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Cucumbers: Effect of Imports on U.S. Seasonal Markets, with a Focus on the U.S. Southeast

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Abbreviations and Acronyms

Item	Definition
AEWR	Adverse Effect Wage Rate
AMS	Agricultural Marketing Service (USDA)
APMA	Agricultural Products Marketing Act (Canada)
AUV	average unit value
AVE	ad valorem equivalent
CAD	Canadian dollar
CAFTA-DR FTA	Dominican Republic-Central America-United States Free Trade Agreement
CALA	Canadian Agricultural Loans Act
CAP	Canadian Agricultural Partnership
CES	constant elasticity of substitution
COP	cost of production
COVID-19	coronavirus disease 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
ERS	Economic Research Service (USDA)
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Statistics Division database
FAS	Foreign Agricultural Service (USDA)
FDA	U.S. Food and Drug Administration
FDCA	Federal Food, Drug, and Cosmetic Act (United States)
FDI	foreign direct investment
FFVA	Florida Fruit & Vegetable Association
FLC	farm labor contractor
FOB	free on board
FPAA	Fresh Produce Association of the Americas
FPMA	Farm Products Marketing Act (Ontario, Canada)
FSMA	Food Safety Modernization Act (United States)
FTE	full-time equivalent
FY	fiscal year
GCII	Greenhouse Competitiveness and Innovation Initiative (Canada)
GTA	Global Trade Atlas (database)
H-2A	H-2A Temporary Agricultural Program
ha	hectare (2.47 acres)
HS	Harmonized Commodity Description and Coding System
HTS	Harmonized Tariff Schedule of the United States
kg	kilogram(s)
LMIA	Labour Market Impact Assessment (Canada)
MFN	most favored nation (tariff rates)
mt	metric ton(s)
NAFTA	North American Free Trade Agreement
NASS	National Agricultural Statistics Service (USDA)
NAWS	National Agricultural Worker Survey
NCRS	National Resources Conversation Service (USDA)
NTR	normal trade relations (rate)
PA	protected agriculture
PROAGRO	Program for the Promotion of Agriculture (Mexico)
SAWP	Seasonal Agricultural Worker Program (Canada)
SCBGP	Specialty Crop Block Grant Program (United States)
SCRI	Specialty Crop Research Initiative (United States)
SIAP	Agrifood and Fisheries Information Service (Mexico)

Item	Definition
SQF	Safe Quality Food Program (global program)
TIPA	Texas International Produce Association
TFW	temporary foreign worker (Canada)
USD	U.S. dollar
USDA	U.S. Department of Agriculture
USITC	U.S. International Trade Commission
USMCA	United States-Mexico-Canada Agreement
USTR	The Office of the U.S. Trade Representative
WTO	World Trade Organization

Executive Summary

This report provides information and analysis on the U.S. cucumber industry, and the effects of imports of cucumbers on U.S. seasonal markets, with a particular focus on the U.S. Southeast. The U.S. cucumber industry consists of two segments: cucumbers for fresh consumption ("fresh market"), and cucumbers for pickling. Recently, industry representatives in the U.S. Southeast, who primarily grow fresh market cucumbers, have reported increased competition from U.S. imports of cucumbers for the fresh market, as well as a decline in U.S. prices for these products.

The largest cucumber-producing states in the United States, by volume, are Michigan, Florida, Georgia, North Carolina, and California. Between 2015 and 2020, cucumber production in the United States fell from approximately 826,000 metric tons (mt) to 636,000 mt, while U.S. domestic market share fell from around half to less than 40 percent. At the same time, apparent consumption of cucumbers in the United States decreased by just 0.3 percent, while per capita consumption remained steady at just under 5 kilograms.

The United States is a net importer of cucumbers, with seasonal patterns in imports and domestic production. The United States is the world's largest importer of cucumbers with 994,741 mt of total imports in 2020. From 2015 to 2020, U.S. imports of fresh cucumbers were mainly supplied by two major source countries—Canada and Mexico—which are profiled in this report along with the United States. Due to several factors, including proximity, Mexico was the largest supplier of fresh cucumbers to the United States from 2015 to 2020. Together, Mexico and Canada supplied 95.6 percent of U.S. imports of fresh cucumbers and 60.1 percent of total supply in 2020. Approximately 75 percent of U.S. imports from Mexico enter the country between November and the end of May, with nearly half entering from December through March. Over 90 percent of U.S. imports from Canada occur between March and October, with over 40 percent occurring in July and August. U.S. imports from Mexico overlap mainly with the U.S. Southeast harvest season, where a majority of harvesting occurs between the beginning of November to the end of May, although there is also some production in the summer and early fall. Growers in Michigan harvest cucumbers in the summer season, and California harvests cucumbers in the early spring through the fall.

The Request

U.S. Trade Representative Robert Lighthizer requested this report in a letter received by the U.S. International Trade Commission (USITC or Commission) on December 7, 2020. The letter asked that the Commission conduct an investigation and prepare a report on the effects of imports on the domestic seasonal markets of all imports which are classified within the Harmonized Tariff Schedule of the United States (HTS) under heading 0707.00, which covers cucumbers, including gherkins, fresh or chilled. The Trade Representative stated that the Commission's report should focus primarily on the 2015–20 period and include the following:

- Effect of imports on the domestic seasonal markets of the products in question, with particular focus on production and competitiveness of cucumbers grown in the Southeastern United States.

- Recent trends in trade in cucumbers between the United States and its trading partners, including information on seasonal patterns of trade.
- Descriptions of monthly price trends, including an analysis and comparison of the prices of domestically produced products and imported products in the U.S. market.

Approach

Based on the request from the Trade Representative, the Commission conducted three broad assessments of the U.S. fresh cucumber industry and major suppliers to the United States: (1) a cross-country comparison of competitiveness, (2) an analysis of U.S. imports and prices, and (3) an estimate of the economic impact of imports on seasonal markets. The report also provides detailed profiles of industries producing fresh cucumbers in major supplier countries to the U.S. market (i.e., Canada, Mexico, and the United States, with a focus on producers in the U.S. Southeast). The study took a different approach for each of the three requested assessments:

- The cross-country competitiveness framework compared the United States' fresh market cucumber industry—with a focus on the U.S. Southeast—to industries in Canada and Mexico, the major import suppliers to the U.S. market in terms of delivered cost, product differentiation, and reliability of supply.
- A descriptive analysis of monthly import trends was conducted using U.S. import data and an analysis of prices in the U.S. market was conducted using available price data. Along with information on the product mix of imports, this information was used to provide a comparison of U.S. prices and import prices in the U.S. market.
- A seasonal partial equilibrium model was used to assess the economic impact of U.S. imports on production, earnings, employment, and prices of the U.S. fresh market cucumber industry.

Cross-country Comparison of Competitiveness

Several countries, including the United States, supply the U.S. market with fresh market cucumbers; the competitiveness of these suppliers, however, somewhat varies substantially (table ES.1). The Commission's research showed that at both the national level and specifically within the U.S. Southeast, the U.S. fresh market cucumber industry is a high-cost producer of moderately differentiated products, supplying primarily American slicer cucumbers, which are mostly grown using open field production practices on the ground, which can result in fresh cucumbers with less uniform shape and color. Canada is also a high-cost supplier of fresh cucumbers but offers more highly differentiated goods than the United States, supplying significant quantities of burpless cucumbers (English, Persian, and other mini cucumbers),mostly grown in high-technology greenhouses, as well as a small amount of open field American slicers. Mexico is a lower-cost supplier of highly differentiated products, supplying American slicers grown under protected agriculture (PA) and in open fields, often with vertical production practices such as trellising, as well as burpless cucumbers which are largely grown using PA and comprise an increasing share of Mexican production. All three countries are reliable suppliers.

Table ES.1 Comparison of competitive factor categories for fresh market cucumbers in selected countries, 2015–20

Country	Delivered cost	Product differentiation	Reliability of supply
United States	High	Medium	High
Southeast	High	Medium	Medium
Canada	High	High	Medium
Mexico	Medium	High	High

Source: Compiled by USITC staff.
Note: The comparison is based on cucumbers for fresh consumption and does not consider competitive factors of cucumbers for processing. For the United States, the national level competitive analysis considers the U.S. fresh market cucumber industry as a whole. The Southeast considers competitiveness of the industries in Florida, Georgia, and North Carolina.

U.S. Import and Price Trends in the U.S. Market

Seasonal Import Trends

The United States primarily imports cucumbers from Mexico and Canada. When all supplier sources are combined, U.S. imports of all cucumbers follow a clear seasonal pattern of higher volumes from November through May, and lower volumes from June through October. Mexico, the major supplier of fresh market cucumbers to the United States, can supply product year-round, and the volume of imports from Mexico in both periods (November through May and June through October) has increased over the past few decades. In most months, U.S. imports of all types of cucumbers from Mexico far exceed cucumber imports from other supplier countries. During 2015–20, Mexico supplied approximately 79.7 percent of U.S. cucumber imports. During this period, about 75 percent of total annual imports from Mexico by volume in each year entered during the period from November through May. These imports coincide in the U.S. market with supply from Florida and to a lesser extent, Georgia, and California. U.S. imports from Mexico are generally at their highest from January to March and reach their lowest levels during the summer months (figure ES 1). After a dip in January and February, during early spring, Mexico supplies start to drop as Florida supplies ramp back up. The remainder of U.S. imports from Mexico (about a quarter by volume) enter from June through October, coinciding with a period in which there is ample U.S.-grown supply. This domestic summer supply comes from states in the Northeast and Midwest, as well as North Carolina, Georgia, and California.

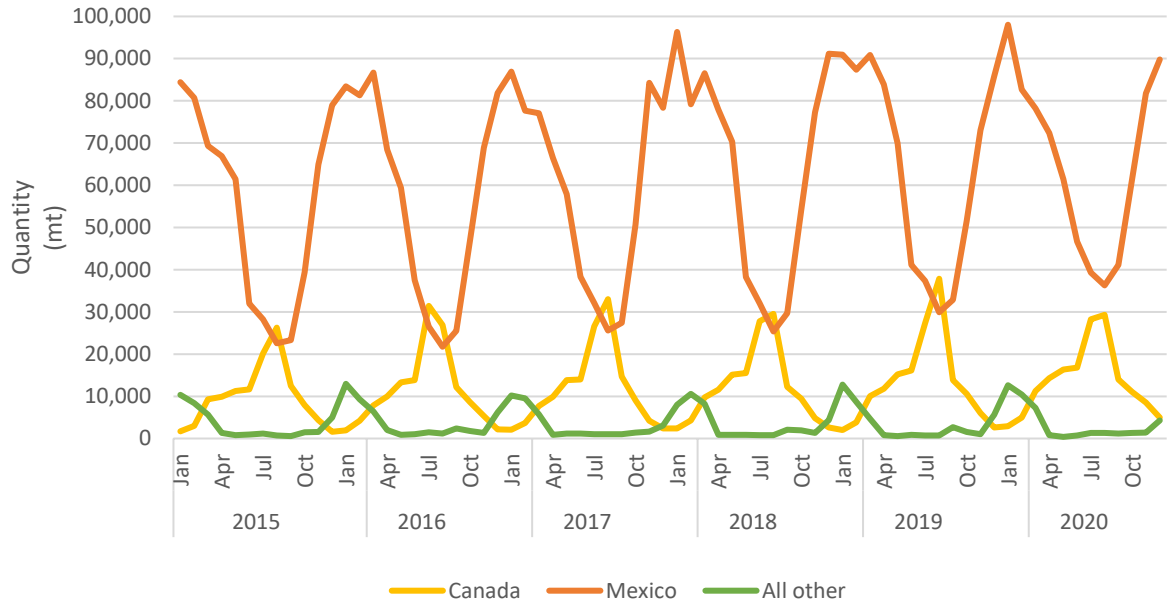
Canada is the second-largest supplier of imported cucumbers to the U.S. market. During 2015–20, Canada supplied 15.7 percent of U.S. imports. Canadian cucumber industry representatives have noted that both greenhouse and open field cucumbers from Canada are imported at times that are considered complementary to production in the U.S. Southeast. However, U.S. growers of American slicer cucumbers who harvest in the summer compete directly with U.S. imports from Canada of similar product. Imports from Canada typically peak in the period from July through September, which is usually a relatively lower period of supply from southeastern U.S. growers as well as from Mexico and Honduras.

U.S. imports of cucumbers from other supplier countries played a minor role in the U.S. market. These suppliers, which primarily include Honduras, along with limited imports from the Dominican Republic

and Spain, accounted for 4.5 percent of total U.S. imports between 2015 and 2020. U.S. imports from these suppliers peak in the winter months, which overlaps with the main cucumber import period from Mexico.

Figure ES.1 Monthly U.S. cucumber imports from Mexico, Canada, and all other sources, by quantity, 2015–20

In metric tons (mt). Underlying data for this figure can be found in appendix F, tables F.8, F.9, and F.10.



Source: USITC DataWeb/Census, imports for consumption, first unit of quantity, HTS statistical reporting numbers 0707.00.2000, 0707.00.4000, 0707.00.5010, 0707.00.5090, 0707.00.6010, 0707.00.6030, 0707.00.6050, accessed June 16, 2021.

Although there was a distinct seasonal pattern in U.S. imports of cucumbers from Mexico during 2015–20, U.S. imports during Mexico's lower-volume period (summer season) have increased substantially over the past 30 years. Industry representatives have reported that improved growing methods in Mexico, such as increased use of irrigation and shade structures, have resulted in a longer production period. This has enabled U.S. imports from Mexico during the summer season to rise from just under 0.1 percent of the annual total in 1990 to 22.3 percent in 2015 and to 28.5 percent in 2020. Thus, in recent decades, U.S. imports from Mexico compete with the U.S. Southeast cucumbers for longer periods each year.

Price Trends for Cucumbers in the U.S. Market

Industry representatives throughout the supply chain generally agree that, while U.S. demand for cucumbers is consistent and strong year-round, buyers are price conscious, and cucumber prices tend to respond very quickly to sudden increases or decreases in supply. As a result, cucumber prices vary widely throughout the season and change daily. The highly perishable nature of cucumbers also contributes to prices that fluctuate quickly based on supply and demand, since cucumbers cannot be held in inventory to smooth out supply.

In general, using point of shipment data available from the U.S. Department of Agriculture's Agricultural Marketing Service,[1] cucumber imports are priced below U.S.-grown (domestic) cucumbers at the point of shipment in about half of instances, but imported cucumbers are generally priced above domestic cucumbers in wholesale markets (where the cost of freight and other markups are included in the price). Between 2015 and 2020, average monthly import prices were below domestic prices at the point of shipment about 49 percent of the time. The addition of transportation costs and other markups appeared to erode the relative price advantage of Mexican cucumbers in the East Coast wholesale market, the region where most cucumbers from the U.S. Southeast are sold. This is because of the longer distance in transportation from Mexico. Average monthly prices for Mexican product were below those for the U.S. Southeast product in East Coast wholesale markets only 8 percent of the time from 2015 to 2020.

Effect of Imports on U.S. Seasonal Markets

In order to estimate the economic effects of increased cucumber imports on the U.S. domestic market, the Commission developed and applied a partial equilibrium model of the U.S. seasonal market for fresh market cucumbers. Markets producing in each period, June through October and November through May experienced increases in the growth rates of imports during specific years within the 2008–20 period. The partial equilibrium model simulates a counterfactual scenario in which the higher import growth did not occur, and imports are reduced from 2008 onward.

In this hypothetical scenario, the removal of above-average increases in imports from 2008 to 2020 would have had positive effects on U.S. production, revenue, and operating income in 2015–20. In such a scenario, lower cucumber import volumes would have led to higher import prices and a shift towards consumption of domestic varieties. This then would have led to higher prices of domestically produced cucumbers and more output. Increases in output and prices would have led to increases in domestic revenue, operating income, and employment.

Model results show that the hypothetical removal of the above-average increases in imports (the counterfactual) during November–May would have increased U.S. producers' domestic production during this period by an average of 37.2 percent, domestic revenue by an average of $31.4 million, and operating income by an average of $6.6 million during the 2015-20 growing seasons (table ES.3). For June–October, domestic production would have increased 27.1 percent on average in the counterfactual, domestic revenue would have been $35.6 million higher on average, and operating income about $7.5 million higher (table ES.2). In the earlier years modeled, the economic effects of the higher import growth years on domestic producers are larger during November–May. The effects during November–May are most likely to impact some of Florida, Georgia, and California production, as those are the states that harvest during those months. However, in the more recent years modeled, the trend reverses and the effects on domestic revenues and operating incomes are larger for states that produce during June–October.

[1] The limitations of this pricing data are described further in chapter 6. The main limitation is a lack of coverage of U.S. contract sales, which make up a large share of total U.S. sales of cucumbers. Large retailers typically use contracts rather than purchasing at the wholesale markets. In addition, at the shipping point, there is a lack of coverage of cucumbers from certain locations, such as Canada.

Table ES.2 Estimated economic effects in June–October of a hypothetical reduction in imports, 2016–20
In percentages, thousands of metric tons, millions of dollars, and number of FTEs; mt = metric tons; FTEs = full-time equivalent workers.

Period	Import price (%)	Import quantity (%)	Domestic price (%)	Domestic output (%)	Domestic output (1,000 mt)	Domestic revenue (million $)	Domestic operating income (million $)	Domestic employment (no. of FTEs)
Jun–Oct 2016	12.24	−23.95	2.60	16.62	40.70	31.12	6.52	231
Jun–Oct 2017	13.85	−23.95	3.25	21.16	33.48	31.26	6.55	282
Jun–Oct 2018	13.69	−23.95	3.18	20.68	39.20	34.73	7.27	281
Jun–Oct 2019	18.00	−27.54	4.41	29.56	42.19	38.44	8.05	334
Jun–Oct 2020	25.24	−30.96	6.70	47.57	43.96	42.21	8.84	467
Average	16.60	−26.07	4.03	27.12	39.91	35.55	7.45	319

Source: USITC estimates.
Note: These numbers were simulated using a customized partial equilibrium model of the U.S. market for fresh market cucumbers. They can be interpreted as the percent change and dollar-value change of model outcomes after removing the above average increases in imports.

Table ES.3 Estimated economic effects in November–May of a hypothetical reduction in imports, 2015–20
In percentages, thousands of metric tons, millions of dollars, and number of FTEs; mt = metric tons; FTEs = full-time equivalent workers.

Period	Import price (%)	Import quantity (%)	Domestic price (%)	Domestic output (%)	Domestic output (1,000 mt)	Domestic revenue (million $)	Domestic operating income (million $)	Domestic employment (no. of FTEs)
Nov 2015–May 2016	15.70	−19.68	4.45	29.89	36.53	33.30	6.97	208
Nov 2016–May 2017	16.14	−19.68	4.63	31.20	29.71	27.36	5.73	250
Nov 2017–May 2018	19.26	−22.09	5.54	38.17	35.28	33.31	6.97	253
Nov 2018–May 2019	19.86	−22.09	5.78	40.08	35.56	34.50	7.23	282
Nov 2019–May 2020	21.92	−22.09	6.56	46.44	30.61	28.43	5.95	325
Average	18.58	−21.13	5.39	37.16	33.54	31.38	6.57	263

Source: USITC estimates.
Note: These numbers were simulated using a customized partial equilibrium model of the U.S. market for fresh market cucumbers. They can be interpreted as the percent change and dollar-value change of model outcomes after removing the above average increases in imports.

Industry Profiles

United States

The U.S. cucumber industry is a relatively small part of the country's agricultural sector, primarily focused on serving fresh market American slicer and pickling cucumbers to the domestic market.

Nationally, the majority of this production by volume is intended for pickling, with the share of cucumbers grown for the fresh market dropping from 42.0 percent of production to 24.7 percent from 2015 to 2020. Production in the southeastern United States, including Florida, Georgia, and North Carolina, was 304,907 mt in 2020, or 48.0 percent of total U.S. production. Production in this region is primarily for fresh market consumption. Fresh market cucumber growers in the United States generally use open field production. Trellising is sometimes done but is not a common practice due to high labor costs.

Certain key factors contribute to the competitiveness of the U.S. fresh market cucumber industry in the U.S. market, including the large geographical dispersion of U.S. production, geographical proximity to the market, and consumer preferences for local produce. While cucumbers produced in the United States have some advantages over imported products, other factors—in particular the high costs of producing cucumbers in the United States and the weather-related volatility of production in the Southeast—limit the competitiveness of the U.S. industry.

Mexico

The Mexican fresh market cucumber industry is a small, but highly export-oriented, part of the country's agriculture sector. As a share of Mexican vegetable production, cucumbers (including those for pickling) contributed 5.3 percent of the total and were among the top 20 food and beverage exports in 2019. The majority of fresh market cucumber production is exported (about 91 percent on average during 2015–20), largely to the United States. Mexico produces several varieties of fresh market cucumbers, including American slicer, English, Persian, and other mini cucumbers in open fields and under various types of protected agriculture (PA). Shade houses and greenhouses are the most common type of PA used in Mexico, accounting for approximately 33 and 24 percent of total production, respectively, between 2015 and 2020. Vertical production (such as trellising) is also commonly used both in the open field and under PA. Regionally, production is concentrated in the northwestern states of Sinaloa and Sonora and the central part of the country.

Mexico's cucumber industry has a number of factors which enhance its competitive strengths. Low wage rates help reduce delivered costs and facilitate greater product differentiation through the use of production techniques that are more labor intensive but can improve quality or customization (for example, with respect to packaging options). Mexico's overall climate is conducive to growing cucumbers and the use of PA systems. Building a PA system does require additional investment, but use of PA may also lower input costs (e.g., for pesticides). Mexico's climate and use of PA, coupled with other production practices, increase product differentiation and reliability of supply. These factors also enhance Mexico's ability to produce all economically important cucumber varieties. Mexico's competitiveness is also strengthened by its geographical proximity and improved transportation linkages with the United States and the resulting access to all or most major U.S. regions and markets. Although there are some factors that reduce the industry's competitiveness (such as challenges in obtaining financing and a less favorable business environment compared to those in the United States and Canada), these do not outweigh Mexico's competitive advantages.

Canada

The Canadian fresh market cucumber industry is an export-oriented industry focused primarily on the U.S. market. Canada is a minor cucumber producer, accounting for less than 1 percent of global production in 2019. However, overall production, which averaged 275,182 metric tons (mt) between 2015–20, increased by 24.5 percent over this period, driven by increased production in high-technology greenhouses. Canada's exports to the United States also grew steadily during 2015–20 due to increasing demand for burpless varieties, such as English and Persian cucumbers, which are mainly produced in these high-tech greenhouses and make up the majority of Canadian fresh market cucumber production. Canada's high-tech greenhouses typically consist of permanent glass structures with climate control, growing lights, advanced irrigation techniques and alternatives to traditional soil. Canadian fresh market cucumber production is primarily concentrated in Ontario, with some additional production also in Quebec, British Columbia, and Alberta.

