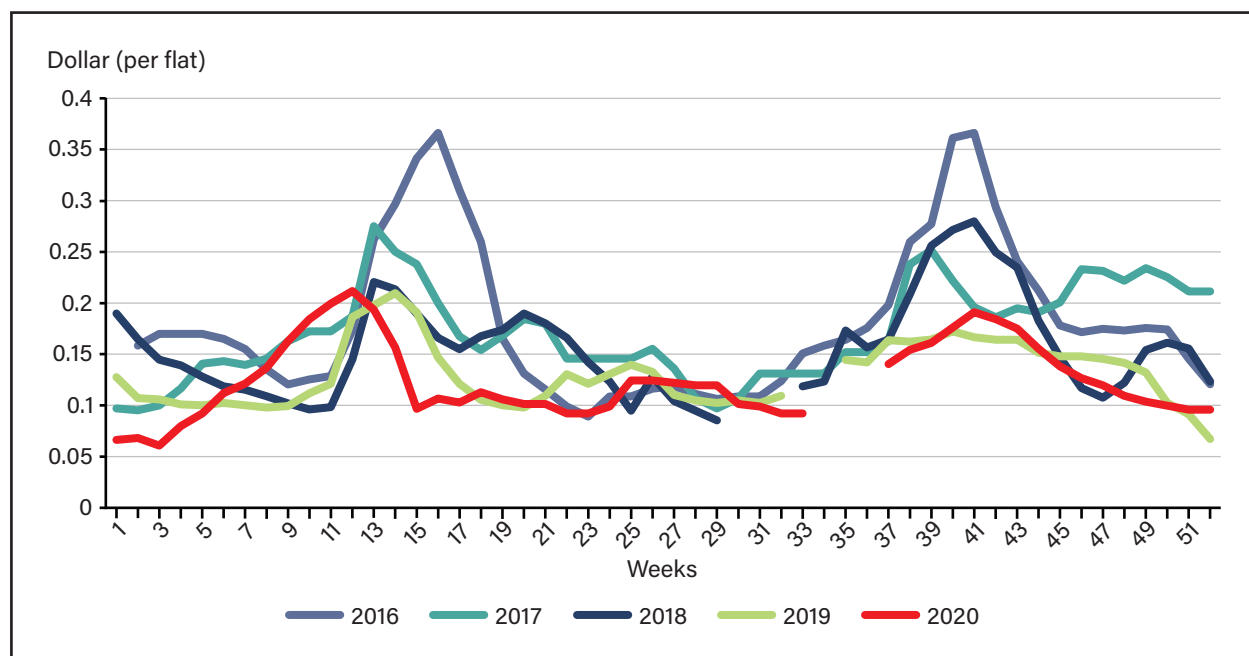
Consumption

Since 2001, the U.S. Highbush Blueberry Council (USHBC), a national research and promotion organization, has been working to increase the demand for blueberries. The council was authorized under the Commodity Promotion, Research, and Information Act of 1996. The USHBC has been increasing its promotion budget and investing in research to document the health benefits of blueberry consumption (Kaiser, 2020). The domestic demand for blueberries has grown rapidly since the establishment of USHBC as more consumers are leading healthier lifestyles and gravitating toward blueberries for their health benefits (see box, “Organic Blueberries”). The per capita availability, a proxy for consumption, of fresh highbush blueberries soared in the last two decades. The average per capita availability for 2018–2020 was estimated at 2.2 pounds per person, more than 500 percent higher than the average during 2000–2002. Increasing foreign supplies helped support domestic demand. From 2018–2020, the import share of domestic fresh blueberries disappearance in the United States was 62 percent compared with 47 percent in 2000–2002.

Prices

Despite the seasonal expansion of domestic production, U.S. blueberry supplies remain lower from late fall to early spring. The highest prices are in the spring and fall when supplies are low, and producers aim to increase production in those months. The increase in varietal plantings that supply the market beyond the typical marketing period achieves higher prices during these “market shoulders.” Imports of fresh blueberries have correspondingly expanded in response. These changes have increased the fresh blueberry supplies in the off-season and thus lowered the seasonal price differences in the past few years (figure 17).

Figure 17
Fresh blueberry weekly shipping point prices, 2016 to 2020



Note: Flats are twelve 6-ounce cups with lids. 2020 prices were likely affected by the Coronavirus (COVID-19) pandemic in the United States. The weeks correspond with the calendar year, from January 1 to December 31 each year.

Source: USDA, Economic Research Service calculations using Agricultural Marketing Service *Market News*, Movement data.

The growth in domestic and import supply created a seasonal overlap, shifting season price patterns. In the last 5 years, prices peaked earlier in the spring and fall months. California, Florida, and Georgia all produce blueberries in March and April and face import competition, mainly from Chile and Mexico. The increase in Mexican blueberries has put particular pressure on Florida and Georgia.

Overlap occurs in the fall between domestic and imported supplies. Fall imports from Peru have increased. In September, a small volume of shipments is available from Oregon, Washington, and Michigan in the U.S. market in addition to imports from Canada, which puts pressure on prices. With such rapid growth in the fall season, average fall prices have declined in the past few years.

Organic Blueberries

The growth in demand for organic food helped expand organic blueberry production. The United States' organic blueberry quantity harvested reached 77.5 million pounds in 2019 compared with 11.9 million pounds in 2008. Washington State has been the largest producer of organic blueberries in the United States since USDA, NASS first started collecting organic blueberry data in 2008 (USDA, NASS, 2019). Organic production grew rapidly in eastern Washington, where there is less pest and disease pressure due to less rainfall and low humidity (DeVetter et al., 2015, Strik, 2014). California observed the largest jump in organic blueberry production. In 2008, California's total harvested organic blueberries were just below 400,000 pounds, and in 2019, production jumped to 17.3 million pounds. California's organic blueberry acres increased by over 1,600 acres in 2019 from 2008, which helped it replace Oregon as the second top-producing State in 2019. Florida also witnessed a dramatic jump in organic production, from less than 160,000 pounds in 2008 to 1.9 million pounds in 2019.

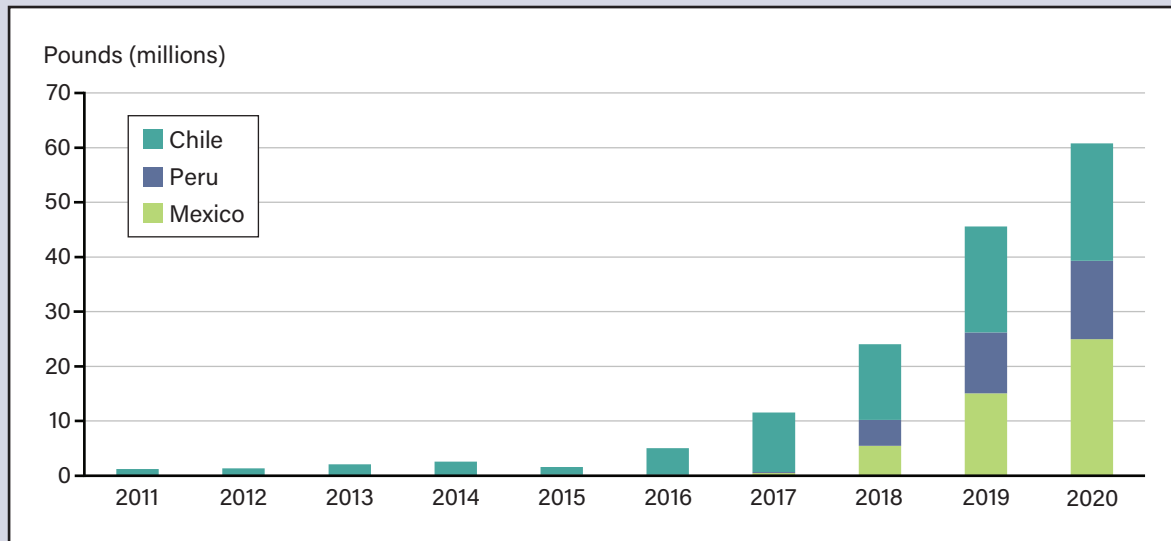
The value of organic blueberry sales increased more than fivefold since 2008 to reach \$205 million in 2019, with over 90 percent being fresh market sales. Washington leads in the value of sales at \$74 million. California had the second highest organic blueberry production in sales value in 2019, valued at \$64 million, compared with \$1.1 million in 2008. Oregon's organic blueberry sales value grew from \$5.5 million in 2008 to \$34 million in 2019. Although organic blueberry production volumes and values increased substantially between the first and last organic surveys (2008 and 2019) conducted by USDA, NASS, the organic blueberry sector still represents a niche market with continued room for growth.