A mix of competing factors affect Canada's competitiveness, including high labor costs, which account for a third of the cost of production in Canada, raising overall delivered costs for Canadian producers. However, an accessible foreign worker program may serve to offset shortages of domestic agricultural workers. Additionally, Canada's competitiveness is enhanced by its high-technology greenhouse operations which allow Canada to extend its growing season, produce higher yields than open field production, and grow the increasingly popular burpless varieties. Conversely, the high costs associated with greenhouse construction and operations also raise delivered costs.

Chapter 1
Introduction

This report responds to the U.S. Trade Representative's (Trade Representative) request for information and analysis on the U.S. cucumber industry. Specifically, the Trade Representative asked that the report focus on the effects of imports of cucumbers on U.S. seasonal markets and prices and that it focus particularly on the U.S. Southeast.[2] The Trade Representative asked for an investigation and report in a letter dated December 4, 2020, under authority delegated by the President under section 332(g) of the Tariff Act of 1930.[3]

The U.S. cucumber industry consists of two segments: cucumbers for fresh consumption ("fresh market") and cucumbers for pickling. Recently, industry representatives in the U.S. Southeast have reported increased competition from U.S. imports of cucumbers for fresh consumption, as well as a decline in U.S. prices for these products.[4]

Scope

This report covers imports which are classified within the Harmonized Tariff Schedule of the United States (HTS) under heading 0707.00, which covers cucumbers, including gherkins, fresh or chilled.[5] The Trade Representative stated that the Commission's report should focus primarily on the 2015–20 period and include the following:

- Effect of imports on the domestic seasonal markets of the products in question, with particular focus on production and competitiveness of cucumbers grown in the Southeastern United States.
- Recent trends in trade in cucumbers between the United States and its trading partners, including information on seasonal patterns of trade.
- Descriptions of monthly price trends, including an analysis and comparison of the prices of domestically produced products and imported products in the U.S. market.

[2] This report focuses on the impact on Florida, Georgia, and North Carolina, the only significant producers of fresh market cucumbers in the Southeast. The Southeast more broadly includes Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee. See USDA, ARS, "Find a Location," accessed September 1, 2021.
[3] 19 U.S.C. § 1332(g)).
[4] USITC, hearing transcript, April 8, 2021, 169–72 (testimony of William L. Brim, Lewis Taylor Farms), 181–82 (testimony of James M. Alderman, J. Alderman Farms), 183–85 (testimony of Salvatore Finocchiaro, S&L Beans, Inc.).
[5] Gherkins are a type of fresh cucumber which are used for pickling. More information on gherkins and other types of cucumbers is discussed later in this chapter.

Approach

Based on the request from the Trade Representative, this report includes three broad assessments of the U.S. fresh cucumber industry and major suppliers to the United States: (1) a cross-country comparison of competitiveness, (2) an analysis of U.S. imports and prices, and (3) an estimate of the economic impact of imports on seasonal markets. The report also provides detailed profiles of industries producing fresh cucumbers in major supplier countries to the U.S. market (i.e., Canada, Mexico, and the United States, with a focus on producers in the U.S. Southeast).

In preparing a cross-country assessment, the Commission used an agricultural competitiveness framework to compare the United States' fresh cucumber industry—with a focus on the U.S. Southeast—to the industries in Mexico and Canada, the major foreign suppliers to the U.S. market. The framework connects analytic assumptions, parameters, and structures that define competitive conditions in agricultural trade (chapter 5). In addition, the Commission used available price data along with information on the product mix of imports, to provide a descriptive comparison of prices of domestically produced and imported cucumbers in the U.S. market (chapter 6). Finally, the Commission used a seasonal partial equilibrium model to estimate the economic impact of U.S. imports from major supplier countries on production, earnings, employment, and prices of the U.S. fresh market cucumber industry (chapter 7).

As requested, the report also includes country profiles (chapters 2–4) which contain descriptive information on the U.S. industry, with a focus on the U.S. Southeast industry, and two major foreign suppliers of fresh cucumbers to the U.S. market (Mexico and Canada). These country profile chapters contain information on the factors present in each country's industry that contribute to its level of competitiveness. Information for the report was gathered by reviewing existing literature and conducting extensive interviews with sources knowledgeable about the industry. These sources included government officials, traders, academics, and representatives of firms, trade associations, and nongovernmental organizations, including those that represent the interests of agricultural workers. The Commission identified sources with expertise in each segment of the supply chain, from growers and importers to distributors and purchasers. In addition, Commission staff conducted interviews with third parties outside of industry to confirm data and obtain additional information. The Commission also obtained industry and product information from testimony provided at the Commission's public hearing by government officials and industry representatives, as well as written submissions.

Relevant production and trade data were collected from publicly available data sources, as well as from industry representatives and organizations outside of industry. Global production and trade data were obtained from the Food and Agriculture Organization of the United Nations (FAO), Global Trade Atlas, Mexico's Agri-Food and Fisheries Information Service (SIAP), Statistics Canada, and U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service. Additional trade data came from the Commission's DataWeb, a database built on U.S. Census Bureau data. Pricing data for domestic fresh cucumbers came from USDA's Agricultural Marketing Service. Primary sources for labor-related conditions and costs were labor union-affiliated nongovernmental organizations, academia, and industry sources.

Report Organization

Chapter 1 provides information on the scope and approach for the report, data availability and limitations, global production and trade, and an overview of fresh cucumber products, including cucumber types, production systems, trends, seasonality, and product standards and certifications. It also includes information on the agricultural competitiveness framework. Chapters 2–4 present profiles of the cucumber industry and market in the United States, and the industries in Canada and Mexico, as well as a discussion of factors that contribute to each country's individual competitiveness in the U.S. market. Chapter 5 gives a cross-country comparison of the United States, Mexico and Canada and their relative competitiveness vis-à-vis one another. Chapter 6 provides information on U.S. import and price trends, including information on seasonal patterns within each of these trends. Lastly, chapter 7 presents the estimated economic effects of reduced U.S. imports of cucumbers on U.S. production and prices of cucumbers.

Data Availability and Limitations

Production

Global production data for cucumbers are available from the FAO. However, these data likely exclude greenhouse production, at least for certain countries, as indicated by production estimates for Canada which appear to reflect only the small share of production that is open field, rather than total production.[6] In this report, these data are supplemented with statistics from Agriculture and Agrifood Canada's *Statistical Overview of the Canadian Vegetable Industry*, which provide production, area harvested, and yield data for the years 2015–20, broken out by cucumbers produced in the open field and those produced in greenhouses.[7] The USDA National Agricultural Statistics Service (NASS) reports U.S. production, as well as area harvested, which is broken out by cucumbers intended for the fresh market and for processing (pickling), presented for the years 2016–20.[8] However, NASS annual production and area survey data do not include cucumbers grown under in greenhouses.[9] Greenhouse production data are collected by NASS every five years, rather than annually, and is most recently

[6] FAO, FAOSTAT database, "Cucumbers: Production," accessed March 3, 2021.
[7] Agriculture and Agri-Food Canada, "Statistical Overview of the Canadian Vegetable Industry 2019," September 11, 2020.
[8] USDA, NASS, QuickStats, Cucumbers: Production, area harvested, and yield, accessed March 3, 2021. NASS made structural changes to the methodology starting in 2016 and has not updated and made available data from prior years.
[9] Use of protected agriculture is extremely limited in the United States but where it is used it mainly utilizes greenhouses rather than other forms of protected agriculture. Protected agriculture includes a range of structures, such as greenhouses and shade houses, and technologies, such as climate controls, used to protect crops from certain environmental elements such as cold weather or pests. More information is included in "Farm Level Cucumber Production" below.

reported for 2019.[10] Statistics on production and area harvested for Mexico are available for 2015–20 from the government of Mexico's *Statistical Yearbook of Agricultural Production.*[11]

Trade

Global trade data presented in chapter 1, as well as import and export statistics presented in the Canada and Mexico country chapters and U.S. export statistics, are for Harmonized Commodity Description and Coding System (HS) heading 0707.00, fresh or chilled cucumbers, including gherkins, derived from IHS Markit's Global Trade Atlas. U.S. import data for cucumbers are classified at the Harmonized Tariff Schedule of the United States (HTS) 8-digit level in four subheadings by calendar periods of entry into the U.S. market.[12] At the HTS 10-digit level, greenhouse imports are recorded under separate statistical reporting numbers from those for cucumbers grown under other production systems for some calendar periods, as well as by size, but these separate categories are not available for all such periods.[13] U.S. import data are derived from the USITC DataWeb.

Pricing

Pricing data used for the descriptions of monthly price trends, including an analysis and comparison of the prices of domestically produced products and imported products in the U.S. market, were sourced from the U.S. Department of Agriculture's Agricultural Marketing Service (AMS). These data include terminal market data and shipping point data, both of which include daily prices for different types and packaging types of cucumbers in the U.S. market. The prices AMS collects represent a relatively small share of the U.S. market and have limited coverage of certain locations (e.g., Canada) and types of sales (e.g., contract sales). Further details on these limitations are discussed in chapter 6.

Global Cucumber Production and Trade

Global cucumber production grew from 138.8 million metric tons in 2015 to 158.1 million metric tons in 2019, a 13.9 percent increase over the period. China was the largest global producer of cucumbers in 2019, followed by Turkey, Russia, Ukraine, and Iran.[14] However, each of these countries exported less

[10] USDA, NASS, QuickStats, Census, Cucumber greenhouse production, accessed May 11, 2021.
[11] Government of Mexico, SIAP, Anuario estadístico de la producción agrícola (Agricultural production statistical yearbook), accessed May 3, 2021.
[12] HTS 0707.00.20 (entered during the period from December 1 to the last day of the following February), 0707.00.40 (March 1 to April 30), 0707.00.50 (May 1 to June 30, or September 1 to November 30), and 0707.00.60 (July 1 to August 31).
[13] HTS 0707.00.5010 (May 1 to June 30, or September 1 to November 30, greenhouse), 0707.00.5090 (May 1 to June 30, or September 1 to November 30, other), 0707.00.6010 (July 1 to August 31, greenhouse), 0707.00.6030 (July 1 to August 31, other, not exceeding 15 cm (6 inches) in length and presented in bulk quantities of 453.6 kg (1,000 lbs) or more), and 0707.00.6050 (July 1 to August 31, other). Size breakout for HTS 0707.00.6030 is intended to track cucumbers for processing into pickling. Hogan and Hartson, written submission to the U.S. International Trade Commission on behalf of Hartung Brothers, Inc., August 19, 2009.
[14] FAO, FAOSTAT database, "Crops: Cucumbers," accessed March 8, 2021; Statistics Canada, "Production and Value of Greenhouse Fruits and Vegetables," accessed March 8, 2021; Statistics Canada, "Area, Production, and Farm-Gate Value of Marketed Vegetables," accessed March 8, 2021. FAO production data were not available for 2020.

than 3 percent of their total production in 2019.[15] Mexico was the seventh-largest global producer of cucumbers in 2019, while the United States was the ninth largest. Canada is a relatively small global producer of cucumbers, although its greenhouse production has grown significantly since 2015.[16]

Given the delicate nature of fresh and chilled cucumbers, consumption and trade are concentrated around regional markets. Mexico is the world's largest exporter of cucumbers, accounting for 29 percent of global exports in 2020.[17] Approximately 99 percent of Mexico's exports go to the United States, with the remainder going to Canada. Spain and the Netherlands are also major global exporters, accounting for 26 and 17 percent of global exports, respectively. The vast majority of these exports serve the European market. Canada is the fourth-largest exporter of cucumbers, contributing 6 percent of global exports. Nearly 100 percent of Canada's exports go to the United States. The United States is the world's largest importer of cucumbers, accounting for 36 percent of global imports in 2020. Germany, the United Kingdom, the Netherlands, and Pakistan are also among the top five global importers.[18]

Fresh Cucumber Products

"Fresh or chilled cucumbers" include both cucumbers intended for fresh consumption ("fresh market") and cucumbers intended for pickling.[19] Generally, different varietals and production systems and practices are used depending on if the production is for the fresh market or for pickling. For the purposes of this report, the main products of concern are cucumbers for the fresh market, as the primary varietals produced in the U.S. Southeast and competing imports are intended for fresh consumption.

Fresh Market Cucumbers

Fresh market cucumbers are cucumbers that are grown to be eaten fresh, often with minimal processing. Varietals dedicated to fresh market cucumbers are often separated into two categories—American slicer cucumbers and burpless cucumbers. American slicer cucumbers (often referred to as "slicing cucumbers," "American cucumbers," "garden cucumbers," or "slicers") are the most common fresh market cucumbers produced and sold in the United States.[20] These are also the main variety produced in the U.S. Southeast.[21] These cucumbers are usually 8–9 inches long and have a thick, dark green skin, and more seeds than other varieties. A wax is often applied to the outside skin of American slicer cucumbers to extend shelf life.[22]

[15] FAO, FAOSTAT database, "Crops: Cucumbers," accessed March 8, 2021.
[16] For more information on Canadian greenhouse production, see chapter 3.
[17] IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed February 2, 2021.
[18] IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed February 2, 2021.
[19] Cucumbers are a species of Cucurbitaceae (or cucurbit), a family of plants which also includes melons, squashes, gourds, and more.
[20] Industry representatives, interviews by USITC staff, February 1, 2021, March 9, 2021, and August 27, 2021. See also, USITC, hearing transcript, April 8, 2021, 248 (testimony of Rod Sbragia, Tricar Sales Inc.).
[21] Industry representatives, interviews by USITC staff, February 2, 2021 and August 27, 2021; USITC hearing transcript, April 8, 2021, 225 (testimony of William L. Brim, Lewis Taylor Farms).
[22] Food Source Information, "Cucumbers," accessed March 10, 2021.

Burpless cucumbers are thin-skinned, seedless, or nearly seedless cucumbers. These varietals are known as "burpless" because they contain no or low levels of cucurbitacin, which reduces bitterness and the likelihood of excess gas (i.e., burping) when consumed. Several popular burpless varietals include English cucumbers (also referred to as "European cucumbers," "hothouse cucumbers," or "long seedless cucumbers"), Persian cucumbers and other mini cucumber varietals (often marketed as "snacking cucumbers"), and Japanese cucumbers. English cucumbers are often individually packaged in shrink-wrap to maintain freshness and reduce water loss. These cucumbers tend to be longer and skinnier than American slicer cucumbers. Persian cucumbers, which are generally smaller and less susceptible to water loss, do not require individual shrink wrapping and instead tend to be sold in shrink-wrapped packages or plastic bags of around 6 cucumbers. Other miniature cucumber varieties are also sold in plastic bags or cartons.[23] Burpless varietals are more delicate and are primarily grown in protected agriculture (PA).[24] While there is some limited U.S. production of burpless cucumbers, the majority are imported from Canada and Mexico.[25]

The U.S. cucumber retail market has seen growing demand for burpless varieties, and declining demand for American slicers in recent years. This is attributed to consumer preference for the taste, lack of waxing on the outer skin, size, and packaging of burpless cucumbers. Retailers also note that these varieties tend to be more consistent in quality.[26] Thus, burpless varieties often sell for a higher price than American slicers.[27] Aside from these two cucumber categories, there are also some specialty varieties of fresh market cucumbers, such as lemon cucumbers and white cucumbers, which are not the focus of this report.

Pickling Cucumbers

Cucumber varietals dedicated to the production of pickles include gherkins and national pickling cucumbers, among others. These types tend to be shorter with a thinner, bumpy outer skin, and drier flesh that make them ideal for soaking up brine. While the majority of cucumber production in the U.S. Southeast is of fresh market cucumbers, Florida and North Carolina also produce some cucumbers for pickling.[28] Michigan is the largest producer in the United States of cucumbers for pickling.[29]

Farm-level Cucumber Production

Warm climatic conditions, achieved through geographic location or PA, are ideal for cucumber production. Cucumbers grow best in temperatures between 65- and 75-degrees Fahrenheit, while being susceptible to dying when exposed to frost, or consecutive days below 55 degrees or above 90

[23] Industry representative, interview by USITC staff, July 16, 2021; Willliams, "Cute Cucumbers," August 2018.
[24] USITC hearing transcript, April 8, 2021, 120 (testimony of Gene McAvoy, University of Florida IFAS). See also, chapter 3, table 3.6, and chapter 4, "Industry Structure" section.
[25] Industry representatives, interviews by USITC staff, February 2, and August 27, 2021.
[26] See chapter 2 section on Consumption for more information on U.S. demand trends.
[27] USDA, AMS, *Market News,* custom report, terminal market report, accessed March 16, 2021.
[28] See chapter 2 for more information on U.S. production of cucumbers dedicated to pickling.
[29] USDA, NASS, QuickStats, Cucumbers, Production: Cucumbers for Processing, accessed August 25, 2021; FDA and WIFSS "Cucumbers," accessed March 9, 2021.

degrees.[30] The variety of cucumber chosen for cultivation is determined by factors including growing period, climate, yield per hectare, resistance to disease, and quality. Certain varieties often do better in different climates.[31]

Cucumbers are generally grown in two distinct production systems: in open fields exposed to the elements or under PA structures.[32] American slicer cucumbers are typically grown in open fields. They can be grown either on the ground or on a trellis or pole system. The use of trellis and pole systems can increase overall yields and prevent "yellow-belly" (yellow discoloration of the skin in the area where the cucumber has rested on the ground) and other defects.[33] Although not a widespread growing practice in the United States, lower-cost forms of PA, such as shade houses, are occasionally used to grow American slicer cucumbers. Meanwhile, burpless varieties are typically grown under PA structures, such as greenhouses, and on a trellis system.[34] Industry representatives indicate that the vast majority of cucumber production is irrigated, with drip irrigation being the most common type of irrigation in many regions.[35] Drip irrigation uses small plastic tubes to drop water onto the soil at the root of the plant at a slow rate to maximize the benefit of the water being given to the plant while minimizing water being wasted.[36]

While some cucumber producers focus solely on cucumbers, most rotate cucumbers with other crops such as tomatoes and bell peppers, which often utilize the same production systems. Crop rotation allows producers to spread risk across a few crops in the case that prices or growing conditions for one crop deteriorate. Rotation also allows growers to better manage pests and disease.[37]

While cucumbers for pickling are often harvested mechanically, fresh market cucumbers are generally harvested by hand.[38] Once harvested, cucumbers may be packed into containers or other packaging in the field, or taken to a packing house to be cooled and sorted prior to packing.[39] Cucumbers are highly perishable and must be moved quickly from the farm to the end market. The window between harvest and consumption is usually two weeks.[40]

[30] FDA and WIFSS, *Cucumbers*, accessed March 9, 2021.
[31] Industry representative, interview by USITC staff, May 28, 2021.
[32] For the purposes of this report, open field production is defined as outdoor production without the use of protected agriculture structures.
[33] Industry representative, interview by USITC staff, May 10, 2021.
[34] Industry representative, interview by USITC staff, February 1, 2021.
[35] Industry representatives, interviews by USITC staff, May 10 and 28, 2021.
[36] FAO, "Drip Irrigation," accessed July 26, 2021; industry representative, interview by USITC staff, June 1, 2021; USITC hearing transcript, April 8, 2021, 300 (testimony of Guillermo Martinez, Frello Fresh, LLC).
[37] Industry representatives, interviews by USITC staff, April 28, and May 21, 2021.
[38] Industry representative, interview by USITC staff, February 1, 2021.
[39] See country chapters in this report for more information on when and where each packing method is used.
[40] Industry representative, interview by USITC staff, February 3, 2021.

Protected Agriculture

Protected agriculture (PA) is the use of technologies and techniques to increase production by protecting crops from a range of "environmental, biological, and climatological elements."[41] Depending on the type of PA, these production systems provide a range of benefits to growers that surpasses those of open field production. For example, PA extends their growing season into colder or hotter months, increases yields, improves the quality and consistency of product, and reduces the costs of some inputs such as water and pesticides.[42] PA includes several types of structures to protect plants, which can have different names in different regions or countries. Types of PA used in the production of cucumbers include macro or high tunnels, shade houses, and greenhouses, which vary greatly in terms of their level of technology and cost. Macro tunnels are constructed from polyethylene plastic or fabric over a metal frame, and are usually fully enclosed. Benefits of high tunnels are their relatively low cost and their ability to be moved. Shade houses have a cover, often made of permeable mesh, which can help to control the growing environment, for example, by filtering sunlight and reducing water loss.[43] Similar to macro tunnels, shade house structures are typically not permanent. In contrast, greenhouses are more permanent and durable structures, often made of glass or hard plastic windows, with stronger support systems that are anchored into the ground. Greenhouses utilize a range of technologies and may also control the environment within, such as humidity, light, or temperature.[44] While PA is not widely used in U.S. production of fresh market cucumbers, it is frequently used in production in both Canada and Mexico. Canada consistently uses high-technology greenhouses with permanent glass structures and including climate control, growing lights, advanced irrigation techniques and alternatives to traditional soil.[45] Mexico uses several different types of PA systems ranging from low- to high-technology. While some greenhouses used in Mexico may be considered "high-technology," they may not employ all of the same technologies as those found in Canada.[46]

Labor

Overall, cucumbers are a labor-intensive crop because production, including harvesting, is generally not mechanized and, therefore, depends on manual labor. However, labor requirements differ across production systems and according to production practices used (e.g., trellising). Different production systems often have different employment structures which impact a grower's overall labor use. For example, high-tech greenhouses generally employ workers year-round while in open field production

[41] Pratt and Ortega, "Protected Agriculture in Mexico: Building the Methodology for the First Certified Agricultural Green Bond," May 2019), 5; USITC hearing transcript, April 8, 2021, 244 (testimony of Guillermo Martinez, Frello Fresh, LLC).
[42] Industry representatives, interviews by USITC staff, April 28, 2021 (Argaman), May 10, 2021 (Wegmans), May 26, 2021 (Walmart), July 2, 2021 (Southern Valley), July 7, 2021 (TIPA); USITC hearing transcript, April 8, 2021, 25, and 243–44 (testimonies of Nadia Bourély, Government of Canada and Guillermo Martinez, Frello Fresh, LLC).
[43] Pratt and Ortega, "Protected Agriculture in Mexico," May 2019, 9; Agra Tech, Inc., "Shade Houses Provide Seasonal Low-Cost Protected Space," April 23, 2012.
[44] Rimol Greenhouse Systems, "High Tunnel vs. Greenhouse vs. Hoop House," August 15, 2019; industry representative, interview by USITC staff, July 16, 2021; see also, USITC hearing transcript, April 8, 2021, 242–43 (testimony of Guillermo Martinez, Frello Fresh, LLC).
[45] For more information on Canadian greenhouses, see chapter 4.
[46] For more information on PA in Mexico, see chapter 3.

systems, the use of seasonal workers is common, especially during planting and harvest. In addition, growing cucumbers on the ground is less labor intensive than growing them vertically (e.g., on trellis, wires, or poles). "Vertical production" requires that cucumber plants be trained to grow on a trellis system and then continually maintained.[47] Labor costs and availability are likely to influence a grower's decisions to use more or less labor-intensive practices. Specific information about labor use for cucumber production in the United States, Mexican, and Canadian cucumber industries is included in the country profile chapters of this report (chapters 2–4).