Global demand and high grower prices for organic blueberries encouraged growth in global supplies. In 2020, fresh organic imports reached 72 million pounds, an increase from 1.3 million pounds in 2011. Organic blueberries represented 1 percent of imported fresh blueberry volume in 2011, increasing to 15 percent in 2020.

The United States imports the majority of organic blueberries from Chile, Mexico, and Peru. Chile is a favorable area for organic blueberry production and was the largest supplier to the United States until 2020. The organic blueberry import market share from Chile decreased from 91 percent in 2011 to 30 percent in 2020 as imports from Peru and Mexico grew (figure 18). In 2020, Mexico became the top organic supplier to the United States, with 25 million pounds of organic blueberries, 22 percent of Mexico's blueberry exports, from 0.1 percent in 2011. As a result, Mexico's market share of imports was 35 percent in 2020. Peru's 14 million pounds of organic blueberries exported in 2020 made up 20 percent of organic U.S. imports.

Figure 18

U.S. fresh organic blueberry imports by top three suppliers, 2011 to 2020



Note: The Harmonized System (HS) code for organic blueberries started in 2011.

Source: USDA, Economic Research Service calculations using U.S. Department of Commerce, Bureau of Census data.

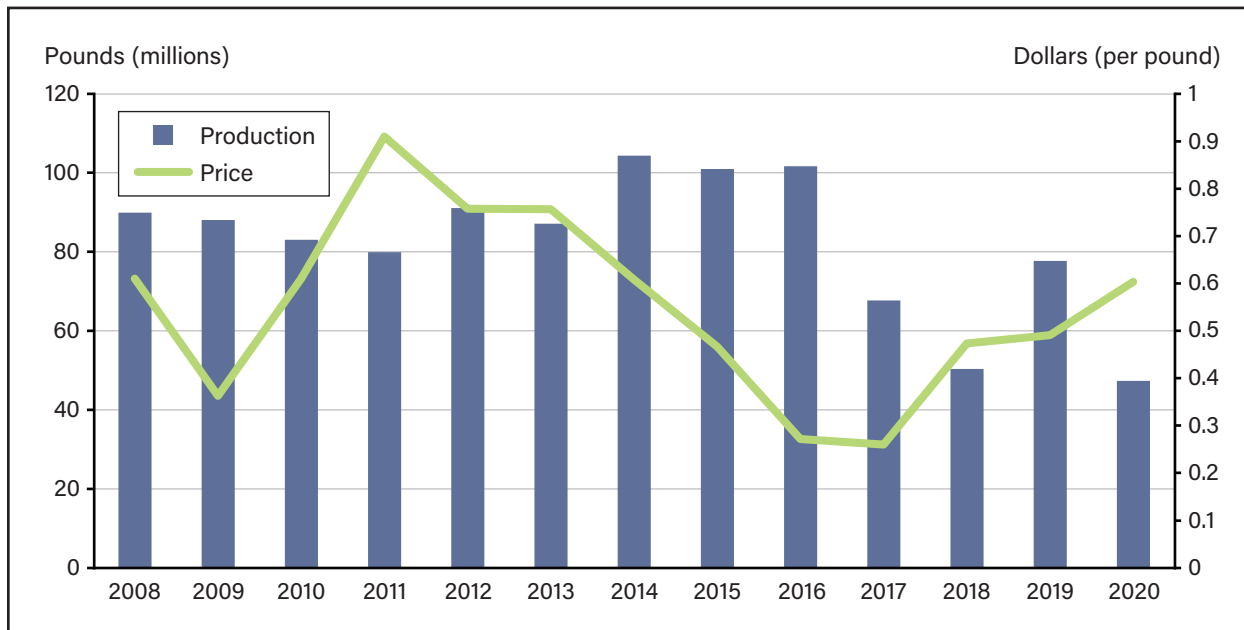
Processing-Market Blueberries

Lowbush blueberries are native to Maine and Eastern Canada. Nearly all lowbush blueberries are harvested for processing or the frozen market. Lowbush blueberries occur naturally in the forest and come into production when the trees are cut down, yet they still need active production management from growers to be sold to the market (University of Maine Cooperative Extension, 2020). Lowbush