Seasonality

Harvest seasons for fresh market cucumbers vary depending on regional weather and the use of PA. As a whole, the U.S. Southeast is able to produce fresh market cucumbers year-round, though Florida and Georgia both see some gaps in production in the late summer months, while North Carolina's season covers the late spring through early fall but ceases in the winter (figure 1.1). Michigan has a shorter production season, with harvests spanning the four months from mid-June to mid-October. The majority of California's fresh market production occurs in the southern part of the state, with some production in the northern and central regions as well. Harvest seasons in California vary between these regions, but cover most of the year except for three winter months from December to mid-March.

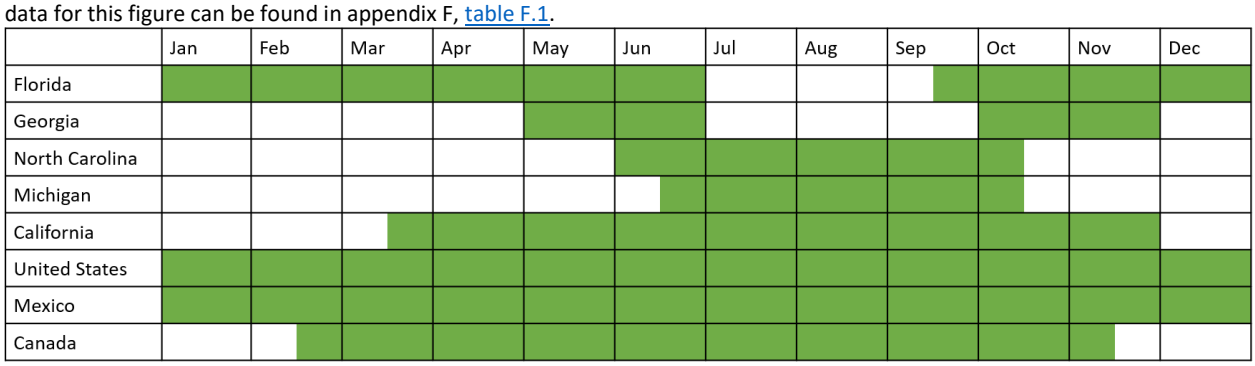
With the use of high-technology greenhouses, which account for the majority of Canada's fresh market production, Canada is also able to produce nearly year-round, with the exception of the three-month period between mid-November and mid-February. Mexico, which produces both in open fields and under several types of PA, is also able to harvest cucumbers year-round, although open field harvesting in northwestern states, where the majority of production occurs, stops for the three- and one-half-month period between July and mid-October.[48] While Florida and Georgia's production ceases in the summer due to high heat and humidity and related pest pressures, Mexico's summer season ceases due to high heat and lack of water availability. Meanwhile, North Carolina, Michigan, Canada, and parts of California's production ceases when the weather is cold, because cucumbers are susceptible to damage from frost.

[47] Industry representative, interview by USITC staff, July 16, 2021; industry representative, email to USITC staff, August 11, 2021.

[48] While growers have the ability to harvest year-round under certain types of PA in Mexico, some industry representatives claim that the actual growing season is much shorter (November–March) and based on demand. Industry representatives, interview by USITC staff, August 11, 2021.

Figure 1.1 Harvest seasons for fresh market cucumbers

Shaded cells indicate months in which significant harvesting is occurring based on typical commercial practices. Underlying data for this figure can be found in appendix F, table F.1.



Sources: Florida Department of Agriculture and Consumer Services, "Florida Agriculture by the Numbers," 2019, 85; Freeman et al., "Chapter 7. Cucurbit Production," 2020; Kemble, *Southeastern U.S. 2020 Vegetable Crop Handbook*, 2020, 52; Blue Book Services, "Cucumbers," accessed July 14, 2021; Holmes et al., "Crop Profile for Cucumbers in North Carolina," June 2005, 3; Manning, Brainard, and Heilig, "How to Grow Cucumbers," May 19, 2016; Schraeder, Aguiar, and Mayberry, "Cucumber Production in California," 1; Canadian government representative, email to Commission staff, July 6, 2021; industry representatives, interview by USITC staff, March 9, 2021.
Notes: These seasons represent typical commercial practices, though seasons may be shortened due to extenuating weather events or extended if the grower chooses to employ certain production technologies. It should also be noted that demand may affect individual grower decisions to shorten or extend the harvest seasons. Florida harvest season reflects practices in northern, southern, and central Florida, where most production is located. Georgia harvest seasons reflect practices in southern Georgia where most production is located. North Carolina harvest season reflects practices in eastern North Carolina where most production is located. Michigan harvest season reflects practices in the central, eastern, and southwestern lower peninsula of Michigan where most is located. California harvest season reflects production practices in northern, southern, and central California. Canada harvest season reflects production in high-technology greenhouses, which is where nearly all of Canada's fresh market cucumbers are grown. Mexico's harvest season reflects both open field produced cucumbers as well as cucumbers grown under PA in north-western and central Mexico, where the majority of fresh market cucumbers are being grown.

Supply Chain

Fresh market cucumbers can be sold to fresh produce packers or distributors, to retailers or institutional buyers, or directly to consumers. Speed to market and temperature control throughout the transportation process determine the quality of the product at market and are the most important factors for determining logistics and transportation. Other buyer considerations include the timeliness of past deliveries and reliability of supply.[49]

Retailers in particular have additional buyer considerations. They often consider whether the producer's package size offerings match what they are able to sell to the consumer.[50] Buyers prefer to have a mix of vegetables to offer and obtain this mix as efficiently as possible (e.g., from a single source or, if from multiple sources, ones in close proximity).[51] The retail grocery sector in the United States has heavily consolidated in recent years, increasing its pricing power and creating pressure on growers.[52] According to industry representatives, traceability technology now allows retailers to associate individual fresh

[49] Industry representatives, interview by USITC staff, July 6, 2021.
[50] Industry representatives, interview by USITC staff, July 6, 2021.
[51] Industry representatives, interview by USITC staff, July 6, 2021; USITC, hearing transcript, April 8, 2021, 240 (testimony of Craig Slate, SunFed Produce).
[52] Industry representative, interview by USITC staff, March 9, 2021; U.S. government representative, email to USITC staff, March 3, 2021.

market cucumbers with particular growers and track which growers have quality problems, creating a very high quality expectation.[53]

Product Standards and Certifications

Compliance with the U.S. Food Safety Systems

All cucumbers, whether produced domestically or imported, are required to meet U.S. food safety and labeling standards. The U.S. Food and Drug Administration (FDA) has specific mandates concerning the safety of U.S.-grown and -processed food products as well as imported products. The agency has the authority to detain food, including imported products, if it is adulterated by various hazards and to take other actions, such as mandatory recalls, to enforce U.S. food safety standards.[54]

The Food Safety Modernization Act (FSMA) of 2011 expanded the FDA's food safety oversight authority through amendments to the Federal Food, Drug, and Cosmetic Act (FDCA) (21 U.S.C. §§ 301 et seq.).[55] The FDCA, as amended by FSMA, governs the safety of many U.S.-grown and imported food products, including cucumbers.[56] For example, the Produce Safety Rule required under FSMA applies to both domestic and imported produce, including cucumbers, and sets science-based minimum standards for the safe growing, harvesting, packing, and holding of fruits and vegetables grown for human consumption.[57] It also requires compliance with certain standards on water use, soil amendments, employee training, and sanitation. This rule further requires that all domestic produce farms that have sold an annual average of more than $250,000 over the past three years be subject to regular inspections, although the FDA has not yet established a rule for the frequency of inspection for fresh produce farms.[58]

In addition, FSMA requires U.S. importers and suppliers to verify the safety of their supply chains. In particular, the Foreign Supplier Verification program required under FSMA provides a mechanism for U.S. importers to verify that their suppliers meet U.S. food safety standards.[59] U.S. cucumbers and imports must also comply with U.S. regulations regarding maximum residue levels for pesticides, although these are largely harmonized between the U.S. and Mexico and were not mentioned by U.S. growers as an important factor for competitiveness.

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[53] Industry representatives, interview by USITC staff, July 6, 2021.
[54] FDA, "FSMA Facts: Background on the FDA Food Safety Modernization Act," January 30, 2018.
[55] FDA prepared major substantive rules and guidance documents to implement FSMA from 2011 through 2015. FDA, "FSMA Rules and Guidance for Industry," December 7, 2016.
[56] FDA, "FSMA Facts: Background on the FDA Food Safety Modernization Act," January 30, 2018.
[57] Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption, 80 Fed. Reg. 74353 (November 27, 2015). For more information on Produce Safety Rule coverage and compliance dates see FDA, "FSMA Final Rule on Produce Safety," accessed March 23, 2021.
[58] FDA, "Produce Safety Inspections," December 20, 2019; U.S. government representative, interview by USITC staff, July 7, 2021.
[59] Foreign Supplier Verification Programs for Importers of Food for Humans and Animals, 80 Fed. Reg. 74225 (November 27, 2015) provides details on this supplier program; see also FDA, "Key Requirements: Final Rule on Foreign Supplier Verification Programs," May 11, 2017; USITC hearing transcript, September 17, 2020, 114–15 (testimony of Lance Jungmeyer, Fresh Produce Association of the Americas).

USDA Marketing Standards

The USDA Agricultural Marketing Service (AMS) grading system is used to indicate the quality of fresh cucumbers being sold in the U.S. market. Grading is voluntary. At the shipping point, a seller might order a grading inspection in order to ensure the quality of the product before shipping it to the end market customer. In the terminal market, purchasers may also order a grading inspection to ensure that the quality of the product meets the agreed-upon standard. AMS graders indicate quality based on color, shape, size, and amount of damage (which may include decay, sunscald, and damage caused by scarring, yellowing, sunburn, dirt or foreign material, freezing, disease, insects, cuts, bruises, or other means). AMS designates fresh cucumbers on a numeric scale in descending order of quality, broken out by size (U.S. Fancy, U.S. Extra No. 1, U.S. No. 1, U.S. No. 1 Small, U.S. No. 1 Large, U.S. No. 2). Greenhouse cucumbers have a similar grading system though they are not broken out by size (U.S. Fancy, U.S. No. 1, U.S. No. 2). Pickling cucumbers are also designated on a numeric system. (U.S. No. 1, U.S. No. 2, and U.S. No. 3). In cases where there is a disagreement between a buyer and a seller about whether a product meets the agreed-upon grade, involved parties may seek assistance from the Secretary of Agriculture under the Perishable Agricultural Commodities Act to obtain a resolution.[60] AMS standards and grades are intended to primarily serve wholesale markets. Retailers may also have their own quality requirements in addition to these marketing standards.[61]

Voluntary Food Safety Programs

Good Agricultural Practices (GAP) and Good Handling Practices (GHP) are voluntary audit programs established by USDA to verify that fruits and vegetables are produced, packed, handled, and stored to minimize risks of microbial food safety hazards.[62] Suppliers often source cucumbers and other fresh produce from growers and distributors certified under these programs to help ensure food safety. In addition, many retailers and service industry consumers of cucumbers require suppliers to meet Global Food Safety Initiative (GFSI) standards. The GFSI is a global food safety benchmarking initiative under the auspices of the Consumer Goods Forum, an international group of retailers and manufacturers, that recognizes various food safety certifications (e.g., Safe Quality Food or SQF) as meeting GFSI Standards.[63] Many growers and traders become certified by third-party certifiers as part of participation in these

[60] Perishable Agriculture Commodities Act, 7 U.S.C. §§ 499a et seq.; U.S. government representative, interview by USITC staff, July 13, 2021.
[61] U.S. government representative, interview by USITC staff, July 13, 2021.
[62] USDA, AMS, "Good Agricultural Practices," accessed July 28, 2021.
[63] GFSI, "Certification: Achieving a GFSI-Recognised Certificate," accessed July 28, 2021; SQFI, "About the SQF Program," accessed July 28, 2021. Walmart requires all suppliers with a total annual revenue greater than $1 million to be certified by GFSI. Walmart and Sam's Club, *Food Safety Requirements for Food and Beverage Suppliers*, 2017.

programs and, for example, to help U.S. importers establish eligibility to participate in FDA's Voluntary Qualified Importer Program.[64]

Organic Certifications

As with quality grading standards, growers of cucumbers use USDA-accredited certifiers to verify the organic status of their product.[65] USDA-certified organic goods must be grown without using certain chemicals or prohibited methods.[66] Retailers indicate that demand for organic cucumbers is growing.[67] A recent survey conducted by Natural Grocers, a Colorado based chain of organic grocery stores, indicated that consumers are purchasing organic produce to avoid exposure to pesticides and genetically modified organisms (GMOs), and because they believe it is more nutritious.[68] Increased demand and perceived benefits for organic product mean that organic growers can generally charge a higher price. However, certified organic cucumbers still make up only a small portion of fresh cucumber consumption in the United States, and industry representatives indicate that the added costs required to produce organic sometimes outweigh the additional revenue.[69]

Competitiveness Framework

To analyze the competitive factors affecting the cucumber sectors across the countries that are major suppliers to the U.S. market, the Commission used a framework drawing together the analytical assumptions, parameters, and structures that define competitive conditions in food and agricultural trade.[70] Competitive conditions encompass the economic, institutional, and regulatory environment in which firms compete. Agricultural competitiveness is measured by comparing delivered costs, product differentiation, and supplier reliability for domestically produced goods against those of imports. Figure 1.2 shows how these three characteristics are affected by several competitive factors for agriculture. Government policies and the regulatory environment can affect competitiveness under these categories and information about them is presented in the country profiles.

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[64] FDA, as called for by FSMA, has a third-party certifier accreditation program through which FDA recognizes accreditation bodies to accredit third-party certification bodies to conduct food safety audits and issue certifications as noted in Accreditation of Third-Party Certification Bodies to Conduct Food Safety Audits and To Issue Certifications, 80 Fed. Reg. 74569 (November 27, 2015). Industry representatives, interview by USITC staff, July 29, 2020; industry representatives, interview by USITC staff, July 30, 2020. Third-party certification bodies accredited under FDA's third-party accreditation program can issue food and facilities certifications required for participation in FDA's Voluntary Qualified Importer Program. 80 Fed. Reg. 74569.

[65] To sell imported products as organic in the United States these products must be certified to either the USDA standard or an equivalent international standard. USDA, AMS, "Importing Organic Products into the U.S.," accessed October 20, 2021.

[66] USDA, AMS, "Labeling Organic Products," accessed July 28, 2021.

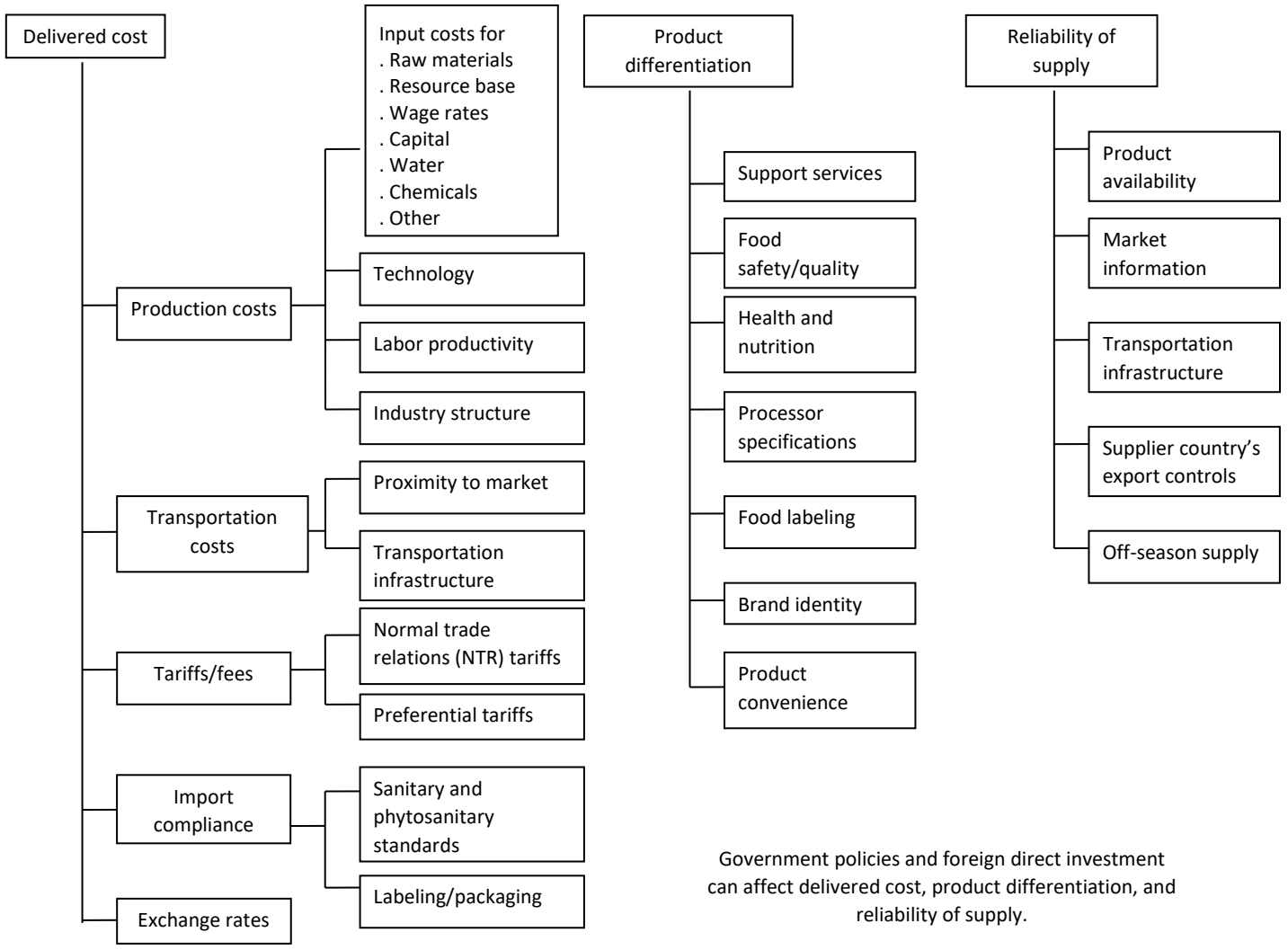
[67] Industry representatives, interviews by USITC staff, May 9, 2021, and May 26, 2021.

[68] Natural Grocers by Vitamin Cottage, Inc., "The Top 3 Reasons Shoppers Buy Organic Produce," August 24, 2017.

[69] Industry representative, interview by USITC staff, June 24, 2021; USITC, hearing transcript, April 8, 2021, 223 (testimony of William L. Brim, Lewis Taylor Farms).

[70] The Commission uses Michael Porter's theory of competitive advantage as a starting point from which to develop a framework for analyzing competitive conditions affecting agricultural trade. For more information on this framework and its limitations, refer to USITC, *China's Agricultural Trade*, March 2011, E-3 to 3-8; Porter, *Competitive Strategy*, 1980, and Porter, *Competitive Advantage*, 1985.

Figure 1.2 Factors that affect competitiveness in agricultural markets



Source: Compiled by USITC staff.

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Chapter 2
The Industry and Market in the United States

The U.S. fresh market cucumber industry is a relatively small part of the country's agricultural sector, primarily focused on serving fresh market American slicer varieties to the domestic market. Between 2015 and 2020, U.S. cucumber production (including cucumbers for pickling) fell 23 percent from approximately 826,000 metric tons (mt) to 636,000 mt, while market share fell from about half to less than 40 percent.[71] U.S. domestic cucumber production is not sufficient to meet U.S. consumer demand, and imports are increasingly important in filling that gap.

The U.S. fresh market cucumber industry's competitiveness is negatively impacted by climate and pest pressures, particularly in the Southeast, as well as high labor costs which increase overall delivered costs and affects growers' ability to use certain production systems and practices. However, dispersed production across the United States as a whole helps to mitigate these climate risks and contributes to other advantages.

Production, Trade, and Consumption

Production

The United States accounted for 0.8 percent of global cucumber production (including cucumbers for pickling) in 2019 and was the ninth-largest producer globally.[72] Open field production, the vast majority of U.S. production, averaged 801,459 mt between 2016–20 (table 2.1).[73] The largest producing states, by volume, are Michigan, Florida, Georgia, and North Carolina. National production decreased by 27.8 percent between 2016–20 as area harvested decreased by 19.4 percent, and yields decreased by 10.3 percent (tables 2.2 and 2.3). Production did increase markedly between 2016–17, driven by a 35.9 percent increase in production in Florida, where the area harvested and yields increased by 19.3 percent and 13.9 percent, respectively. U.S. production is mainly of American slicers and gherkins (a type of pickling cucumber).[74] Nationally, the majority of total production is intended for pickling, with the share of cucumbers grown for the fresh market dropping from 42.0 percent of production in 2016 to

[71] USDA, NASS, QuickStats, Cucumber Production in cwt, accessed March 3, 2021; USITC DataWeb/Census, HTS heading 0707.00, accessed July 12, 2021.
[72] FAO, "Crops: Cucumbers," FAOSTAT database, accessed March 3, 2021. FAOSTAT only includes open field production.
[73] The U.S. Department of Agriculture's National Agricultural Statistics Service (USDA, NASS) made structural changes to the methodology starting in 2016 and has not updated and made available data from prior years. Government representative, email message to USITC staff, March 31, 2021.
[74] There is some limited production of burpless cucumbers in the United States, including in the U.S. Southeast. According to industry representatives, this production is likely small-scale and very dispersed, not often reaching larger commercial markets. Industry representatives, interviews by USITC staff, June 24, August 27, and October 5, 2021.

24.7 percent in 2020.[75] Production in the southeastern United States, including Florida, Georgia, and North Carolina, was 304,907 mt in 2020, or 48.0 percent of total U.S. production. Production in the U.S. Southeast is primarily for fresh market consumption. Production varied widely within individual states from year to year during 2015–20, driven largely by decreases in both area harvested and yields (tables 2.2 and 2.3).