blueberries are grown in 2-year cycles, meaning that growers harvest only half of their field each year. Almost all lowbush blueberry fields are mechanically harvested as fruit appearance is less important for the processed market. Highbush blueberries destined for the higher-priced fresh market sometimes go to the processed market if the harvest is in excess or the fruit does not meet fresh-market standards (Calvin et al., 2022). From 2000–2002 to 2018–2020, frozen blueberry per capita use increased from 0.32 pounds per person to a record high in 2020 of 0.86 pounds per person.

Maine is the primary production State of lowbush blueberries. USDA, NASS began collecting acreage data for lowbush blueberries in 2014. That year, 22,800 acres were harvested. Acres harvested reached their lowest level at 17,000 in 2017 but trended upward to 20,700 acres in 2020. Given the recent droughts and rising temperatures in Maine, yields, on average, trended downward from 4,580 pounds per acre in 2014 to 2,290 pounds per acre in 2020. As a result, production of lowbush blueberries in Maine dropped from more than 101 million pounds in 2016 to about half that in 2018. In 2020, production was at its lowest of 47.4 million pounds (figure 19). The grower prices for processing blueberries reflected the supply changes, yet they tended to be relatively inelastic given that most processing blueberries can be frozen for up to 3 years, and there’s often enough stock from cold storage even when the same-year supply is low.

Figure 19

U.S. lowbush blueberry utilized production and price received, 2008 to 2020



Note: Data are available beginning in 2008.

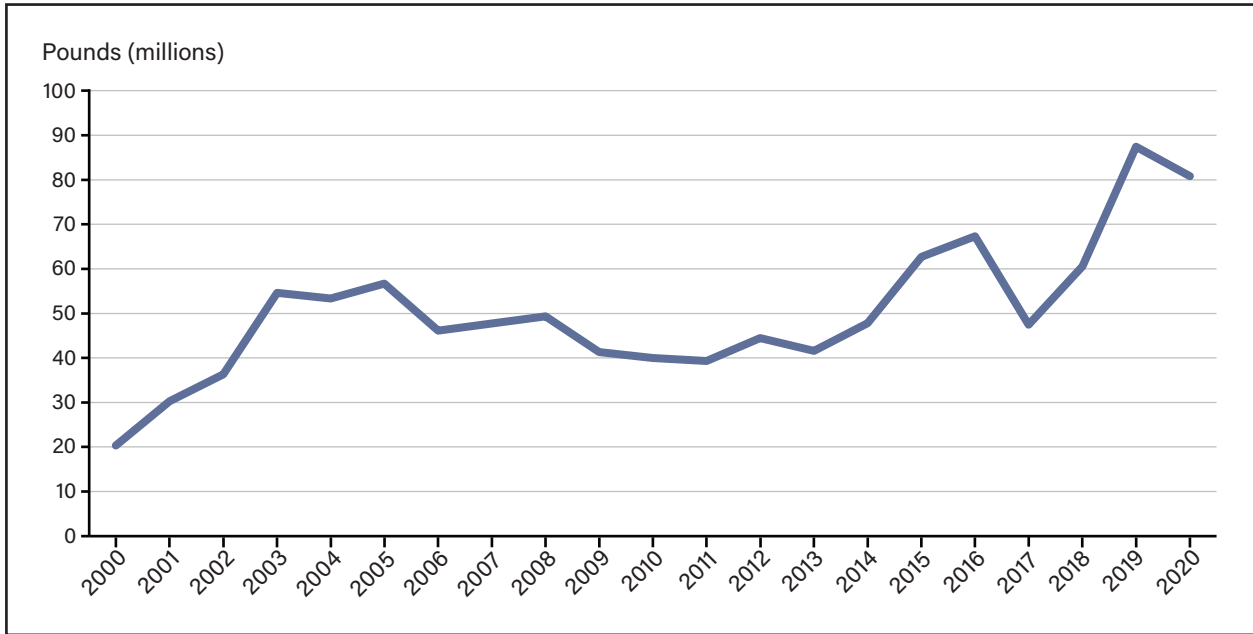
Source: USDA, Economic Research Service calculations using USDA, National Agricultural Statistics Service data.

Imports

Most processed blueberries are frozen. U.S. imports of frozen blueberries increased from 37 million pounds in 2000 to 214 million pounds in 2020. In 2020, 77 percent of frozen lowbush blueberries came from Canada, 16 percent from Chile, and less than 1 percent from Peru.

Canada is the largest lowbush blueberry producer, with most of the production in the provinces of Quebec and New Brunswick. Due to consumer trends, lowbush blueberry production has declined since 2016, while highbush blueberry production increased. U.S. imports of fresh lowbush blueberries reached a record high of 35 million pounds in 2015 and dropped drastically in 2017. While fresh lowbush imports dropped, frozen imports of lowbush blueberries from Canada reached a record high of 87 million pounds in 2019 (figure 20). Between 2000–2002 and 2018–2020, the import share available in the United States grew from 51 percent to 72 percent of total frozen blueberries.

Figure 20
U.S. frozen lowbush imports from Canada, 2000 to 2020

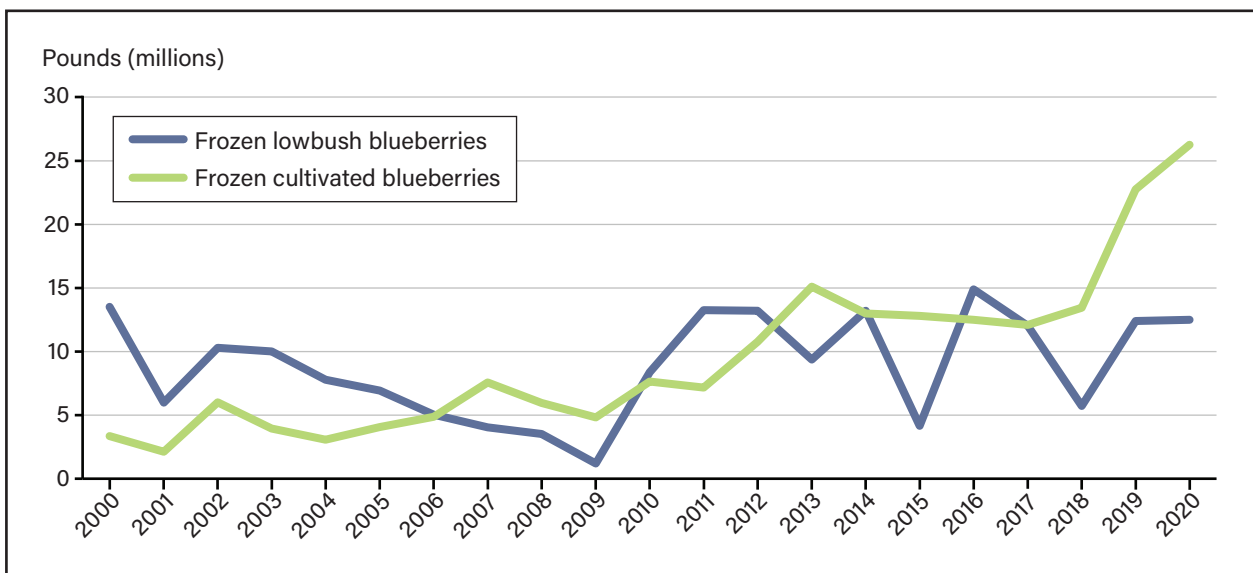


Source: USDA, Economic Research Service calculations based on data from the U.S. Department of Commerce, Bureau of the Census.

Exports

From 2000–2002 to 2018–20, exports of frozen blueberries, including both highbush and lowbush varieties, almost doubled and reached a record high of 65 million pounds in 2020. Almost 60 percent of frozen blueberries were sent to Canada in 2018–2020, and the majority were shipped in July and August. Canada increased its imports of U.S. frozen blueberries in recent years, especially the highbush variety. South Korea, Japan, Australia, and the Netherlands were the top importers after Canada from 2018–2020.