Table 2.1 Cucumbers: U.S. production, 2016–20
In metric tons and percentages; mt = metric tons, % = percentage.

Region	2016	2017	2018	2019	2020
Florida (mt)	198,434	269,735	215,046	174,917	172,128
Georgia (mt)	97,896	84,459	71,631	91,536	65,481
North Carolina (mt)	76,813	84,581	75,289	83,976	67,298
Southeast (mt)	373,143	438,774	361,966	350,429	304,907
California (mt)	76,813	72,901	84,357	55,273	47,104
Michigan (mt)	277,076	285,763	209,504	301,161	220,233
All other states (mt)	152,910	162,064	127,585	41,841	63,491
Total US (mt)	879,942	959,503	783,412	748,704	635,735
Florida (%)	22.6	28.1	27.4	23.4	27.1
Georgia (%)	11.1	8.8	9.1	12.2	10.3
North Carolina (%)	8.7	8.8	9.6	11.2	10.6
Southeast (%)	42.4	45.7	46.2	46.8	48.0
California (%)	8.7	7.6	10.8	7.4	7.4
Michigan (%)	31.5	29.8	26.7	40.2	34.6
All other sources (%)	17.4	16.9	16.3	5.6	10.0

Source: USDA, NASS, Vegetables Summaries 2017, 2018, 2019, and 2020.
Note: USITC estimates for Georgia production in 2020. Data are for open field cucumbers and do not include greenhouse production. In 2015, total U.S. cucumber production was 825,592 mt.

[75] USDA, NASS, QuickStats, *Cucumbers Fresh Market Utilized production in CWT, Cucumbers Processing Utilized production in Tons*, accessed May 5, 2021.

Table 2.2 Cucumbers: U.S. area harvested, 2016–20
In hectares and percentages; ha = hectares.

Item	2016	2017	2018	2019	2020
Florida area harvested (ha)	8,782	10,481	10,077	9,308	8,377
Georgia area harvested (ha)	3,318	3,845	3,804	3,683	3,662
North Carolina area harvested (ha)	4,371	4,249	3,885	4,613	4,128
Southeast area harvested (ha)	16,471	18,575	17,766	17,604	16,167
California area harvested (ha)	3,399	3,318	3,278	2,752	2,509
Michigan area harvested (ha)	16,349	15,176	13,921	16,026	14,043
All other sources area harvested (ha)	10,198	10,360	9,915	4,411	4,674
U.S. area harvested (ha)	46,417	47,429	44,880	40,792	37,393
Florida area harvested (%)	18.9	22.1	22.5	22.8	22.4
Georgia area harvested (%)	7.1	8.1	8.5	9.0	9.8
North Carolina area harvested (%)	9.4	9.0	8.7	11.3	11.0
Southeast area harvested (%)	35.5	39.2	39.6	43.2	43.2
California area harvested (%)	7.3	7.0	7.3	6.7	6.7
Michigan area harvested (%)	35.2	32.0	31.0	39.3	37.6
All other sources area harvested (%)	22.0	21.8	22.1	10.8	12.5
U.S. area harvested (%)	100.0	100.0	100.0	100.0	100.0

Source: USDA, NASS, Vegetables Summaries 2017, 2018, 2019, and 2020.
Note: USITC estimates for Georgia production in 2020. Data are for open field cucumbers and do not include greenhouse production. In 2015, total U.S. cucumber harvested area was 49,813 ha.

Table 2.3 Cucumbers: U.S. yields, 2016–20
In metric tons per hectare.

Item	2016	2017	2018	2019	2020
Florida yield	22.6	25.7	21.3	18.8	20.7
Georgia yield	29.5	22.0	18.8	25.1	17.3
North Carolina yield	17.6	20.1	19.5	18.2	16.3
Southeast yield	22.7	23.7	20.4	20.0	19.0
California yield	22.6	22.0	25.7	20.1	18.8
Michigan yield	16.9	18.8	15.1	18.8	16.3
All other sources yield	15.0	15.6	12.9	9.5	13.6
U.S. yield	19.0	20.3	17.5	18.4	17.3

Source: USITC calculation based on USDA, NASS, Vegetables Summaries 2017, 2018, 2019, and 2020.
Note: USITC estimates for Georgia production in 2020. Data are for open field cucumbers and do not include greenhouse production. In 2015, U.S. cucumber yields were 16.6 mt per ha.

Use of protected agriculture (PA) in cucumber production in the United States is extremely limited, but where it exists, it mainly utilizes greenhouses versus other PA structures, like high tunnels or shade houses. While the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS) does not collect annual survey data on greenhouse production, these data are collected every five years as part of the USDA's Census of Horticulture with data available in 2014 and 2019.

According to NASS, the United States produced 23,147 mt of cucumbers in greenhouses in 2019 on 59 ha, representing just 3.5 percent of total U.S. production.[76] This greenhouse production was concentrated in California.[77] Despite greenhouse growing being a small but increasingly important growing method for overall vegetable production in the United States, cucumber greenhouse production in the United States decreased by 29.7 percent between 2014 and 2019. There is some

[76] USDA, NASS, QuickStats, Census, Cucumber Greenhouse production, accessed May 11, 2021.
[77] USDA, NASS, QuickStats, Census, Cucumber Greenhouse production, accessed May 11, 2021.

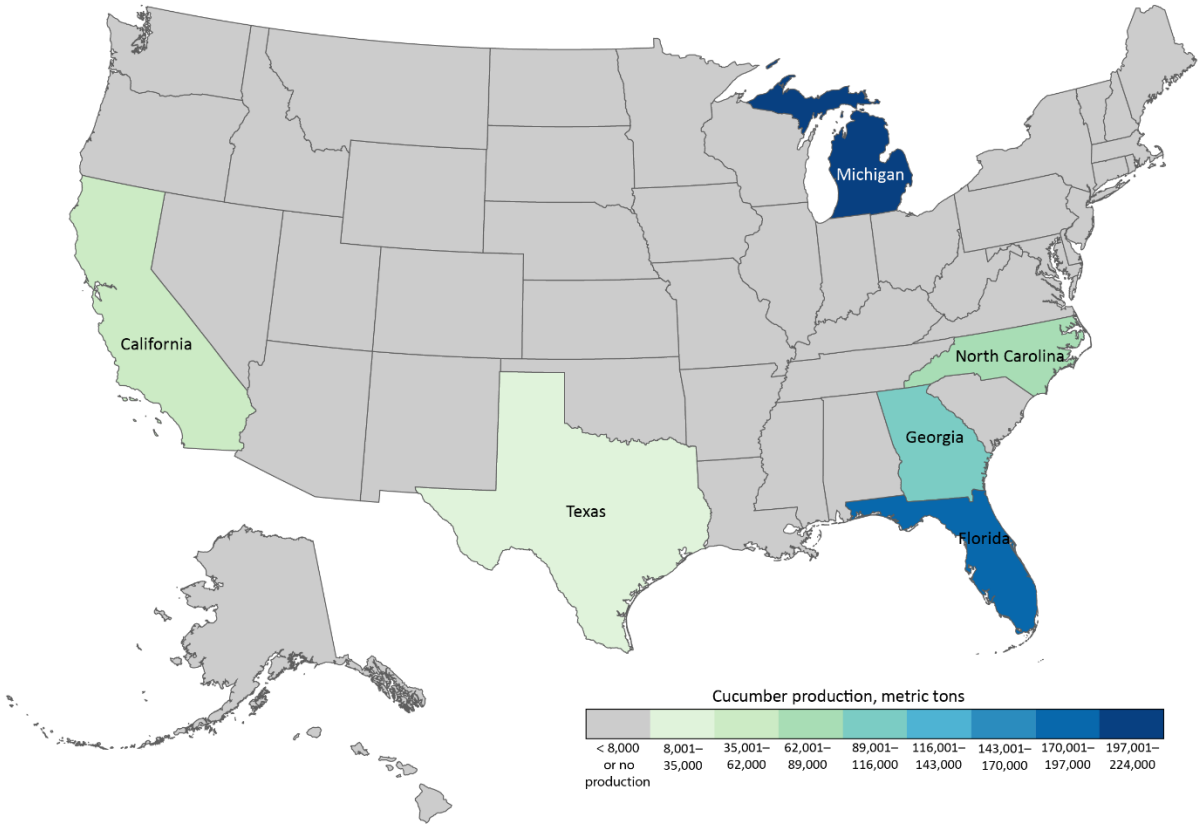
speculation among industry observers as to what may be causing this decline for cucumbers, including a decrease in reporting by producers, and a switch to producing more lucrative crops in the high-yielding but high-cost greenhouse production systems.[78]

The main cucumber growing region in the United States is the Southeast, with significant production also occurring in Michigan, California, and Texas (figure 2.1). In the U.S. Southeast, the states of Florida, Georgia, and North Carolina combined grow almost half (48.0% in 2020) (table 2.1) of the country's cucumbers.[79] In 2020, about two-thirds of cucumber production in the Southeast was for the relatively higher-value fresh market cucumber, which was higher than the national average of 25.1 percent; the remainder produced is fresh cucumber for pickling.[80] Michigan is the largest cucumber-producing state by volume in the country, with about 90 percent of the state's 220,233 mt of production in 2020 grown for pickling, which tends to have a lower value than the fresh market.[81] Like Michigan, Texas grows mostly pickling cucumbers, while 40 percent of production in California is for the fresh market.[82]

[78] Government representatives, interview by USITC staff, May 11, 2021; industry representative, interview by USITC staff, July 16, 2021.
[79] USDA, NASS, QuickStats, Cucumber Production in cwt, accessed March 3, 2021.
[80] Note that data for specific states are missing for certain years, resulting in percentages that do not add to 100. USDA, NASS, QuickStats, Cucumber Production Fresh market, Processing, accessed May 5, 2021. USDA, NASS, QuickStats, Cucumber Production in cwt, accessed March 3, 2021.
[81] Michigan is second to Florida in cucumber production by value due to Florida's focus primarily on production for the higher-value fresh market. USDA, NASS, QuickStats, Production Fresh market, Processing, accessed May 5, 2021.
[82] USDA, NASS, QuickStats, Production Fresh market, Processing, accessed May 5, 2021.; USDA, NASS, QuickStats, Cucumber Production Fresh market, Processing, accessed May 5, 2021; Blue Book Services, "Produce Blue Book: Cucumbers," accessed June 29, 2021.

Figure 2.1 Cucumber production in the United States, by state, 2020

In metric tons. Underlying data for this figure can be found in appendix F, table F.2.



Source: USDA, NASS, *Cucumber Production in cwt,* accessed March 3, 2021.
Note: Production includes cucumbers for fresh market and for processing. Volumes include cucumbers grown only in open field conditions and do not include greenhouse production. The latest available data for Georgia are from 2019.

Although the majority of U.S. cucumber production occurs in the summer months, the varied climates across the United States dictate a wide range of production seasons for U.S. cucumbers. The Southeast harvest season begins in the late fall in Georgia, and then transitions to Florida in the winter, then moves back to Georgia in the spring and to North Carolina in early summer.[83] Georgia has two harvest seasons per year: one in the spring and again in the fall.[84] Growers in Michigan harvest cucumbers in the summer season.[85] California, which harvests cucumbers in the late spring through the fall, is the fifth-largest cucumber-producing state by volume.[86]

[83] USITC, hearing transcript, April 8, 2021, 159–60 (testimony of Dick Minor, Minor Brothers Farm); industry representatives, interviews by USITC staff, February 3, February 24, May 10, and October 5, 2021.
[84] Industry representative, interview by USITC staff, May 10, 2021.
[85] Industry representative, interview by USITC staff, February 26, 2021.
[86] USDA, NASS, QuickStats, Cucumber Production Fresh market, Processing, accessed May 5, 2021; Blue Book Services, "Produce Blue Book: Cucumbers," accessed June 29, 2021.

Trade

The United States is the largest importer of cucumbers in the world with 994,741 mt of total imports in 2020.[87] Cucumber imports increased by 22.8 percent by volume over the period 2015–20, with an average annual increase of 36,969 mt (4.1 percent) (table 2.4). Mexico and Canada were the two largest suppliers to the U.S. cucumber market during 2015–20, providing 95.5 percent of total imports. U.S. imports from each country increased each year during the period.

Mexico was the largest supplier to the U.S. cucumber market, supplying 789,175 mt in 2020, a 21 percent increase since 2015. Nearly all of U.S. cucumber imports from Mexico are for the fresh market.[88] Seventy-five percent of U.S. imports from Mexico enter the country between November and the end of May, with nearly half entering December through March.[89]

Canada is the next-largest source of U.S. cucumber imports, supplying 162,541 mt in 2020, an increase of 35.9 percent over the six years to 2020. Cucumbers for processing comprised 15.1 percent of U.S. imports from Canada in 2020.[90] Over 90 percent of U.S. imports from Canada enter between March and October, with more than 40 percent occurring in July and August (see chapter 6 for a detailed analysis of seasonal trade trends). The United States is a minor exporter, supplying 14,239 mt of exports in 2020, nearly all to Canada.[91]

Table 2.4 Cucumbers: U.S. imports for consumption, by source, 2015–20
In metric tons and percentages; mt = metric tons.

Import source	2015	2016	2017	2018	2019	2020
Mexico (mt)	652,312	688,285	702,643	757,428	774,431	789,175
Canada (mt)	119,589	137,810	141,236	145,037	157,320	162,541
Honduras (mt)	27,508	31,596	26,441	29,459	29,081	34,250
All other sources (mt)	10,475	15,224	11,428	11,315	11,673	8,775
All import sources (mt)	809,883	872,915	881,748	943,239	972,504	994,741
Mexico (%)	80.5	78.8	79.7	80.3	79.6	79.3
Canada (%)	14.8	15.8	16.0	15.4	16.2	16.3
Honduras (%)	3.4	3.6	3.0	3.1	3.0	3.4
All other sources (%)	1.3	1.7	1.3	1.2	1.2	0.9
All import sources (%)	100.0	100.0	100.0	100.0	100.0	100.0

Source: USITC DataWeb/Census, HTS heading 0707.00, accessed July 15, 2021.

During 2020, 99 percent of U.S. imports of fresh cucumbers entered duty free under one of two U.S. free trade agreements. U.S. imports from Canada or Mexico entered under the United States–Mexico–Canada Agreement (USMCA) (and its predecessor the North American Free Trade Agreement), while imports from Honduras, as well as other member countries, entered under the Dominican Republic–Central America Free Trade (CAFTA-DR) Agreement.[92] In 2020, FTA partners supplied over 99 percent of

[87] IHS Markit, Global Trade Atlas, HS heading 0707.00, accessed May 11, 2021.
[88] USITC DataWeb/Census, HTS heading 0707.00, accessed July 15, 2021.
[89] USITC DataWeb/Census, HTS heading 0707.00, accessed July 15, 2021.
[90] USITC DataWeb/Census, HTS statistical reporting number 0707.00.6030, accessed July 15, 2021.
[91] USITC DataWeb/Census, HTS heading 0707.00, accessed July 15, 2021.
[92] CAFTA-DR is an FTA between the United States and Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and the Dominican Republic. All parties signed CAFTA-DR on May 28, 2004, except the Dominican Republic, which signed in August 2004.

imports.[93] The remaining imports were subject to the U.S. normal trade relations (NTR) rate of duty. NTR rates vary according to the time of year the fresh cucumbers enter the United States; rates are highest during the spring and fall, and lowest during the summer.[94] The rate of duty is 4.2 cents per kilogram (kg) for fresh cucumbers that enter between December 1 and the last day of February (HTS 0707.00.20), increasing to 5.6 cents per kg for fresh cucumbers that enter between March 1 and June 30 (HTS 0707.00.40) and between September 1 and November 30 (HTS 0707.00.50), and decreasing to its lowest rate of 1.5 cents per kg for fresh cucumbers that enter between July 1 and August 30 (HTS 0707.00.60). The ad valorem equivalent tariff on fresh cucumbers ranged from 0.9 to 2.5 percent in 2020.[95]

Consumption

Industry representatives perceive that U.S. consumer demand for fresh market cucumbers has generally increased along with that of other fresh vegetables as Americans eat a healthier diet, and producers respond with novel and more convenient varieties and packaging.[96] Although apparent consumption of cucumbers (which includes cucumbers for pickling) in the United States decreased just slightly (by 0.3 percent) between 2015–20 (table 2.5), per capita consumption has held relatively steady at about 5kg per capita.[97] Virtually all U.S. production is consumed domestically, but it cannot meet total U.S. consumer demand for cucumbers. The United States imports product year-round but particularly during the November–May period when domestic production is not as readily available. Imports, primarily from Mexico, as a share of U.S. domestic consumption followed a generally upward trend during 2015–20.

Table 2.5 Cucumbers: Apparent consumption in the United States, 2015–20
In metric tons, kilograms, and percentages; mt = metric tons; kg = kilograms.

Item	2015	2016	2017	2018	2019	2020
Production (mt)	825,592	879,942	959,503	783,412	748,704	635,735
Imports (mt)	809,883	872,915	881,748	943,239	972,504	994,741
Exports (mt)	33,568	36,709	32,771	34,088	33,822	33,700
Apparent consumption (mt)	1,587,809	1,703,104	1,794,583	1,680,250	1,673,050	1,582,420
Per capita consumption (kg)	4.9	5.3	5.5	5.1	5.1	4.8
Imports share of apparent consumption (%)	51.0	51.3	49.1	56.1	58.1	62.9

Source: Official U.S. agricultural statistics published by USDA NASS; official U.S. imports for consumption statistics published by USITC DataWeb/Census, HS heading 0707.00, accessed February 11, 2021; official U.S. domestic export statistics using USITC DataWeb/Census, Schedule B heading 0707.00, accessed March 12, 2021; and United Nations, Department of Economic and Social Affairs, Population Division (2019), accessed May 10, 2021.

Consumer demand for fresh market cucumbers in the United States has shifted away from the traditional American slicer towards burpless and snacking varieties, including English, Persian, and other mini cucumbers.[98] These varieties of cucumbers are seedless and have thinner skin, more flavor, and

[93] USITC DataWeb/Census, HTS heading 0707.00, accessed July 12, 2021.
[94] Tariffs are applied on all fresh cucumbers, including fresh market and fresh for pickling.
[95] USITC DataWeb/Census, HTS heading 0707.00, accessed various dates. An ad valorem tariff is the most common tariff form, which means that the customs duty is calculated as a percentage of the value of the product. World Bank, "Forms of Import Tariffs," accessed July 1, 2021.
[96] Industry representatives, interviews by USITC staff, February 26, May 26, and August 11, 2021.
[97] Apparent consumption is calculated as production plus imports, minus exports.
[98] Industry representative, interview by USITC staff, August 11, 2021.

often less bitterness than American slicers—traits that are increasingly valued by consumers.[99] Unlike slicers, which are waxed or oiled and sold unpackaged, English and Persian cucumbers are sold packaged, with English typically shrink-wrapped individually, and Persian cucumbers sold several to a carton or in a bag.[100] The increase in demand for burpless cucumbers is part of the snacking trend in the fresh produce segment, where consumers value convenience and small-sized products, such as mini cucumbers, that lend themselves to quick, easy eating.[101]

English and Persian varieties are primarily grown in greenhouses and other forms of PA, resulting in a more uniform and higher quality product with longer periods of availability throughout the year, something that is important for the retail market, as retail consumers make purchases based on appearance, taste, and convenience and demand cucumbers throughout the year.[102] However, slicers, which are more commonly grown in open fields, are generally favored in the food service sector since they better withstand mechanical slicing, although there are indications that burpless varieties are starting to become more common in food service.[103]

Industry Structure

The industry structure of the U.S. fresh market cucumber sector, including predominant production practices and marketing channels, varies across the major growing regions in the United States, often due to differing climates and growing seasons. Separate discussions below for the southeastern United States highlight distinct regional industry characteristics.

Industry Composition

The U.S. fresh market cucumber industry is composed of producers (growers), intermediaries (packers, shippers, importers, brokers, wholesalers), and customers (processors, food service, restaurants, retailers). Production of cucumbers is fragmented in the United States. According to USDA NASS, there were over 15,000 U.S. fresh market cucumber producers in 2017.[104] About half of the total harvested area of fresh market cucumbers in the United States is on very large farms (i.e., farms with over 500 acres, or 202.4 hectares, in total operations), though small to mid-sized farms make up larger shares of total cucumber production in some states.[105] Some larger U.S. growers may also have operations in multiple states or in Mexico, in order to take advantage of the different growing seasons of each region

[99] UC Davis, Western Institute for Food Safety and Security, *Cucumbers*, 2, May 2016. UC Davis, Western Institute for Food Safety and Security, *Cucumbers*, 2, May 2016. In addition to being less bitter, burpless cucumbers are also said to cause less indigestion. Harrison, "Why Are Burpless Cucumbers Called Burpless?" accessed October 26, 2021.
[100] Industry representative, interview by USITC staff, July 16, 2021; Williams, "Cute Cucumbers," August 2018.
[101] Nelson, "As Snacking Occasions Rise, Produce Departments Add More Options," February 9, 2021; Williams, "Cute Cucumbers," August 2018; industry representative, interview by USITC staff, August 11, 2021.
[102] Industry representatives, interviews by USITC staff, May 9, May 26, and August 11, 2021.
[103] Industry representatives, interviews by USITC staff, August 11, and July 16, 2021.
[104] USDA, NASS QuickStats, Cucumbers - operations with area harvested - area harvested, fresh market and processing, accessed June 2, 2021.
[105] USDA, NASS QuickStats, Cucumbers, fresh and for processing - acres harvested, area harvested, fresh market and processing, accessed June 2, 2021.

and produce a supply of cucumbers in more months of the year.[106] Regardless of size, most U.S. farms do not grow cucumber exclusively but instead cultivate additional vegetable and berry crops situated alongside or sometimes in the same plots as cucumbers.

Production Systems and Practices

Fresh market cucumber growers in the United States generally use open field production for American slicer varieties of cucumbers. They typically plant in beds using plastics (i.e., raised soil beds overlaid with thick sheets of plastic perforated for planting). Although the growing practice of trellising vines vertically is sometimes used by U.S. growers, the practice is not common, reportedly because of the additional labor required to implement and maintain them, which in the United States is costly.[107] Most growers sow seeds directly in the beds, though some growers may start seedlings as transplants in greenhouses to jumpstart the propagation process and plant earlier in the season before transferring them to the open field.[108] Cucumber beds for commercial production are typically irrigated, most commonly via drip irrigation lines. Unlike other systems, drip irrigation keeps the roots of the plant hydrated while preventing too much moisture on the leaves (which causes mildew) and allows for the delivery of fertilizer and certain crop protection materials directly to the root zone.[109] Drip lines require frequent replacement.[110] Cucumbers for the fresh market are typically harvested by hand in the top fresh market cucumber-producing states.[111] Open field production of U.S. cucumbers tends to be American slicer varieties, though U.S. growers can grow greenhouse varieties (for example, burpless varieties) in open field under the right conditions.[112] Because open field production predominates in the southeastern United States, most growers there typically cultivate American slicer varieties.[113]

[106] See USITC, hearing transcript, April 8, 2021, 316. (testimony of Craig Slate, SunFed Produce). Other examples of multi-location cucumber growing operations include http://vansolkemaproduce.com/our-company.cfm, https://www.4earthfarms.com/where-we-grow/where-we-grow/, https://miedemaproduce.com/our-story/, and https://southernvalley.us/about/.

[107] Industry representatives, interview by USITC staff, May 10, 2021; academic professional, email message to USITC staff, July 28, 2021.

[108] Kemble, *Southeastern U.S. 2020 Vegetable Crop Handbook*, 2020, 13–14; Lewis Taylor Farms, "LTF Greenhouses and Transplants," accessed July 13, 2021; industry representative, interview by USITC staff, October 4, 2021.

[109] Industry representatives, interviews by USITC staff, May 10 and August 10, 2021; Grabowski, "Downy Mildew of Cucumber, Melon and Squash," 2018; academic professional, email message to USITC staff, August 6, 2021. Some less common irrigation systems used to cultivate cucumbers include center pivot irrigation and seepage irrigation systems, both of which can be less expensive than drip irrigation, but also less effective at maintaining ideal growing conditions. Industry representatives, interview by USITC staff, May 10, 2021; academic professional, email message to USITC staff, August 6, 2021.

[110] Industry representatives indicate that drip lines must be replaced after one or two crop cycles, and that the cost of drip materials has been increasing in recent years. Industry representatives, interviews by USITC staff, May 21, July 23, August 8, and August 27, 2021.

[111] Industry representatives, interviews by USITC staff, March 10, May 10, and July 14, 2021.

[112] Andersen, *Home Gardening Series: Cucumbers*, accessed September 7, 2021.

[113] Industry representatives, interviews by USITC staff, May 10 and August 27, 2021; Kemble, *Southeastern U.S. 2020 Vegetable Crop Handbook*, 2020, 52.

Cucumbers grown under protection made up about 3.5 percent of U.S. production in 2019.[114] American slicer cucumbers are generally not grown in greenhouses because market prices do not justify the added expense of greenhouse production and the cost of large investment required is prohibitive to most growers.[115] In addition, growing under protected agriculture generally requires the use of trellising or other forms of vertical production, which are generally not used in open fields in the United States. These forms of vertical production make growing under protected agriculture more labor intensive relative to open field production in the United States. Southeastern growers report that the humid climate and risk of weather-related damage from hurricanes would make any local greenhouses expensive to air-condition and insure.[116] Shade houses and other forms of low-technology (low-tech) PA are not commonly used by cucumber growers in top cucumber-producing states. The reasons are similar to the impracticality of greenhouses, although the fixed and operating costs of these lower-tech types of PA are much lower than the costs of a greenhouse.[117]

U.S. growers deploy several strategies to deal with pest and disease pressures that can adversely affect cucumber production, especially in the U.S. Southeast where humidity is high. Immediately before laying down plastic, most growers reported fumigating beds.[118] After planting, growers also reported spraying pesticides on their cucumber beds—southeastern growers sometimes spray as often as once a day, to keep pest pressures at bay.[119] Within the growing season, growers also rotate cucumber crops with other non-cucurbit vegetable and fruit crops on the same plastic to alleviate cucurbit-specific pest pressures (this practice saves the grower the expense of plastic removal and reinstallation as well). Growers spray fungicides to control for downy mildew, a late-season disease that spreads via spores disseminated through the wind and affects the leaves of the cucumber plants causing stunting and reduced yields. Producers may select varieties that are more resistant to downy mildew and other disease threats.[120] Organic cucumbers are reportedly a small but growing part of fresh market cucumber production, accounting for approximately 5 percent of Michigan's production and less than 10 percent of production in both Georgia and Florida, separately.[121] However, this does not appear to be a significant focus for U.S. producers, who claim that pest pressures and additional input costs can

[114] USDA, NASS, QuickStats Agricultural Census, Cucumber Greenhouse production, accessed May 11, 2021. "Under protection" here refers to crops grown "under glass or other forms of protection." USDA, NASS, *2019 Census of Horticultural Specialties, Interviewer's Manual*, December 2019, 44.
[115] Burfield, "Inside the World of Cucumbers—Field-Grown and Greenhouse-Grown," January 12, 2021; One U.S. greenhouse operator recently cited this cost as $1.5–2 million/acre. U.S. House Committee on Agriculture, "21st Century Food Systems," July 29, 2021.
[116] Government representative, email message to USITC staff, June 4, 2021; industry representatives, interview by USITC staff, May 10, 2021; USITC, hearing transcript, April 8, 2021, 117–118 (testimony of Gene McAvoy, University of Florida, Charles Hall, Georgia Fruit and Vegetable Association).
[117]Academic professionals, interview by USITC staff, May 21, 2021; USDA, NRCS, "Growing all Seasons: High Tunnels" accessed September 22, 2021.
[118] Kemble, *Southeastern U.S. 2020 Vegetable Crop Handbook*, 2020, 52.
[119] Industry representatives, interviews by USITC staff, March 10 and May 10, 2021.
[120] Seminis, *Agronomic Spotlight: Managing Downy Mildew in Cucumbers*, 2016.
[121] Industry representative, interview by USITC staff, July 23, 2021; academic professional, email message to USITC staff, July 28, 2021.

outweigh the premium price, which is reportedly not always much higher than the prices for conventional cucumbers.[122]

Packing

Packing practices for fresh market cucumbers are mostly standardized across the U.S. industry, using cardboard cartons and wooden crates. However, only some (usually larger) growers do their own packing.[123] Those that do tend to use a "shed packing" system, bringing cucumbers to a field house to be washed and cooled by using hydrocooling and/or forced air cooling to remove field heat. The cooling period may last from a few hours to overnight, after which the cucumbers are graded by size and quality, and packed and shipped to the buyer. Other growers without packing houses may send their cucumbers to a warehouse to be packed, or may field-pack their product—washing, grading, sorting, and boxing cucumbers in the field as they are picked, and then immediately transferring boxes of vegetables to cool elsewhere.[124] American slicer cucumbers are sometimes waxed during the packing process to prevent moisture loss and maintain freshness.[125] U.S. growers of English cucumbers typically enclose their product in shrink wrap, which also prevents moisture loss and damage to the thinner skin.[126]

Supply Chain

U.S. produced fresh market cucumbers are grown on farms, harvested, and packed to be sold through various channels including retailers, food processors, food service and restaurants, vegetable packers, or directly to consumers based on a variety of factors.[127] Growers may sell to buyers directly, may sell through wholesale markets or produce auctions, or may use brokers.[128] Some restaurant, food service, and large retail buyers of cucumbers are reported to prefer contract pricing arrangements, surveying their suppliers to ensure they are getting the lowest price. These buyers are said to favor year-round contracts to ensure steady supplies. This practice, coupled with buyer preference for large-volume orders, can make it difficult for some U.S. producers to sell directly to these outlets.[129]

Commercial cucumber growers in the U.S. Southeast reported selling to both retailers and institutional food service buyers, with reports that about 40 to 85 percent of their harvest was sold to retail

[122] Industry representatives, interviews by USITC staff, August 11, and August 19, 2021. USITC hearing transcript, April 8, 2021 (testimony of William L. Brim, Lewis Taylor Farms), 224.
[123] USITC, hearing transcript, April 8, 2021, 77 (testimony of Dick Bowman, J&J Family of Farms), 145 (testimony of Marie Bedner, Bedner Growers, Inc.), 153 (testimony of Sam Watson, Chill C Farms), 230 (Fred Erickson, J&D Produce); industry representatives, interview by USITC staff, March 10, 2021.
[124] Industry representatives, interview by USITC staff, February 3, February 24, March 10, and May 10, 2021; Seminis, *Agronomic Spotlight: Cucumber Harvest and Storage*, August 8, 2019.
[125] Industry representatives, interviews by USITC staff, March 10, August 10, and October 4, 2021.
[126] USDA, AMS, *Shipping Point and Market Inspection Instructions for Greenhouse Cucumbers*, January 1998, 16.
[127] Industry representatives, interviews by USITC staff, February 1, March 10, and August 10, 2021.
[128] Direct sales by growers to buyers are more likely if the grower is large and/or has longstanding business relationships established. Miller, "U.S. Fresh and Pickling Cucumber Markets," December 31, 2013; industry representatives, interviews by USITC staff, February 24 and August 10, 2021. Some growers may also own trucks to transport their product to buyers themselves.
[129] Industry representatives, interviews by USITC staff, February 24 and May 26, 2021.

buyers.[130] Growers from Georgia reported selling half or more of their produce on the spot market rather than via contracts with buyers, while other sources in the Southeast noted that nearly 75 percent of all growers (i.e., including those farms not equipped for large-scale commercial production) sell entirely or in part on the spot market.[131] Contracts that did exist for growers could be drawn up to cover periods that ranged from two to three months, to six months, or longer.[132]

U.S. cucumber industry representatives have reported increasing consolidation of the retail buyers of their product in recent years.[133] Growers at the Commission's hearing noted that this trend of industry consolidation has provided buyers more leverage in contract negotiations with growers and has made establishing initial relationships with companies more challenging as they must compete with other growers for face time with a shrinking number of buyers.[134]

U.S. cucumber growers may sell their product throughout the country, though they tend to be most competitive in local markets due to three key factors: freight costs, the implications of long transport times on product quality, and demand for locally grown produce. As such, even those producers from states with smaller volumes of cucumber production can be competitive in their local markets during certain times of the year.[135] Producers from the U.S. Southeast tend to market cucumbers to buyers on the East Coast.[136] However, a small portion of the cucumbers grown in the U.S. Southeast were available for sale in wholesale terminal markets in the Midwest and Western United States between 2015 and 2020, typically during the middle of harvest seasons in Florida and Georgia.[137]

[130] USITC, hearing transcript, April 8, 2021, 203 (testimony of James M. Alderman, J. Alderman Farms; William L. Brim, Lewis Taylor Farms), 204 (testimony of Caleb Burgin, M.F. Burgin, Inc. d/b/a Burgin Farms); industry representatives, interviews by USITC staff, March 10 and May 10, 2021; academic professionals, interview by USITC staff, May 21, 2021; government representative, email message to USITC staff, May 26, 2021.
[131] USITC, hearing transcript, April 8, 2021, 194–96 (testimony of William L. Brim, Lewis Taylor Farms; James M. Alderman, J. Alderman Farms; Sam Watson, Chill C Farms); academic professionals, interview by USITC staff, May 21, 2021.
[132] Industry representatives, interview by USITC staff, March 10, 2021; USITC, hearing transcript, April 8, 2021, 145 (testimony of Dick Bowman, J&J Family of Farms), 287 (testimony of Craig Slate, SunFed Produce).
[133] USITC, hearing transcript, April 8, 2021, 314–315 (testimony of Rod Sbragia, Tricar Sales; Bret Erickson, J&D Produce); industry representatives, interviews by USITC staff, March 10 and August 10, 2021. Literature looking at consolidation has also noted this trend for grocery stores at the local and national level in the United States from 2002–2012. Smith, "The Evolution of U.S. Retail Concentration," Working Paper, January 11, 2021.
[134] USITC, hearing transcript, April 8, 2021, 314–315 (testimony of Rod Sbragia, Tricar Sales; Bret Erickson, J&D Produce).
[135] Industry representatives, interviews by USITC staff, August 10 and October 5, 2021.
[136] Government representatives, email messages to USITC staff, May 26 and June 4, 2021; academic professionals, interview by USITC staff, May 21, 2021.
[137] Midwest and Western U.S. terminal markets here include the Chicago, Dallas, Detroit, Los Angeles, San Francisco, and St. Louis markets. USDA, AMS, Terminal Markets Data. Note that terminal markets data present only a segment of total U.S. cucumber sales, as sales made directly from growers to retailers are not included.

Cost of Production

Using U.S. fresh market cucumber cost of production estimates, labor costs (including pre-harvest and harvest labor) represented about 33 percent of the total costs of production per acre.[138] Other major input cost shares included irrigation (about 25 percent), plant materials including seeds and transplants (about 7 percent), fertilizer costs (about 5 percent), and plant protection costs including pesticides, fungicides, and herbicides (about 7 percent).[139] Pesticides were typically about 1 percent of the total cost of production, though one budget from the University of Georgia showed the costs of pesticide and fumigants to comprise as much as 12 percent of the total cost of production.[140] Cucumber growers reported that in March 2021 the break-even cost of production of one box of cucumbers was about $7–$8.[141] Estimates of the cost of production per box of American slicer cucumbers for U.S. producers are included in chapter 5 (table 5.3).

After harvest, the costs of packaging, marketing, and distribution can be significant for U.S. cucumber growers, which has impacts on the domestic supply chain of U.S. cucumbers. The University of Georgia found that these costs could be as much as 27 percent of the total cost of growing and selling cucumbers (cost of production plus packaging, marketing, and distribution costs).[142] Other estimates provided by growers in March 2021 state that the break-even cost of a box of cucumbers inclusive of distribution costs was about $16, or double the cost of production at the grower level.[143] Southeastern

[138] Cost of production estimates come from enterprise budgets developed by agricultural extension departments across several regions of the United States (although they are concentrated in the U.S. Southeast). These budgets reflect the costs to cultivate an acre of hand-planted and hand-harvested cucumbers for the fresh market, grown on plastic using drip irrigation. Except when noted, the share of total production presented is the median value for these costs across the 5 budgets used. Across the five budgets, the cost of labor ranged between 32 and 38 percent, plant materials between 5 and 43 percent, irrigation between 5 and 27 percent, fertilizer between 1 and 14 percent, and plant protection between 2 and 21 percent. Sanchez et al., *Agricultural Alternative: Cucumber Production*, 2018, 6; Mississippi State University, *Traditional Vegetables 2018 Planning Budgets*, December 2017, 19; McMinn, Rainey, and McWhirt, *Cucumber Production Enterprise Budget*, 2017; Fonsah, Kichler, and Shealey, *2021 Cucumber on Plastic Budget*, 2021; Center for Crop Diversification, *Cucumber, Fresh Market, Trickle Irrigated - Kentucky Estimated per Acre Costs and Returns for 2017*, 2017.

[139] Other costs of production featured in some of the 5 budgets used but not listed above include equipment repair, fuel, insurance, interest on operating costs, land costs, machinery, and other overhead costs.

[140] Fonsah, Kichler, and Shealey, *2021 Cucumber on Plastic Budget*, 2021. Academic representatives noted greater pest prevention expenses are incurred because pest pressures are intensified by high volumes of vegetable production (as is the case in Florida and Georgia), which provide more opportunities for pests to propagate and spread to other plants. Additionally, the University of Georgia and Clemson University include the cost of soil fumigation in budget estimates for pesticide spending. Fumigant use is widespread among growers in Florida, Georgia, and parts of North Carolina, but less popular elsewhere in the United States. Academic representative, email to USITC staff, September 9, 2021.

[141] Industry representative, interview by USITC staff, March 10, 2021; USITC, hearing transcript, April 8, 2021, 68 (Charles Hall, Georgia Fruit and Vegetable Growers Association); Caleb Burgin, written submission to USITC, April 1, 2021. A box of cucumbers (1 1/9 bushel) typically weighs about 25 kg. University of Arkansas, Cooperative Extension Service, *Vegetable Weights Per Bushel*, July 23, 2013; University of Georgia Extension, *Weights and Processed Yields of Fruits and Vegetables in Retail Containers*, January 2014.

[142] Fonsah, Kichler, and Shealey, *2021 Cucumber on Plastic Budget*, 2021.

[143] Industry representative, interview by USITC staff, March 10, 2021.

growers have reported increases in packaging prices and freight rates in recent years, with one news source citing a 17 percent increase in the price of packaging from November 2020 to May 2021.[144]

Labor

Cucumbers—as with any hand-harvested and hand-planted fruit or vegetable crop with multiple pickings—are labor intensive to produce, and thus particularly sensitive to the availability of labor.[145] U.S. farms draw their labor force from the U.S. domestic workforce[146] or from temporary foreign worker programs, either recruiting workers directly or using a farm labor contractor (FLC). Farm laborers may be paid hourly or by piece rate, and this unit of pay may vary within a farm during the same season.[147] Wage rates are further discussed below under Factors Affecting Competitiveness. A shortage of domestic labor in the U.S. agriculture sector has been reported over the years by farmers in surveys, news reports, and congressional testimony.[148] However, cucumber growers in the Southeast reported that they have not experienced issues finding labor in recent years as they rely on temporary migrant workers from the H-2A Temporary Agricultural Program (H-2A visa program) (see box 2.1).[149] Growers have noted recent temporary disruptions to their agricultural labor supply that have occurred due to bureaucratic delays associated with the administration of the program.[150] In addition, there have been some COVID-19 pandemic-related delays to procuring labor through the H-2A program reported over the past year across the U.S. agricultural sector,[151] although U.S. government agencies worked to amend

[144] Prices for recycled paper—an important source of wood fiber for the packaging industry and used to make boxes—and corn, a main ingredient in the glue that holds the containers together, rose considerably in 2021. Chipman, "High Package Costs Hit Food Makers as Recycled Paper, Corn Soar," May 7, 2021; industry representatives, interviews by USITC staff, March 10 and May 10, 2021.
[145] Rutledge and Taylor, "California Farmers Change Production Practices as the Farm Labor Supply Declines," 2019; Zahniser et al., "Farm Labor Markets in the United States and Mexico," November 2018, 4.
[146] Note that domestic workers may include workers of both authorized and unauthorized work status.
[147] Industry representative, interview by USITC staff, May 10, 2021.
[148] For a summary of dynamics of the U.S. agricultural labor supply, see Zahniser et al., "Farm Labor Markets in the United States and Mexico Pose Challenges for U.S. Agriculture," November 2018.
[149] 8 USC § 1188; USITC, hearing transcript, April 8, 2021, 73 (testimony of Mike Joyner, Florida Fruit and Vegetable Growers Association) 79 (testimony of Dick Bowman, J&J Family of Farms) 97 (testimony of Marie Bedner, Bedner Growers), and 103 (testimony of Charles Hall, Georgia Fruit and Vegetable Growers Association); Luckstead and Devadoss, "The Importance of H-2A Guest Workers in Agriculture," 2019, 1.
[150] Industry representative, interview by USITC staff, May 10, 2021.
[151] The U.S. Embassy in Mexico announced that it would suspend routine immigrant and nonimmigrant visa services effective March 18, 2020, due to COVID-19 pandemic concerns. On August 16, 2021, the U.S. Embassy noted on its website that "applicants may experience significant delays for visa appointments." USDOS, U.S. Embassy in Mexico, "Status of U.S. Consular Operations in Mexico in Light of COVID-19," accessed October 26, 2020; Miller, "U.S. Moves to Protect Labor Supply After Embassy in Mexico Halts Visa Processing," March 16, 2020. Individual reports of tighter pandemic-related travel restrictions, border controls, and embassy closures impacting the movement and processing of H-2A workers began early in the pandemic and have continued into 2021. Weinrab and Ingwersen, "U.S. Farmers Scramble for Help as COVID-19 Scuttles Immigrant Workforce," July 2, 2020; Petrovic, "Pandemic Impacts Work Visas," April 10, 2021; Karst, "Suppliers Point to Government Policy as One Reason behind Labor Shortage," April 29, 2021.

regulations to support the usage of the program throughout the pandemic at levels equivalent or higher to those of the previous year.[152]

Because agricultural labor demand for open field vegetable production is seasonal, domestic workers in the past have relocated throughout the year to follow the peak harvest seasons in each region. A labor representative in the Southeast reported that domestic agricultural workers are now tending to transition to local work in other industries.[153] In part in response to this trend, the use of H-2A labor among U.S. growers has been growing steadily in recent years.[154] Under the program, U.S. farms recruit workers from abroad (typically Mexico) and contract with them for temporary agricultural work, either alongside domestic workers or other H-2A recruits. The reliability of labor supply that this structure provides makes the H-2A program popular with growers,[155] while the higher wage compared to that of agricultural jobs in other countries makes the program popular with participating foreign agricultural workers. A 2020 estimate found that H-2A workers comprised about 10 percent of all U.S. crop farmworkers.[156] Although the number of H-2A workers used in cucumber production is difficult to estimate on a national or state-by-state basis because of the way the data are collected,[157] applications

[152] On April 20, 2020, USCIS, the government agency responsible for clearing H-2A guest workers, amended regulations to expedite processing of employer petitions allowing them to hire workers with valid H-2A status who were currently in the United States at the time, and to extend the three-year maximum allowable period of stay for cleared H-2A workers. 85 Fed. Reg. 21739 (April 20, 2020). USDA, "DHS and USDA Move to Protect American Farmers and Ensure Continued Flow of America's Food Supply," April 15, 2020. With these adjustments in place, the program set records for the number of H-2A positions certified in April–June 2020 compared to the same period in previous years, and increased the number of positions certified for previous fiscal year by 8 percent. Nigh, "Coronavirus No Match for H-2A Demand," August 20, 2020; USDOL, ETA, OFLC, *H-2A Temporary Agricultural Labor Certification Program—Selected Statistics, FY 2020*, September 30, 2020.

[153] Industry representative, interview by USITC staff, March 10, 2021.

[154] Castillo et al., *Examining the Growth in Seasonal Agricultural H-2A Labor*, August 2021, 2.

[155] Industry representatives, interviews by USITC staff, March 1 and May 10, 2021; government representative, interview by USITC staff, September 13, 2021.

[156] Costa and Martin, *Coronavirus and Farmworkers—Farm Employment, Safety Issues, and the H-2A Guestworker Program*, March 24, 2020; Honig, "Farmers Are Seeking More Temporary H-2A Workers," November 5, 2018.