Figure 21
U.S. frozen lowbush blueberry exports to Canada, 2000 to 2020



Source: USDA, Economic Research Service calculations based on data from the U.S. Department of Commerce, Bureau of the Census.

Challenges of the Domestic Berry Industry

Pest and Disease Management

Pest management is one of the major issues berry growers face as they try to meet rising supply challenges. Berries are susceptible to various pests, which may result in severe production losses as a result of quality reduction and lower yields. A pest control program may take up a significant portion of production costs with rising input prices and labor costs. Berry growers also face unique pest control issues, such as minimizing the risk to pollinators, on which blueberry and strawberry cultivars depend to reach full yields. Most U.S. berry production relies on pesticides for pest control, including herbicides, insecticides, and fungicides targeting weeds, insects, and fungal diseases. To reduce the evolution of pesticide resistance while preventing pest damage, researchers and practitioners often suggest adopting integrated pest management (IPM), which is a sustainable science-based pest control program (Regional IPM Centers, 2023). It combines chemical controls with other biological, cultural, and physical tools and strategies to identify and manage pests (USDA, Office of the Chief Economist [OCE], 2018). For organic berry production, growers are not allowed the use of certain materials commonly used in conventional agriculture, including many synthetic fertilizers, insecticides, herbicides, and fungicides. This limits what organic production systems have to work with compared with their conventional counterparts when dealing with pests, diseases, and weeds (DeVetter et al., 2015).

Trade Competition

U.S. berry producers face growing competition in the domestic market as production rises in the United States and globally. The imports of strawberries and blueberries have increased rapidly in the past two decades, with most imports concentrated in the off-season (winter months) when domestic supply is low. Arnade and Kuchler (2015) estimated the positive consumer benefits of having increased off-season berry imports to reduce the seasonality of domestically grown berries. However, for blueberries, domestic supplies and imports started to overlap in the past decade (Kramer et al., 2020), caused by both the increase in year-round imports as well as new cultivars expanding the domestic production window.

Wu et al. (2018b) and Wu and Guan (2021) documented that the Mexican Government subsidized the cost of protected agriculture during 2001–2018 and suggested that the subsidies may have driven the growth in the Mexican berry industry. However, total subsidies to Mexico's fruit and vegetable sector tended to be small in comparison to U.S. fruit and vegetable imports from Mexico. According to Wu and Guan's calculations, Mexico's total program supports for its fruit and vegetable sector averaged \$39.9 million per year during 2014–2018, while U.S. imports from Mexico of fruit, vegetables, and their products (including juice) averaged \$12.4 billion per year during that period. Many of the support programs for protected agriculture studied by Wu et al. (2018b) and by Wu and Guan (2021) are no longer in effect or have been greatly modified by Mexico's current presidential administration (December 2018–present). The Mexican government reduced total expenditures in agriculture and rural development and emphasized policies focused on small- and medium-scale farmers (USDA, ERS, 2023).

With the increase in import volume from the Southern Hemisphere with lower production costs, the berry industry has expressed concern that unfair trade practices drove down market prices from exporting countries (USTR, 2020b). In 2020, the Office of the United States Trade Representative (USTR), the U.S. Department of Agriculture, and the U.S. Department of Commerce investigated the increases in imports of seasonal and perishable fruit and vegetables (USTR, 2020b). In the two hearings held in August 2020, the southeastern blueberry industry, such as growers in Florida or Georgia, expressed concerns about unfair competition from Mexican blueberry imports. The USTR requested the U.S. International Trade Commission (USITC) initiate a Section 201 global safeguard investigation into the extent to which increased imports of blueberries caused

serious injury to the domestic blueberry industry. Section 201 is an important part of the Administration's trade toolbox, given that if the USITC determines that the case holds, the President is authorized to make a positive adjustment to import competition, including increased tariffs and quantitative limitations. On February 11, 2021, USITC determined in a unanimous vote that fresh, chilled, or frozen blueberries were not being imported into the United States in such increased quantities as to be a substantial cause of serious harm to the domestic industry (U.S. International Trade Commission (USITC), 2021).