[157] The U.S. Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW) tracks wage and employment for certain agricultural subsectors. However, because the QCEW is based on unemployment insurance records, it does not capture certain small farm employers exempt from participation in the unemployment insurance system, and may not count H-2A workers as part of the agricultural employment totals in certain states. Castillo et al., *Examining the Growth in Seasonal Agricultural H-2A Labor*, August 2021, 8. The U.S. Department of Labor (USDOL) does release data for H-2A applications submitted for certification, which contain a data entry field for the primary crop H-2A workers are being recruited to cultivate and harvest. (See, for example, USDOL, ETA, *H-2A FY2019 Disclosure File*, accessed September 23, 2021.) However, because most growers have diversified crop portfolios, it is difficult to parse from these applications exactly how many workers recruited under applications for non-cucumber crops are also working in cucumber production. Government representative, interview by USITC staff, September 13, 2021.

for fruit and vegetable H-2A workers comprised 5.4 percent of all positions certified under the program across the entire U.S. agricultural sector in fiscal year (FY) 2019.[158]

Florida and Georgia have made increasing use of the H-2A program in recent years, with research suggesting that of all the agricultural sectors in Florida, berry and vegetable growers have comprised an increasing share of the state's H-2A labor employers.[159] Georgia and Florida led the country in the number of H-2A visa certifications: 29,480 and 33,598 H-2A visa holders, respectively, or about 11.4 and 13.0 percent of all H-2A visa certifications issued nationally in 2019. These states have seen a 69.5 and 47.2 percent increase in the number of H-2A positions that employers are certified to hire since FY 2016.[160]

Growers in the Southeast have noted that the cost savings of using domestic labor compared to H-2A labor has been diminishing.[161] This is likely due to rising domestic agricultural wages driven by competition for the domestic workers from other U.S. industry sectors.[162] The regulations and costs required of the H-2A program are summarized in box 2.1.

Box 2.1 H-2A Program Description and Costs

In response to grower reports of labor shortages among domestic workers dating as far back as the 1940s, U.S. policymakers have established formal arrangements permitting agricultural employers to hire foreign seasonal farmworkers on a temporary basis.[a] The latest iteration of this arrangement, the H-2A temporary work visa program for agricultural workers, was established in 1986. Continued and growing use of this program emphasizes the importance of labor in vegetable production and the high cost these growers are willing to pay to ensure a reliable labor supply.

[158] Note that the fruit and vegetable worker category is separately reported from that of certain select fruits and vegetables like apples (4.8 percent), melons (4.6 percent), corn (3.8 percent), and tomatoes (2.4 percent), and from that of nursery and greenhouse workers (3.8 percent). Remaining individual crops account for less than 2.4 percent of the total but cumulatively account for 42 percent of H-2A worker categories. USDOL, ETA, OFLC, *H-2A Temporary Agricultural Labor Certification Program - Selected Statistics, FY 2019*, September 30, 2019. DOL groups H-2A applications listing cucumbers as the primary crop under the broader fruits and vegetables category. Government representative, interview by USITC staff, September 13, 2021.

[159] During FY2015, citrus workers comprised 51 percent of all H-2A workers in Florida, compared to 84 percent in FY2012, "reflecting an increasing number of vegetable, blueberry, and strawberry growers participating" in the H-2A program. Roka and Guan, "Farm Labor Management Trends in Florida, USA—Challenges and Opportunities," 2018, 81.

[160] USDOL, ETA, OFLC, *H-2A Temporary Agricultural Labor Certification Program - Selected Statistics, FY 2016*, September 30, 2016; USDOL, ETA, OFLC, *H-2A Temporary Agricultural Labor Certification Program - Selected Statistics, FY 2019*, September 30, 2019. From these certifications, Georgia and Florida had 18,918 and 32,731 admissions of H-2A visa holders into their states in FY 2019, respectively. USDHS, *Yearbook of Immigration Statistics 2019 - Nonimmigrants 2019 Supplementary Tables*, accessed October 15, 2020. Admissions measure the number of times a visa holder entered the state, which could be multiple times within the year. Note too that H-2A workers may fill more than one job on a single visa—a recent study approximated that 2017 H-2A visa holders filled about 1.2 jobs in average per visa. Martin, "The Role of the H-2A Program in California Agriculture," 2019, 2.

[161] Industry representative, interview by USITC staff, May 10, 2021.

[162] Industry representative, interview by USITC staff, March 10 and October 4, 2021; Zahniser et al., "Farm Labor Markets in the United States and Mexico Pose Challenges for U.S. Agriculture," November 2018, 6, 40. Note that changes to federal and state minimum wage rates affect the legal wage for domestic agricultural laborers who are covered by the Fair Labor Standards Act, both on farms that do and do not participate in H-2A program, as explained in discussion of adverse effect wage rate (AEWR) in box 2.1.

Hiring Process

Between 60 and 75 days before the start of the season, a grower or farm labor contractor (FLC) submits an agricultural job order to the state workforce agency. Submissions include a crop- and activity-specific job order which specifies the number of workers requested, the job responsibilities, minimum wage and hours offered, benefits to be paid by the employer, and start and end dates of the contract. Submission of the agricultural job order initiates a recruitment process for domestic workers and notifies the state workforce agency of the grower or FLC's intent to file a future application for H-2A workers. At least 45 days before the start date of work in the job order, the grower or FLC will also submit the job order and an H-2A Application for Temporary Employment Certification to the U.S. Department of Labor.[c] If the number of job referrals of domestic workers from state workforce agencies is not sufficient to meet labor demand as stated in the job order and the employer's job order is found to meet all of the H-2A program requirements, the U.S. Department of Labor will issue a temporary labor certification to the employer at least 30 days before the start of work.[d] Once the temporary labor certification process is completed, a petition for nonimmigrant worker visas is submitted to the U.S. Department of Homeland Security's Citizenship and Immigration Services. The agency conducts background checks on recruited foreign guest workers awaiting admittance to the United States in their home country.[e] Once these guest workers are cleared, the U.S. Department of State issues them H-2A visas.

Program Requirements

Before hiring guest workers, employers must prove that the employment is temporary (10 months or less) or seasonal, that no qualified U.S. workers are available to perform the job, and that employment of guest workers will not adversely impact the earnings of domestic workers performing similar tasks. If the employer is hiring H-2A workers, they must offer domestic workers the same level of benefits, wages, and working conditions as offered to H-2A workers.[f]

Employment Costs

Worker wages: Farms hiring H-2A workers are required to pay a wage that is the highest of (1) the Adverse Effect Wage Rate (AEWR), (2) the prevailing hourly wage or piece rate, (3) the agreed-upon collective bargaining wage, or (4) the federal or state minimum wage.[g] H-2A workers are also guaranteed payment equal to at least 75 percent of the total contracted amount, regardless of whether there is sufficient work over the contract period to reach that amount.[h]

Worker benefits: Farms are required to offer certain benefits to H-2A workers, such as housing at no cost that meets local health and safety standards, workers' compensation, meals (or a facility at which to prepare meals), transit from the worker's home country and—if the worker completes the contract—back to the worker's home country, and daily transportation to and from the worksite.[i]

Payroll taxes and healthcare: Employers are also responsible for payments required by federal and state employment laws, paying for health insurance coverage if their business is large enough, and for workers' compensation for both domestic and H-2A workers.[j] Employers will also pay payroll taxes (Social Security, Medicaid, and federal and state unemployment insurance) on the wages of domestic workers. Some states, like California, also require payment of state unemployment insurance taxes on H-2A workers as well.[k]

Operational Costs

While not included in the direct payment of wages and benefits to workers in the H-2A program, employers are responsible for all pre-employment expenses associated with the H-2A application and

recruitment process. These costs include filing and visa fees, any fees charged by or bond expenses[l] incurred by FLCs, and advertising costs to recruit domestic workers. These costs may vary depending on the application and whether a grower is using a FLC in its recruitment efforts. Grower organizations in certain states offer services to help farms file for H-2A visas. Some of these organizations, like the North Carolina Growers Association, even serve as joint employers with growers, helping to allocate workers during their visa term to member farms with the greatest labor need.[m]

Enforcement

The U.S. Department of Labor audits and inspects farms and FLCs for compliance with program requirements and can impose fines of up to $118,000 (as of January 2021) per employer violation as well as requiring back pay on wages or benefits owed to H-2A or domestic workers, or, in extreme cases, revocation of the employer's labor certification and/or debarment of the FLC.[n] Among vegetable growers, the U.S. Department of Labor has found instances of growers using both foreign and domestic labor and paying domestic workers less than H-2A workers in violation of the program rules.[o] One labor representative indicated that in practice, some of these violating employers were using the large consistent supply of H-2A workers as leverage to bargain down the wages of more vulnerable domestic workers.[p]

[a] Luckstead and Devadoss, "The Importance of H-2A Guest Workers in Agriculture," 2019, 1.
[b] Government representative, interview by USITC staff, September 13, 2021. For a recent detailed accounting of these costs, see Roka and Guan, "Farm Labor Management Trends in Florida," 2018; USDA, "H-2A Visa Program," accessed July 27, 2021.
[c] Local recruitment of domestic workers must continue until halfway through the job order contract period. If domestic workers are hired prior to the contract's start date, the U.S. Department of Labor (USDOL) reduces the requested number of foreign guest workers one-for-one. If domestic workers are hired after the contract's start date, employers have the option of retaining foreign guest workers or sending them home. USDOL, ETA, "H-2A Temporary Agricultural Program," accessed July 27, 2021.
[d] 20 CFR § 655.100-167.
[e] Though most H-2A visas for vegetable production are only issued for 4–5 months, foreign workers may work within the United States on H-2A visas for up to three years if their employers use visa extensions. Some growers may try to recruit foreign workers from a pool of workers who are on current H-2A job orders with other growers, hiring them once the H-2A workers' current contract period expires. In these instances, employers may negotiate among each other to decide who will cover the cost of the workers' in-bound and out-bound transportation costs. Castillo et al., *Examining the Growth in Seasonal Agricultural H-2A Labor*, August 2021, 30; government representative, interview by USITC staff, September 13, 2021.
[f] 20 CFR § 655.122.
[g] 20 CFR § 655.120(a). There are exceptions to this rule for certain livestock and herding occupations. The Adverse Effect Wage Rate (AEWR) is determined annually by the USDOL, Office of Foreign Labor Certification. The wage is derived from the combined annual average gross hourly wage of field and livestock workers as measured in the USDA Farm Labor Survey. The wage is set at a rate such that it will not adversely affect the employment opportunities of U.S. workers for each state. 86 Fed. Reg. 10996 (February 23, 2021); 20 CFR § 655.100. About 95 percent H-2A jobs are being paid the AEWR. Government representative, interview by USITC staff, September 13, 2021. The prevailing hourly wage rate is determined by state workforce agencies to be prevailing in the area in accordance with state-based wage surveys. 20 CFR § 655.1300. A collective bargaining wage rate exists if the job opportunity is covered by a collective bargaining agreement that was negotiated at arm's length between the union and the employer 20 CFR § 655.10(b)(1).
[h] 20 CFR § 655.122(h)(4)(i).
[i] 20 CFR § 655.122(d)-(h).
[j] The 2019 AEWR to minimum wage ratio was 133 percent in Florida and 154 percent in Georgia. Nigh, "H-2A and the AEWR We Were," March 15, 2019. Under the regulations promulgated under the authority of the Affordable Care Act (ACA), an employer is required to provide health insurance to full-time employees if the average number of monthly employees is greater than 50. The employer in this instance is the grower if labor is hired directly or is the FLC if it is are used to recruit farm labor for growers. H-2A workers qualify for ACA-compliant plans and can enroll in their employer's coverage if provided. There is a no-coverage penalty of $2,000 per year (adjusted for inflation) for each of the employer's full-time employees (excluding the first 30), which some growers may risk if the cost of coverage is higher. 26 CFR § 54.4980H-2, 4.
[k] State of California, Employment Development Department, *Information Sheet—Types of Employment*, accessed July 27, 2021; Martin and Schimmer, "Foreign Persons with Certain Visas and Their California Employers Beware: Non-Conformity of Federal and California Employment Tax Rules," July 1, 2005, 3.
[l] FLCs are required to purchase a bond with each H-2A application (grower-employers do not have to purchase). The bond ensures that all financial obligations owed to the H-2A workers are fully met by the FLC. While the amount of the bond increases by the number of workers being requested, the overall cost of an individual bond depends on the asset level and prior employment history of the FLC petitioner. Roka, Simnitt, and Farnsworth, "Pre-Employment Costs Associated with H-2A Agricultural Workers,'" May 4, 2017, 342.
[m] Charlton et al., "Can Wages Rise Quickly Enough to Keep Workers in the Fields?" 2019; North Carolina Growers Association, "How We Help," accessed July 20, 2021.
[n] Government representative, interview by USITC staff, September 13, 2021; USDOL, WHD, "H-2A: Temporary Agricultural Employment of Foreign Workers," accessed July 26, 2021. For examples of penalties imposed in recent violations, see USDOL, WHD, "U.S. Department of Labor

Finds Florida-Based Farm Labor Contractor Violated Guest Worker Visa Requirements at 5 North Carolina Farms," March 5, 2020; USDOL, WHD, "South Florida H-2A Employer Pays $21K after US Department of Labor Uncovers Guest Worker Visa Program Violations," May 12, 2021.
[o] USDOL, WHD, "Maine Tomato Grower Pays $337K in Back Wages, Penalties after U.S. Department of Labor Investigation," March 30, 2021.
[p] Labor representative, interview by USITC staff, March 10, 2021.

Finally, unauthorized labor still makes up a large share of the U.S. agriculture workforce, despite the growing use of the H-2A program and efforts by states like Georgia to pass laws discouraging the employment of unauthorized workers.[163] According to the most recent public data available from the National Agricultural Worker Survey (NAWS), in the southeastern United States, the share of laborers in agriculture with unauthorized work status was 42 percent in FY 2015–16, compared to 34 percent in the Midwest and 56 percent in California.[164] A follow-up report on the FY 2017–18 NAWS data (which were not publicly released as of this writing) noted that 36 percent of the hired crop workforce nationally had no work authorization, compared to 49 percent in FY 2015–16.[165] Unauthorized farm workers tend to receive lower wages compared to legal workers, which may further lower labor costs for some U.S. producers.[166] None of the available data sources—NAWS data, DOL's H-2A application data, and the USDA Farm Labor Survey[167]—provide breakouts for the number of workers employed in the U.S. cucumber industry specifically.

Government Regulations and Programs

Regulations

Cucumbers are subject to agricultural sector-wide regulations regarding food safety, environment, and labor concerns. While most food safety regulations are set and standardized at the federal level, the regulatory environment for environmental and labor policy in the United States can vary more widely at

[163] Luckstead and Devadoss, "The Importance of H-2A Guest Workers in Agriculture," 2019. Georgia requires that private employers participate in the E-Verify program to confirm the U.S. work eligibility of their employees. State of Georgia, Illegal Immigration Reform and Enforcement Act of 2011.
[164] USDOL, ETA, "Table 5. Hired Crop Worker Demographics Characteristics, Midwest Estimates, Six Periods," accessed July 26, 2021.; USDOL, ETA, "Table 9. Hired Crop Worker Demographics Characteristics, Southeast Estimates, Six Periods," accessed July 26, 2021.; USDOL, ETA, "Table 13. Hired Crop Worker Demographics, California Estimates, Six Periods," accessed July 26, 2021. An exact share of laborers in agriculture with unauthorized work status is difficult to calculate, with other estimates ranging from 24 to 70 percent. Passel and Cohn, "Unauthorized Immigrant Workforce Is Smaller, but with More Women," November 27, 2018. Center for American Progress, "Protecting Undocumented Workers on the Pandemic's Front Lines," December 2, 2020. Zahniser et al., "Farm Labor Markets in the United States and Mexico," November 2018, 5.
[165] Ornelas et al., *Findings from the National Agricultural Workers Survey (NAWS) 2017–2018: A Demographic and Employment Profile of United States Farmworkers*, March 2021, 83.
[166] Bowers and Chand, "An Examination of Wage and Income Inequality," 2018, 182; Scott, Mhairi Hale, and Padilla, "Immigration Status and Farmwork," April 2, 2021, 1; Richards, "Immigration Reform and Farm Labor Markets," July 2021, 1059.
[167] The USDA's NASS Farm Labor Survey is conducted semiannually by NASS in cooperation with the U.S. Department of Labor. It provides the basis for quarterly and annual estimates of employment and wages for all workers directly hired by U.S. farms and ranches (excluding Alaska). Farms and ranches in the sample are asked to provide payroll and employment data for their workforce—unauthorized workers should, in principle, be included in payroll and employment estimates. Zahniser et al., "Farm Labor Markets in the United States and Mexico," November 2018, 7.

the state level. All U.S. growers must comply, for example, with the Food, Drug, and Cosmetic Act (FDCA), as amended by the Food Safety Modernization Act, and its implementing regulations (see chapter 1).[168] At the state level, environmental laws exist to regulate access to agricultural inputs, like land[169] and water.[170] Other environmental standards set at the federal level regulate the emissions intensity from farm equipment.[171] As previously discussed, labor laws at the state and national level regulate wages and benefits paid to agricultural laborers, as well tax and working condition requirements of the employer.[172] For example, as discussed in box 2.1 above, there are a number of requirements and processes governing the use of H-2A labor.

Programs to Assist Growers

There are several grant programs available at the federal and state levels that cucumber growers may access to help offset the cost of adopting new production technology and practices. For example, the USDA National Resources Conservation Service (NRCS) provides grant funding to support conservation programs to protect soil and water quality.[173] Programs to assist with the cost of new production technologies also exist at the state level through state-funded grants[174] or cost sharing.[175]

U.S. cucumber growers also benefit from certain government programs that fund research projects to enhance the competitiveness of specialty crops, although these programs do not fund growers individually and represent a small share of total government spending on agriculture overall. The two largest of these programs that apply to the domestic production of cucumbers are the Specialty Crop Block Grant Program (SCBGP) and the Specialty Crop Research Initiative (SCRI), which totaled $72.5 million and $80 million spent in grants, respectively. Under the 2018 Farm Bill, the average annual

[168] 21 USC §§ 301 et seq.
[169] See for example State of Florida, Everglades Forever Act, Chapter 373.4592, (1994); MDARD, "The Farmland and Open Space Preservation Program," accessed July 27, 2021.
[170] See for example California Department of Water Resources, "Sustainable Groundwater Management Act (SGMA)," accessed July 27, 2021; FDACS, *Water Quality/Quantity - Best Management Practices for Florida Vegetables and Agronomic Crops*, 2015; Florida Department of Environmental Protection, "Basin Management Action Plans (BMAPs)," accessed July 27, 2021; Carr, *State of Georgia v. State of Florida - Georgia's Reply to Florida's Exceptions to the Report of the Special Master*, June 26, 2020, 37.
[171] EPA, "Regulations for Emissions from Heavy Equipment with Compression-Ignition (Diesel) Engines".
[172] See for example Whaley, "New Overtime Rules for Ag Workers," February 28, 2019, and the Affordable Care Act. Changes to the AEWR calculation methodology that would have impacted 2021 H-2A wages were issued in November 2020, but suspended by a February 2021 injunction. 85 Fed. Reg. 70445 (November 5, 2019); 86 Fed. Reg. 10996 (February 23, 2021).
[173] NRCS also provides recovery assistance for property damaged by natural disasters. USDA, NRCS, "NRCS Conservation Programs," accessed July 27, 2021.
[174] Notably, the Georgia Department of Agriculture states that it does not offer any grants of state funds to agricultural producers. GDA, "Grants," accessed July 27, 2021. For examples in other states, see CDFA, "State Water Efficiency and Enhancement Program," accessed July 27, 2021; MDARD, "Value-Added and Regional Food Systems Grants," accessed July 27, 2021.
[175] Government representative, email message to USITC staff, June 4, 2021; FDACS, OAWP, "Agricultural Best Management Practices," accessed July 27, 2021.

spending on U.S. agriculture from 2019–23 is $85.6 billion.[176] In FY 2020, 6 out of 687 SCBGP funded projects involved the cultivation of cucumbers (totaling $806,110), and one out of 23 SCRI awarded projects involved the cultivation of cucurbits (i.e., cucumbers and squash) (totaling $7 million).[177]

At the individual grower level, U.S. specialty crop growers have access to several different federal programs to insure against crop losses in the event of natural disasters or poor yields, and, more recently, federal programs that compensate growers for disruptions to their marketing channels, in the event of a pandemic or, for some crops, in response to foreign trade policy.[178] Compensation programs related to COVID-19 disruptions appear to be popular among cucumber growers, especially with growers in Florida. As of June 2021, $10.6 billion of Coronavirus Food Assistance Program 1 payments had been allocated to growers, with $941 million paid out for specialty crops. Within specialty crop payments, $4.2 million has been paid out for cucumber losses (with 70.8 percent of this amount going to growers in Florida).[179]

Finally, growers in the Southeast and across the United States participate in various state level marketing programs aimed at providing product differentiation and brand recognition to locally grown

[176] USDA, AMS, "Specialty Block Crop Grant Program," accessed July 27, 2021; USDA, NIFA, "Specialty Crop Research Initiative (SCRI)," accessed July 27, 2021; USDA, AMS, *Transportation and Marketing - Specialty Crop Block Grant Program - Fiscal Year 2020 Description of Funded Projects*, November 17, 2020. In 2021, in addition to the $72.9 million of Farm Bill funding for the SCBGP, an added $97 million of funding was made through H.R. 133 Stimulus Funding as part of USDA's Pandemic Assistance initiative to mitigate the impact of COVID-19 on the U.S. food system. USDA, AMS, *USDA AMS Specialty Crops Program Newsletter*, May 4, 2021.USDA NIFA, *Request for Pre-Application - Specialty Crop Research Initiative*, October 15, 2019; Hall, "Letter to the Honorable K. Michael Conaway, Chairman of the U.S. House Committee on Agriculture - Direct Spending and Revenue Effects of the Conference Agreement for H.R. 2, the Agriculture Improvement Act of 2018," December 11, 2018; USDA, ERS, "Farm Bill Spending," February 1, 2021. There are also programs and policies under the Horticulture Title (Title X) in the Farm Bill that may benefit U.S. cucumber growers (e.g., support for farmers markets, data and information collection, education on food safety and biotechnology, and market development and promotion initiatives). Johnson, "2018 Farm Bill Primer: Specialty Crops and Organic Agriculture,", September 23, 2019.

[177] USDA, AMS, *Specialty Crop Block Grant Program Fiscal Year 2020 Description of Funded Projects*, November 17, 2020; USDA, NIFA, "Current Research Information Services," accessed July 27, 2021; USDA, NIFA, "Current Research Information System - PROJ NO: MICL08593 - CUCCAP 2: Harnessing Genomic Resources for Disease Resistance and Management in Cucurbit Crops: Bring the Tools to the Field," accessed July 27, 2021.

[178] P.L. 75–430; P.L. 96–365; Rosch, "Federal Crop Insurance: A Primer," February 18, 2021; 7 U.S.C. 1508(b),(c),(h), USDA, FSA, "Disaster Assistance - Noninsured Crop Disaster Assistance Program (NAP)," May 2020; USDA, FSA, "2017 Wildfires and Hurricanes Indemnity Program (WHIP)," accessed July 27, 2021; USDA, "Specialty Crops and the Coronavirus Food Assistance Program," accessed July 27, 2021; USDA, "Coronavirus Food Assistance Program 2 for Specialty Crop Producers," accessed July 27, 2021; USDA, "Market Facilitation Program," accessed July 27, 2021. Cucumbers were/are eligible commodities under all of these programs with the exception of the Market Facilitation Program. Participation in programs like crop insurance by U.S. cucumbers growers has been minimal, because the cost of the insurance premiums is too high to justify given their assessment of likelihood of events that would trigger payout. Government officials in the Southeast reported that if cucumber growers had purchased insurance, it was most likely NAP insurance coverage. NAP provides financial assistance to producers of noninsurable crops when low yields, loss of inventory, or prevented planting occur due to natural disasters. Government representatives, interviews by USITC staff, May 4, 2021; government representative, email message to USITC staff, June 4, 2021. In 2020, 22,819 acres of cucumbers were covered under federal crop insurance policies, with over 62 percent of the insured acreage located in Michigan, covering 41 percent of the cucumber acreage there. FDIC, USDA, RMA, *Commodity Year Statistics for 2020 - Nationwide Summary by Commodity/State*, accessed July 26, 2021.

[179] USDA, "Coronavirus Food Assistance Program 1 Data," accessed July 27, 2021.

produce. These agricultural marketing programs are funded through a mix of grower membership fees and allocations from state budgets, and sometimes state agriculture departments.[180] The programs often produce some recognition for local growers and locally grown products in retail store shelves.[181] Each of the previously mentioned major cucumber-producing states maintains a marketing program to provide recognition for their state's locally grown crops.[182] For example, "Fresh from Florida" has a $5–6 million budget, with 100 retail partners worldwide in approximately 10,000 outlet locations. Membership in the program enables attendance to trade shows and export-focused events, and support for some product-specific campaigns.[183] "Georgia Grown" owns a promotional trademark and charges industry stakeholders a usage fee. The program also connects growers with potential customers (retailers, restaurants, and schools).[184] Both Georgia and Florida programs include logos and separate sections in grocery stores nationwide.[185]

Factors Affecting Competitiveness

As described in chapter 1 of this report, the competitiveness of the U.S. fresh market cucumber industry can be evaluated by comparing the delivered costs, product differentiation, and reliability of supply of U.S. products against those of imports. Certain key factors contribute to the competitiveness of the U.S. fresh market cucumber industry in the U.S. market, including the large geographical dispersion of U.S. production, geographical proximity to the market, and consumer preferences for local produce. While cucumbers produced in the United States have some advantages over imported products, there are a number of other factors—such as the relatively high costs of producing cucumbers in the United States and the weather-related volatility of production in the Southeast—that limit the competitiveness of the U.S. industry. In addition to the factors discussed below, environmental regulations and programs at the state and federal level noted above could affect grower competitiveness. These regulations and programs may impact growers negatively, if they impose additional production costs that growers in other countries may not face, or positively, if they help U.S. growers to mitigate farm losses. Key factors affecting the competitiveness of the U.S. and Southeast industries are identified below and compared to those of foreign suppliers in Chapter 5.

High labor costs increase U.S. delivered costs and may lower productivity and product differentiation.

The cost of labor is an especially impactful competitiveness factor for labor-intensive, perishable crops such as cucumbers. U.S. labor costs are higher than those of Mexico, the leading exporter of cucumbers

[180] Government representatives, interviews by USITC staff, May 4 and May 5, 2021.
[181] Academic representative, interview by USITC staff, March 13, 2021.
[182] For more information on these various state programs, see https://georgiagrown.com/; https://www.followfreshfromflorida.com/; https://www.ncfarmfresh.com/index.asp; https://californiagrown.org/; https://michigangrown.org/.
[183] Government representative, interview by USITC staff, May 4, 2021.
[184] Government representative, interview by USITC staff, May 5, 2021.
[185] GDA, "Georgia Grown: Grocery," accessed October 25, 2021; FDACS, "Fresh from Florida," accessed October 25, 2021. Logos are part of these programs in North Carolina and California as well. NCDACS, "AG'S COOL: Goodness Grows in North Carolina," accessed October 25, 2021; State of California, "California Grown: Download Center," accessed October 25, 2021.

to the United States, which contributes to higher costs of production in the United States. USDA's National Agriculture Statistics Service (NASS) report shows that U.S. hired field workers (inclusive of H-2A and domestic workers) in agriculture received $15.19 per hour in April 2021, compared to closer to $10–$20 per day in Mexico.[186] Wage rates for Florida and the rest of the Southeast were $12.30 and $12.08 per hour, respectively, over the same time period.[187] Furthermore, agricultural wages for domestic and H-2A workers have been driven up in recent years due to the growing use of the H-2A program (as a result of a reported shortfall of domestic labor), the calculation methodology of the AEWR (the minimum wage for H-2A workers) and changes to minimum wage laws, further raising production costs.[188] With production systems reliant on labor-intensive hand-planting and hand-harvesting practices, U.S. cucumber growers have few means of substituting labor for other productivity-enhancing inputs (such as mechanization) which would help relieve labor cost pressures.[189]

Furthermore, vegetable growers reportedly face challenges securing enough domestic labor and this is especially true for growers in the Southeast due to the hot and humid climate.[190] According to an industry representative, because some growers have historically utilized unauthorized migrant workers (considered part of the domestic labor force), federal and state policies aimed at curbing illegal immigration in recent years have made employing sufficient labor for these labor-intensive crops more difficult.[191] In order to have sufficient labor, U.S. farmers (in the Southeast and elsewhere) rely heavily on the H-2A program to recruit foreign seasonal workers. Reliance on this program imposes additional administrative costs on employers to receive and maintain certification,[192] and can make employers vulnerable to certain changes in U.S. workforce and immigration policy. For example, despite robust government efforts to support the usage of the H-2A program throughout the pandemic, there have

[186] Reportedly, in Mexico, as of 2021, workers in the cucumber industry reportedly earned about $10–$12/day although if paid by the piece they can earn $15–20/day. Calculated monthly rate based on a 6-day work week (26 days work month). USITC, hearing transcript, April 8, 2021, 96 (testimony of Richard Bowman, J&J Family of Farms); 264 (testimony of Rob Sbragia, Tricar Sales, Inc.); USDA, NASS, *Farm Labor*, May 26, 2021, 4. For a more detailed discussion of labor in Mexico, see Chapter 3.

[187] USDA, NASS, *Farm Labor*, May 26, 2021. As noted earlier, the USDA, NASS, Farm Labor Survey collects data to derive employment and wage estimates for directly hired U.S. farm workers (i.e., those workers recruited by the farm itself and not by farm labor contractors), which should, in principle, include hired unauthorized workers. Under this assumption, the average wages presented above should be inclusive of those paid to unauthorized workers. Note that these are the average wage rates only, and do not include mandatory operational and pre-employment costs associated with hiring H-2A workers, or the employer's share of payroll taxes.

[188] The national AEWR grew by an average of 3 percent year-on-year from 2012 to 2019. The AEWR for Florida and Georgia grew by 9 and 11 percent, respectively, from 2015 to 2020, whereas some other parts of the country saw growth of up to 27 percent AEWR over the same time period. Nigh, "H-2A and the AEWR We Were," March 15, 2019; Nigh, "2019 H-2A Sets Records, While a 2020 AEWR Wage Increase Approaches," November 27, 2019. Similar to the AEWR, average gross wages for directly hired U.S. farmworkers grew by 25.1 percent from 2015 to 2020, while the growth rate was 12.0 percent and 10.4 percent in Florida and other southeastern states, respectively, over the same time period. USDA, NASS, *Farm Labor*, May 21, 2015, 3-7.; USDA, NASS, Farm Labor, May 28, 2020, 3, 5.

[189] The higher pest pressures of open field cucumber production in the U.S. Southeast also require continuing use of hand labor to spray crops with insecticide, further augmenting the labor cost share of total production.

[190] Labor representative, interview by USITC staff, March 10, 2021. USITC, hearing transcript, 16, 20 (testimony of Commissioner Nicole Fried, Florida Department of Agriculture and Consumer Services).

[191] USITC, hearing transcript, 61 (testimony of Lance Jungmeyer, Fresh Produce Association of the Americas).

[192] See text box 2.1 for a summary of these costs.

been reports of some delays in obtaining labor in the agriculture sector prompted by U.S. workforce policy related to COVID-19 (such as border closures and delays in H-2A authorizations).[193]

High labor costs in the United States can also negatively impact the differentiation of U.S. products in terms of quality, as these costs limit how U.S. producers grow and pack their cucumbers. Production practices (like trellising), and more frequent harvesting or distribution features (like more attentive grading and packing) that might improve average product quality of a cucumber crop but require additional labor are often not affordable for growers to implement. High labor costs also contribute to the lack of adoption of PA by U.S. growers. PA typically requires the use of trellising or other forms of vertical production, which is generally not used in open field production in the United States. This makes PA a more labor-intensive, but higher-yielding, production system overall than open field production in the United States.[194] The greater labor intensity, and therefore, costs associated with PA limits additional capital investments in PA as well.

Open field production lowers competitiveness throughout the United States, particularly in the Southeast.

As the United States uses open field production almost exclusively to grow its cucumbers, its competitiveness is impacted by cultivation challenges that uniquely affect growers exposed to the elements. High pest, disease, and weather pressures, which are particularly prevalent in the Southeast given its climate, can increase production costs, lower quality, and reduce reliability of supply. Production costs are driven up by the additional labor and chemical inputs from added pesticide applications[195] For example, in Georgia some growers have teams that "scout and spray" their fields, on a weekly or even sometimes daily basis.[196] In Florida, 100 percent of acreage must be regularly fumigated due to pests.[197] Open field production increases the risk of excess moisture as well, increasing risk for downy mildew, which negatively impacts the maturation and overall quality of the fruit.[198] Damage to the crop as a result of these threats decreases yields and product quality, while strategies to mitigate these threats, like rotation with other non-cucurbit crops, limit the amount of cucumbers that growers can cultivate at one time, diminishing the reliability of supply.[199] Furthermore, the use of open field production in the United States limits its ability to grow more delicate burpless varieties, which are seeing growing demand and typically require the use of protected agriculture.

[193] Karst, "Suppliers Point to Government Policy as One Reason behind Labor Shortage," April 29, 2021.
[194] Burfield, "Inside the World of Cucumbers—Field-Grown and Greenhouse-Grown," January 12, 2021; academic professionals, interview by USITC staff, May 21, 2021.
[195] Industry representative, interview by USITC staff, February 3, 2021.
[196] Industry representative, interview by USITC staff, May 10, 2021.
[197] Industry representative, interview by USITC staff, February 3, 2021.
[198] Grabowski, "Downy Mildew of Cucumber, Melon and Squash,", 2018.
[199] Industry representatives, interview by USITC staff August 10, 2021.

Dispersed production throughout the United States mitigates climate-related risks, improves product differentiation, and contributes to freight cost advantages.

Cucumber production occurs throughout the United States in various geographic regions with varying climates and production seasons. Because of this dispersion, the U.S. cucumber industry has production in most months of the year. This dispersion protects the U.S. cucumber industry as a whole from weather-related events like hurricanes or heavy rains leading to diseases that may impact the reliability of supply. With regard to the Southeast, the competitive advantage of dispersion is tempered somewhat as much of the Southeast shares a similar growing season and exposure to the same types of regional weather events. However, with south Florida producing in the middle of winter, Georgia and northern and central Florida producing in both spring and fall season, and North Carolina producing in the summer months, the U.S. Southeast is able to supply the U.S. market in all months of the year.[200]

Dispersed production also means that U.S. cucumbers are seen as "locally grown" products in several different markets. Growers everywhere in the United States will feel pressure from imports throughout the year; however, their proximity to local customers combined with the desire by buyers and consumers for locally grown produce and the highly perishable nature of cucumbers means that they can maintain their competitiveness in local markets by differentiating their product as fresher locally grown-branded produce. Close geographic proximity to markets can reduce freight costs compared to imported product.[201]

[200] Academic professional, email message to USITC staff, August 1, 2021; Kemble, *Southeastern U.S. 2020 Vegetable Crop Handbook*, 2020, 52; FDACS, "Florida Agriculture by the Numbers," 2019, 85; Freeman et al., "Chapter 7. Cucurbit Production," in *Vegetable Production Handbook of Florida, 2020–2021 Edition*, 2020; Kemble, *Southeastern U.S. 2020 Vegetable Crop Handbook*, 2020, 52; Produce Blue Book, "Cucumbers," accessed July 14, 2021. Holmes, et al., "Crop Profile for Cucumbers in North Carolina," June 2005, 3.
[201] Industry representatives, interviews by USITC staff, August 10 and October 5, 2021.

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Chapter 3
The Industry in Mexico

The Mexican fresh market cucumber industry is a small, but highly export-oriented, part of the country's agriculture sector. Fresh market cucumbers accounted for less than 1/10 of 1 percent of Mexico's total harvested area for all crops in 2020.[202] As a share of Mexican vegetable production, cucumbers (including those for pickling) contributed 5.3 percent of the total and were among the top 20 food and beverage exports in 2019.[203] On average during 2015–20, about 70 percent of all cucumbers (table 3.5), and about 91 percent of fresh market cucumbers were exported, largely to the United States.[204]

A number of factors enhance the overall competitiveness of Mexico's fresh market cucumber industry for export. These include a favorable climate for horticulture production and the use of protected agriculture (PA). Both expand the growing season and the ability to produce a range of cucumbers varieties including the increasingly popular burpless cucumber varieties. They also contribute to higher yields, as do certain production practices such as vertical production. In addition, a relatively lower cost of production, driven in part by low wages, allows for more labor-intensive production and packaging processes. In addition, while PA requires a higher initial investment it may lower certain variable input costs.

Production, Trade, and Consumption

Production

Mexico was the seventh-largest producer of cucumbers globally although it supplied only 0.9 percent of global cucumber production in 2019.[205] Mexico has several regions where the climate is conducive to growing horticulture crops, including cucumbers, although it does face water and weather pressures.[206] Overall production increased 25.2 percent between 2015 and 2020, driven by increased production in PA environments, including shade houses and greenhouses (table 3.1). The 55.6 percent increase in PA cucumber production more than offset the 4.0 percent decline in open field production over this period. Typically, higher-value fresh market cucumbers rather than pickling cucumbers are grown under PA.[207] During 2015–20, the share of PA cucumber production (by mt) increased 55.6 percent although harvest area only rose 10.7 percent (table 3.2). After increasing for three years, open field cucumber production

[202] Government of Mexico, SIAP, Anuario estadístico: Resumen por cultivos; Pepino, accessed May 18, 2021. Fresh market cucumbers exclude cucumbers produced for pickling, which accounted for roughly one-quarter of Mexico's cucumber production (by tonnage) during 2015–20.
[203] Government of Mexico, SADER, and SIAP, *Panorama Agroalimentario 2020*, 2020, 12–13, 111.
[204] Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 3, 2021; IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed July 12, 2021.
[205] FAOSTAT data only includes open field production. FAO, FAOSTAT database, "Crop: Cucumbers—Production," accessed March 3, 2021.
[206] Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, 2011, Sec. 4.1.1; Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 6; USITC, hearing transcript, April 8, 2021, 239 (testimony of Craig Slate, SunFed Produce).
[207] Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 3, 2021.

generally fell, declining 17.1 percent between 2017 and 2020 although harvest area contracted 26.5 percent. Mexican production, including the production systems used, is heavily influenced by export market preferences and demand—especially those of the United States.[208]

Table 3.1 Cucumbers: Mexican production, by production system, 2015–20
In metric tons and in percentages.

Production system	2015	2016	2017	2018	2019	2020
Open field (mt)	470,599	492,667	545,353	462,098	499,230	451,900
Protected agriculture (mt)	453,396	526,185	562,348	650,840	692,378	705,298
All production types (mt)	923,995	1,018,852	1,107,701	1,112,938	1,191,608	1,157,198
Open field (%)	50.9	48.4	49.2	41.5	41.9	39.1
Protected agriculture (%)	49.1	51.6	50.8	58.5	58.1	60.9
All production types (%)	100.0	100.0	100.0	100.0	100.0	100.0

Source: Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 3, 2021.

Table 3.2 Cucumbers: Mexican area harvested, by production system, 2015–20
In hectares and in percentages.

Production system	2015	2016	2017	2018	2019	2020
Open field (ha)	13,807	14,002	15,242	13,869	11,525	11,203
Protected agriculture (ha)	4,043	4,602	4,938	5,728	4,483	4,475
All production types (ha)	17,850	18,604	20,180	19,597	16,008	15,678
Open field (%)	77.4	75.3	75.5	70.8	72.0	71.5
Protected agriculture (%)	22.6	24.7	24.5	29.2	28.0	28.5
All production types (%)	100.0	100.0	100.0	100.0	100.0	100.0

Source: Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 3, 2021.

While open field cucumber yields are higher in Mexico than in other countries, including the United States (see table 2.3 in chapter 2), the yields for cucumbers grown under PA in Mexico are over three times higher than for those grown in open fields (table 3.3).

Table 3.3 Cucumbers: Mexican yields, by production system, 2015–20
In metric tons per hectare.

Production system	2015	2016	2017	2018	2019	2020
Open field	34.1	35.2	35.8	33.3	43.3	40.3
Protected agriculture	112.1	114.3	113.9	113.6	154.4	155.2
All production types	51.8	54.8	54.9	56.8	74.4	73.5

Source: Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 3, 2021.

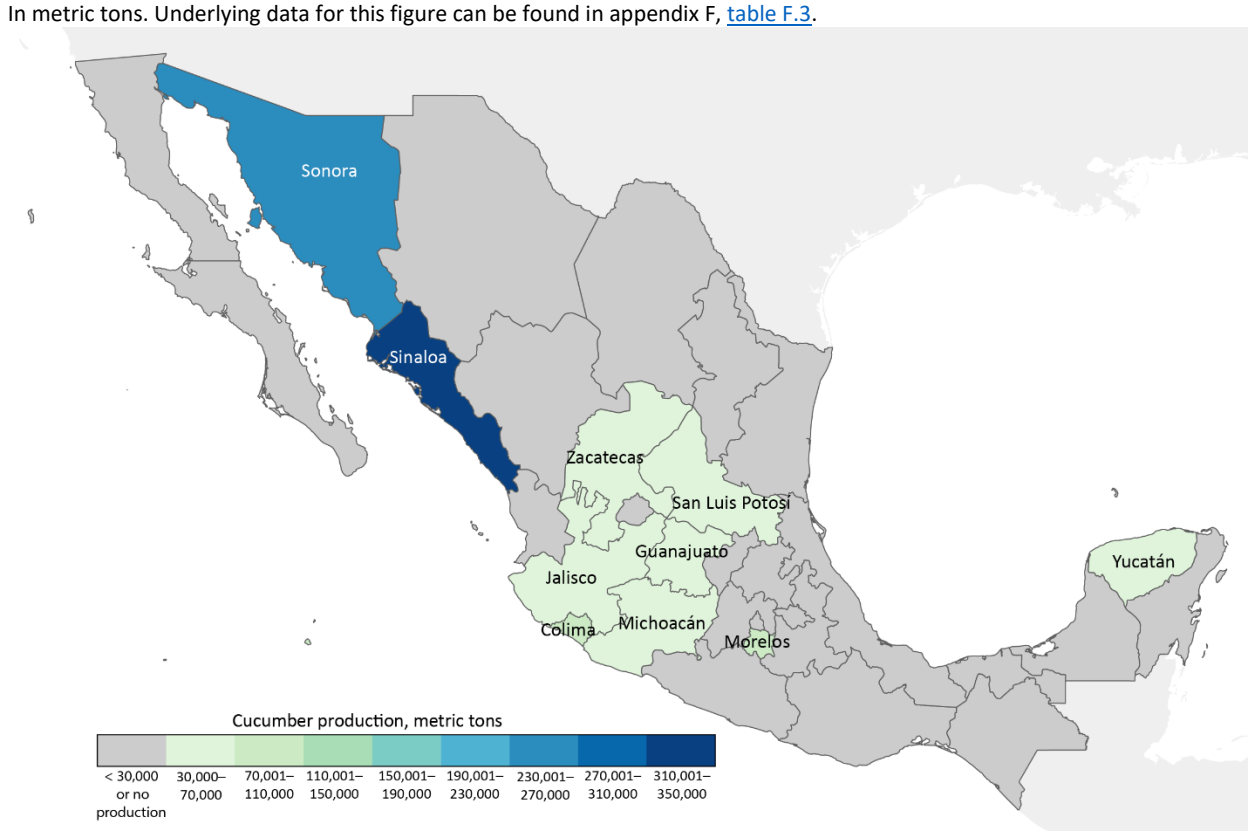
The main cucumber growing regions in Mexico are in the northwestern and central parts of the country, with states in these regions producing 76.3 percent of the nation's cucumber crop in 2020. The states of Sinaloa and Sonora in northwest Mexico accounted for 52.3 percent (605,022 metric tons) of Mexico's cucumber production in 2020 (figure 3.1). Approximately two-thirds of cucumbers grown in this region were for the fresh market.[209] The harvest season in the northwest begins in October, runs through the winter, and ends in May.[210] The seven central Mexican states of Jalisco, Michoacán, Colima, Guanajuato, Zacatecas, San Luis Potosi, and Morelos accounted for a combined 359,019 metric tons (mt) in 2020—

[208] Industry representatives, interviews by USITC staff, July 6, 2021 and August 11, 2021.
[209] Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 3, 2021.
[210] Industry representative, email to USITC staff, August 23, 2021; Rettke, "Growers Prepare for Summer Cucumber Growing Season," May 8, 2019.

31.0 percent of national production. While only about one-third of cucumber production in these central Mexican states was grown under PA in 2020, cucumber production grown under PA increased by 282 percent since 2015.[211] Central Mexico primarily produces fresh market cucumbers, accounting for 77.5 percent of the region's production, though some states, such as Colima, produce only cucumbers for pickling.[212] The harvest season in central Mexico begins in May, runs through the summer, and ends in December.[213]

Figure 3.1 Cucumber production in Mexico, by state, 2020

In metric tons. Underlying data for this figure can be found in appendix F, table F.3.



Source: Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 3, 2021.