Domestic strawberry production faces similar import competition. Although California produces strawberries year-round, the volume is much lower in winter. U.S. marketers import strawberries from Mexico during winter months to supplement the lower domestic supply. However, those imports directly affect Florida's strawberry industry, given the overlapping harvesting season. In November 2020, the USTR requested the USITC to monitor and investigate imports of strawberries from Mexico, a section 332 fact-finding investigation (USITC, 2020).

Other Challenges

Some berry growers continue to face disruptions brought on by the Coronavirus (COVID-19) global pandemic, including lower labor supplies, increased regulations, higher input costs, shipping delays, and port issues. Given that fresh-market strawberries are highly perishable with extremely limited short-term storage options and are often hand-harvested, strawberry growers were severely affected by the initial U.S. COVID-19 lockdown in March 2020 (Kramer et al., 2020). In California, strawberries planted in the previous fall were ready to be harvested in the spring of 2020. With COVID-19 disruptions, many growers did not have time to adapt and faced canceled orders and labor shortages.

Rising labor costs are another major challenge to the U.S. berry industry, given the labor-intensive nature of production. Farm labor costs have been increasing in recent years because of fewer newly arrived unauthorized workers, rising State minimum wages, and new requirements to pay overtime wages to some farm workers (Calvin et al., 2022). Since fresh market strawberries and blueberries are mostly hand-picked, labor costs for berry growers are substantial. The development of mechanical harvesters and mechanical harvesting aids are potential solutions to labor constraints, but still face barriers that include the need for more technical advancement.

Mechanical harvesting is especially challenging for strawberry production, as strawberries are grown in clusters and are easily bruised. Strawberry fields also need to be repicked repeatedly during the harvesting season without damaging the plants. Blueberry growers, in contrast, have a higher adoption rate for mechanical harvesters, especially for berries sold to the processed market. Fresh-market blueberry growers have increased their use of mechanical harvesters in recent years to reduce labor costs, especially for the lower-priced late-season harvests (Eddy, 2021; Calvin et al., 2022). In addition, to increase the use of mechanical harvesting, the berry fields may need to be reconfigured and the industry may also need new berry varieties that do not bruise as easily for mechanical harvesters (Calvin et al., 2022; Takeda et al., 2021; Samtani et al., 2019; Vanderhorst, 2018).

Conclusion

This report tracks the status and development of the strawberry and blueberry industries in the United States in the past two decades. While the United States is a major producer and consumer of both berries, import competition has increased significantly for a variety of reasons. Year-round demand for berries has allowed different regions of the country to supply the market according to climate patterns but also led to increased imports to meet the growing demand.

Imports of blueberries reached a record high in 2020, accounting for over 60 percent of the U.S. supply of highbush blueberries. Peruvian blueberry exports increased rapidly, making Peru the largest Latin American supplier of fresh blueberries to the United States in 2020. Fresh strawberry imports also significantly increased in the last two decades from Mexico, the main supplier. U.S. producers likely will continue to face increasing competition in the strawberry and blueberry markets, although the export market has shown less of a drastic change in the last two decades than the import market.

The U.S. strawberry and blueberry industry continues to advance by developing new varieties and extending seasons. While the total harvested acreage of strawberries decreased in recent years, total production increased, which could be a result of the development and adoption of new higher-yielding strawberry varieties in Florida and California. The increased use of protective production methods, such as high tunnel production for blueberries, helps protect against extreme weather events and allows growers to extend their seasons. Ongoing advancements in mechanical harvesting may be necessary for berry growers to manage increasing harvesting costs and to face the shortages of manual harvesting labor (Takeda et al., 2021, Samtani et al., 2019, Vanderhorst, 2018).

In addition, demand and prices play a crucial role in industry changes. Heightened awareness of health and environmental benefits are the major factors behind the growing demand for fruits, resulting in the expansion of both the conventional and organic berry sectors. Specifically, the organic berry market increased in the last two decades as sales have grown. Year-round demand continues to encourage producers to adopt new production practices and varieties to expand their production season and has changed the seasonal patterns of domestic and import supplies.

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