Trade

Mexico is the largest exporter of cucumbers in the world with 809,814 mt exported in 2020.[214] Annually, 70.0 percent of production is exported, with an even higher share of fresh market cucumbers exported. Exports grew 23.6 percent between 2015 and 2020 (table 3.4). Virtually all exports went to the United States. Exports to the U.S. market typically peak in December and January at around 90,000 mt, then

[211] For the country as a whole, PA increased 26 percent during 2015–20. Government of Mexico, SIAP, Anuario estadístico*:* Pepino, accessed May 3, 2021.
[212] Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 3, 2021.
[213] Industry representative, email to USITC staff, August 23, 2021; Rettke, "Growers Prepare for Summer Cucumber Growing Season," May 8, 2019.
[214] IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed May 11, 2021; Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 3, 2021.

decrease steadily to around 60,000 mt in June, dropping off to around 40,000 mt July through September, before building back up again in the fall.[215] Nearly all of these exports are for fresh consumption.[216] The remaining 1 percent of exports went to Canada.[217] As a major producer and exporter, Mexico's imports of cucumbers during this period were negligible.[218]

Table 3.4 Cucumbers: Mexican exports, by destination market, 2015–20
In metric tons and in percentages. n.c. = not calculable.

Destination market	2015	2016	2017	2018	2019	2020
United States (mt)	651,968	688,556	743,925	757,458	776,519	800,999
Canada (mt)	3,208	5,039	6,430	9,282	5,514	8,815
All other destinations (mt)	15	16	156	333	0	0
All export destinations (mt)	655,191	693,611	750,511	767,073	782,033	809,814
United States (%)	99.5	99.3	99.1	98.7	99.3	98.9
Canada (%)	0.5	0.7	0.9	1.2	0.7	1.1
All other destinations (%)	0.0	0.0	0.0	0.0	n.c.	n.c.
All export destinations (%)	100.0	100.0	100.0	100.0	100.0	100.0

Source: IHS Markit, Global Trade Atlas, HS heading 0707.00, accessed July 19, 2021.
Note: Due to rounding, percentages may not add exactly to 100.

Consumption

Mexico's apparent consumption of cucumbers increased by 29.2 percent between 2015 and 2020 to 347,384 mt (table 3.5). Per capita consumption likewise increased 22.1 percent to 2.7 kg per person—about half the average consumption in the United States (see table 2.6 in chapter 2). Between 2018 and 2019 there was a 63,707 mt spike in apparent Mexican consumption. At the same time, between 2018 and 2019 total Mexican cucumber exports had the smallest annual increase (14,960 mt) of the six-year period of investigation. Overall, on average 31.5 percent of Mexico's cucumber production was consumed domestically between 2015 and 2020.

[215] USITC DataWeb/Census, HS heading 0707.00, accessed February 26, 2021.
[216]Approximately 95 percent of U.S imports of cucumbers from Mexico during July and August 2019 were of fresh market cucumbers. USITC DataWeb/Census, HS statistical reporting numbers 0707.00.6010, 0707.00.6030, 0707.00.6050, accessed February 26, 2021. At the HTS 10-digit level, cucumbers for the fresh market and cucumbers for pickling are classified separately only if entered during the period from July 1 to August 31.
[217] IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed May 11, 2021.
[218] IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed May 11, 2021.

Table 3.5 Cucumbers: apparent consumption in Mexico, 2015–20
In metric tons, percentages, and kilograms.

Item	2015	2016	2017	2018	2019	2020
Production (mt)	923,995	1,018,852	1,107,701	1,112,938	1,191,608	1,157,198
Imports (mt)	0	0	0	3	0	0
Exports (mt)	655,191	693,611	750,511	767,073	782,033	809,814
Apparent consumption (mt)	268,804	325,241	357,190	345,868	409,575	347,384
Per capita consumption (kg)	2.2	2.6	2.9	2.7	3.2	2.7
Percent of production exported (%)	70.9	68.1	67.8	68.9	65.6	70.0

Sources: Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 3, 2021; IHS Markit, Global Trade Atlas, HS heading 0707.00, accessed July 19, 2021; UN, Department of Economic and Social Affairs, Population Division (2019), accessed May 10, 2021.
Notes: Apparent consumption is calculated as production plus imports, minus exports.
Mexico export data do not break out domestic Mexican exports from re-exports. "Re-exports" are exports of foreign goods in the same state as previously imported. See UN International Trade Statistics Knowledgebase, "Re-exports and Re-imports," accessed October 6, 2021.

Industry Structure

Most producers grow a range of fresh market cucumber varieties as part of diversified horticulture operations.[219] The most economically important of fresh market cucumbers are American slicers and burpless English and Persian cucumbers.[220] While American slicers made up the majority of Mexican production during 2015–20, their share of production generally fell as production of burpless cucumbers, especially English, increased.[221] English and Persian cucumbers (likely also including other burpless, mini cucumber varieties) had higher average unit values in U.S. terminal markets compared to American slicers.[222] Burpless cucumbers' increasing share of Mexican production, and the price premium associated with these varieties is likely because burpless cucumbers have become increasingly popular with U.S. consumers. While nearly all fresh market cucumbers are conventionally grown, there has been an increase in organic production.[223] Although organic cucumbers account for only a small share of overall cucumber production, industry representatives believe that nearly all of this production is

[219] Industry representatives, interviews by USITC staff, April 28, 2021, May 28, 2021, July 2, 2021, and July 6, 2021; Government officials, interviews by USITC staff, June 1, 2021; Johnson, "Nogales Spring Vegetable Supply," January 1, 2015. Unless otherwise noted, production is based on metric tons and all data in this paragraph are from Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 4 and 7, 2021 and (for organic production) August 18, 2021. This chapter uses the major Anuario estadístico cucumber classifications: American slicers, European (referred to in this report as English), Persian, and pickling. Mexico also produces small amounts of white cucumbers. Unless otherwise mentioned, for the rest of this chapter, data obtained from Anuario estadístico and corresponding calculations are for fresh market cucumbers only.
[220] American slicer production—which was relatively flat during 2017–20 (averaging roughly 544,300 mt annually)—accounted for about 68 percent of production during 2015–17 vs. 61 percent during 2018–20.
[221] English cucumbers supplied about 23 percent of production during 2015–17 vs. 29 percent during 2018–20, although production declined in 2020. Persian cucumber production grew through 2018 and then fell. Despite this, production in 2020 (58,232 mt) was more than double that of 2015. Reportedly, many larger growers produce Persian and other mini cucumbers although some smaller producers are also beginning to grow them; overall, their production has leveled off. Industry representative, email to USITC staff, August 23, 2021.
[222] USDA, AMS, *Market News,* custom report, terminal market report, accessed March 16, 2021.
[223] During 2015–19, organic production of fresh market cucumbers (almost exclusively of American slicers) was 0.4 percent or less of total production; it was 1.1 percent in 2020. Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed August 18, 2021.

exported to the United States.[224] Reportedly, less variety and lower-quality fresh market cucumbers are available for purchase domestically.[225]

Fresh market cucumber production is concentrated in Sinaloa and Sonora, adjacent states in northwestern Mexico. During 2015–20, Sinaloa supplied about 30 percent of fresh market cucumber production by volume, Sonora supplied 20 percent, and Michoacán, the third-largest producer, contributed about 12 percent.[226] The climate in Mexico, especially in Sinaloa and Sonora, is favorable for horticulture production.[227] While Mexico has at least some year-round production, the primary cucumber season is January to May, when about 61 percent of production by volume occurs.[228] Open field production shifts during the year in order to optimize weather conditions in different regions, which extends Mexico's growing season.[229] Reportedly, Sinaloa's open field production begins in September and continues until June, when the lack of water stops production for the summer months. Greenhouses can allow for year-round production, although not all growers choose to utilize them to produce fresh market cucumbers throughout the year.[230]

Industry Composition

The Mexican cucumber industry is a small, but highly export-oriented, part of the broader horticultural industry. The industry comprises numerous participants including growers, packers, and distributors, most of whom produce or handle a range of horticultural crops.[231] Some growers, especially larger ones using PA, have in-house packing facilities, while other growers' cucumbers may go through third-party packers.[232] Export-oriented horticultural production, including cucumbers, appears to be concentrated in larger farms more commonly found in northwestern states such as Sonora and Sinaloa.[233] In addition, some U.S. companies report working with Mexican farmers to grow fresh market cucumbers for export

[224] Industry representative, email message to USITC staff, October 28, 2021; industry representative, interview by USITC staff, August 11, 2021.
[225] Government officials, interview by USITC staff, June 1, 2021.; industry representative, interview by USITC staff, August 11, 2021.
[226] Production tended to show notable growth fluctuations annually; generally, production grew in Sinaloa and Sonora but declined in Michoacán. Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed June 23, 2021.
[227] USITC, hearing transcript, April 8, 2021, 239 (testimony of Craig Slate, SunFed Produce); USDA, FAS, *Preview of Mexico's Vegetable Production for Expor*t, August 1980, 4–5; Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, 2011, Sec. 2.2.
[228] Just over one-quarter of production occurs in the fall and early winter (September through December). These data include pickles. Government of Mexico, SADER, and SIAP, *Panorama Agroalimentario 2020*, 2020, 110.
[229] Industry representative, interview by USITC staff, August 11, 2021; industry representative, email to USITC staff, August 23, 2021.
[230] Industry representatives, interviews by USITC staff, March 9, 2021 and August 11, 2021.
[231] Industry representatives, interviews by USITC staff, April 28, 2021, May 28, 2021, July 2, 2021, and July 6, 2021; Government officials, interview by USITC staff, June 1, 2021; Johnson, "Nogales Spring Vegetable Supply," January 1, 2015.
[232] Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas, Jitomate, Michoacán 2018.
[233] The majority of farms in Mexico, especially in the south, are small–70 percent of farms are less than 5 ha–and less likely to participate in the export market. Escobar, Martin, and Stabridis, *Farm Labor and Mexico's Export Produce Industry*, October 2019, 51–52; industry representatives, email to USITC staff, August 23, 2021.

who have farms ranging from 12 ha to 150 ha.[234] While cucumber-specific data on farm size are not available, data are available for tomatoes; much of the cucumber crop is likely grown by the same diversified producers that grow tomatoes (or by other produce companies with a similar structure and size), as noted above. The average size of an export-oriented tomato grower's total land holdings in Sinaloa is estimated to be about 640 hectares. (This total may be spread across multiple farms).[235] For conventionally grown crops, large scale producers have a competitive advantage in export markets over small producers, like those concentrated in southern Mexico.[236] There is a notable amount of foreign–especially U.S.–participation in the Mexican cucumber market.[237] While some foreign companies participate as buyers, some have made a range of investments in the Mexican cucumber industry including support for production (see Foreign Investment and Financing below).

Production Systems

While there is widespread use of open fields in Mexico, more than half of fresh market cucumbers are grown in PA systems (figure 3.2).[238] While PA includes a range of structures with varying levels of technology, in Mexico nearly all PA cucumbers are grown in shade houses (lower technology structures usually with cloth covers) or greenhouses (plastic or glass structures).[239] The use of open field production, which is primarily used to grow American slicers, has declined: about 38.6 percent of all cucumbers for the fresh market were cultivated in open fields between 2018 and 2020, versus 46.6 percent between 2015 and 2017.[240] While much of this production is exported, industry sources indicate that it can be harder for field grown cucumbers to meet export standards and at least some production is likely oriented towards the domestic market.[241]

The overall use of PA in Mexico has expanded quickly over the past two decades because of both commercial and policy factors. According to the Latin Business Consultancy, as of 2017, Mexico ranked sixth globally in terms of land devoted to PA horticulture production with an estimated surface area for 42,515 ha.[242] However, this is still a small amount of land: an estimated 2 percent of total Mexican horticultural production (by both area and tonnage) was in PA as of 2018.[243] According to government of

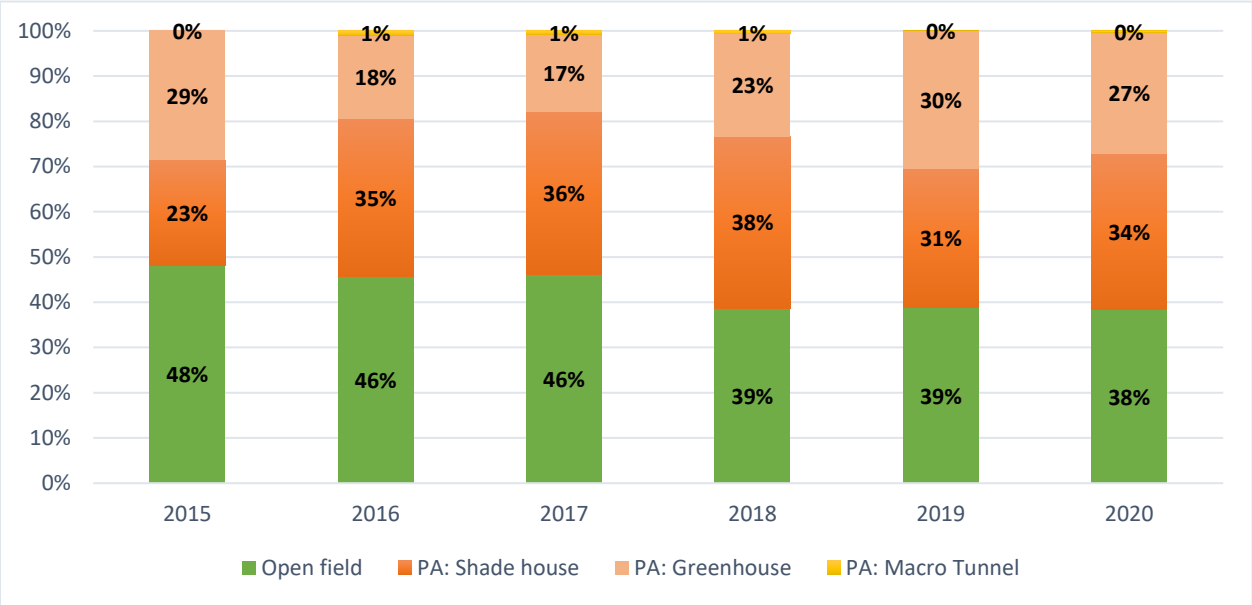
[234] Industry representatives, email to USITC staff, August 23, 2021.
[235] This is the average size of land holdings of the 40 producers who reportedly dominate export production in Sinaloa. Escobar, Martin, and Stabridis, *Farm Labor and Mexico's Export Produce Industry*, October 2019, 58.
[236] Cook, "Mexico's Agricultural Export Sector," slide 12.
[237] For example, see FPAA, "About," accessed July 26, 2021; USITC, hearing transcript, April 8, 2021, 80–84 (testimony of Dante Galeazzi, TIPA).
[238] Unless otherwise noted, all production data are from Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 4, 7, and 11, 2021.
[239] Classifications of PA systems can vary by source and greenhouses can use a range of technologies as presented in "Greenhouses" below. This chapter primarily uses the Anuario estadístico PA classifications: greenhouses, shade houses, and macro tunnels. Government of Mexico, SIAP, Anuario estadístico. Macro tunnels are constructed from polyethylene plastic or fabric over a metal frame and are usually fully enclosed. The more prominently used shade houses and greenhouses are discussed in further detail in the coming sections.
[240] American slicers made up about 95 percent of open field fresh market production (by mt) during 2015–20.
[241] Industry representatives, interview by USITC staff, July 6, 2021.
[242] Transfer LBC, *Opportunities for Dutch Businesses*, April 2020, 14.
[243] Burfield, "Protected Agriculture Reaches 126,000 Acres in Mexico," September 17, 2019.

Mexico data, during 2015–20 about 11 percent of Mexican PA planted area was cucumbers: the largest PA crop is tomatoes (about 55 percent) followed by peppers (13 percent).[244]

While English and Persian cucumber production in Mexico is largely limited to PA systems, the share grown in shade houses verses greenhouses varies notably from year to year. American slicer cucumbers also vary from year to year between PA and open field systems (table 3.6). Variation between production systems is likely based on a number of factors including farmers' commercial planting decisions and changes in yields. Mexican producers have used PA to supply export markets (especially the United States), to optimize production and extend the growing season, to improve product appearance, and to assure food safety for foreign buyers.[245] Private businesses and the Mexican government have encouraged the expansion of PA, which can be expensive to build, through investment and support programs.[246]

Figure 3.2 Cucumbers: production shares by growing environment, 2015–20

In percentages by share of production quantity. Underlying data for this figure can be found in appendix F, table F.4.



Source: Government of Mexico, Anuario estadístico: Pepino, accessed May 4 and 7, 2021.
Note: Due to rounding, shares may not add exactly to 100.

Table 3.6 Cucumbers: production shares, by cucumber type and growing environment, 2015–20

In percentages by share of production quantity.

Type of cucumber	Open field	Shade house	Greenhouse
American slicer	56.5–68.9	18.7–29.4	9.2–19.8
English	0.0–4.1	35.3–66.3	33.7–64.7
Persian	—	61.5–87.6	12.4–38.5

Source: Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 4 and 7, 2021.
Note: Range shows the high and low share of quantity produced for each type of cucumber in the listed production system during 2015–20.

[244] Government of Mexico, Anuario estadístico: Agricultura protegida, accessed June 17, 2021.
[245] USDA, FAS, *Mexico: Greenhouse and Shade House Production*, April 22, 2010, 5; Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 6; World Bank, CIAT, and CATIE, *CSA in Sinaloa*, 2014, 5–6.
[246] Government programs are federal-level programs. See "Foreign Investment and Financing" and "Government Programs and Regulations" below.

Shade Houses

Shade houses are the most common type of PA used in Mexico to grow cucumbers for the fresh market (more than one-third of total production quantity during 2015–20).[247] This is considered a lower technology type of PA. However, it allows growers to filter light as well as reduce insects and certain weather (e.g., wind) pressures on plants, which leads to substantial improvements in yields compared to open field production.[248] Shade houses use covers often made of mesh, which can be an anti-aphid imbued fabric, but in some cases are plastic. They can be built with or without sides.[249] The structures are not permanent, although walled ones may be considered semipermanent.[250] The mesh cover can be held aloft by metal poles, cable systems, or other structures.[251] Most shade houses reportedly use drip irrigation. However, some use precision irrigation similar to what is used in high-technology (high-tech) greenhouses while others rely on lower tech irrigation and sometimes rain.[252] Mesh, unlike plastic or glass, allows rainwater to pass through.[253] During 2015–20, all three of the main types of cucumbers for the fresh market—about three-quarters of all Persians, half of all English cucumbers, and one-fifth of all American slicers—were grown in shade houses.[254] Shade house use was concentrated in Sonora and Sinaloa (about 78 percent of total fresh market cucumber shade house production during 2015–20).[255]

Greenhouses

Greenhouses, the costliest type of PA, have consistently been used to grow cucumbers although their use fluctuates notably from year to year. Like shade houses, greenhouses have higher yields and better quality control because of the enhanced ability to regulate the growing environment and external

[247] Despite annual fluctuations in the types of growing environment used, shade houses were used the most consistently.
[248] Victoria, van der Valk and Elings, *Mexican Protected Horticulture*, 2011, sec. 3.1; USDA, FAS, *Mexico: Greenhouse and Shade House Production*, April 22, 2010, 5; Cook and Calvin, *Greenhouse Tomatoes Change the Dynamics*, April 2005, 69; Government of Mexico, FIRA, *Consejos Prácticos Para Invertir En Invernaderos*, July 2011, 22; Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 9.
[249] Farmers in arid areas that also have intermittent or heavy seasonal rain are reported to be more likely to build shade houses with sides than those in areas with minimal precipitation. Industry representative, email to USITC staff, August 23, 2021.
[250] Calvin and Cook, "North American Greenhouse Tomatoes," April 1, 2005; industry representative, email to USITC staff, August 11, 2021.
[251] *El Tiempo*, "Solo Un 10%," September 23, 2016; *HortiCultivos*, "La Producción De Hortalizas En Casa Sombra," July 31, 2013; Bojórquez, "Selecciona La Malla Adecuada Para Tus Necesidades," November 12, 2008; industry representative, email to USITC staff, August 11, 2021.
[252] USDA, FAS, *Mexico: Greenhouse and Shade House Production*, April 22, 2010, 5; Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 15. Precision irrigation is a drip system that uses sensors and other technology (e.g., related software) to bring water and sometimes fertilizer to a plant in precise amounts as needed. See e.g., Lea-Cox, Van Iersel, and Burnett, "Precision Irrigation," December 31, 2014; Markova, "What Is Precision Irrigation, Benefits It Brings to Farmers," April 26, 2021.
[253] See e.g., *HortiCultivos*, "La Producción De Hortalizas En Casa Sombra," July 31, 2013.
[254] Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 7, 2021.
[255] The overall concentration of shade house use was relatively consistent despite annual fluctuations. Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 7 and 11, 2021.

factors such as light, pests, and temperature.[256] These permanent structures can be made of a variety of materials including glass or plastic.[257] Greenhouses also use a range of technologies.[258] For example, many reportedly use drip irrigation, although some use hydroponic systems (i.e., no soil) with precision irrigation.[259] One study estimates that greenhouse farms need to be at least 6 to 12 ha to have sufficient scale to be competitive for export-oriented production.[260] Between 2015 and 2020, the share of total fresh market cucumbers produced in these structures ranged from a low of 17.0 percent in 2017 to a high of 30.4 percent in 2019.[261] Greenhouse production is intended for export markets.[262] All three main types of cucumbers for the fresh market are grown in Mexican greenhouses. Greenhouses are particularly important for the cultivation of English cucumbers, over half of which were grown in these structures during 2015–20. The top two cucumber-producing states accounted for over half of Mexican greenhouse production, led by Sinaloa (about 43 percent of production annually during the period) and followed by Sonora (about 15 percent of production).

Production Practices

There are certain common production practices—including irrigation and vertical production—used across production systems to grow fresh market cucumbers. About 90 percent of fresh cucumber harvested acreage was irrigated, accounting for about 96 percent of production volume during 2015–20.[263] The use of irrigation was even higher in Sinaloa and Sonora, where virtually all fresh market cucumber production was irrigated during that period. In particular, irrigation coupled with PA can lead to better water management, especially with high-tech systems where water can be dispensed

[256] Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, sec. 3; Cook and Calvin, *Greenhouse Tomatoes Change the Dynamics*, April 2005, 69; USDA, FAS, "Mexico: Greenhouse and Shade House Production," 5; Government of Mexico, "Agronomia Sustentable: What Is Protected Crops (Greenhouse)," June 23, 2015.
[257] Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, 2011, sec. 3; Cook and Calvin, *Greenhouse Tomatoes Change the Dynamics*, April 2005, 69; USDA, FAS, *Mexico: Greenhouse and Shade House Production*, April 22, 2010, 3–5.
[258] A number of features factor into technology classifications including exterior material, the type (or lack) of heating system, watering systems. One report noted that the use of heating in Mexico is limited because of the favorable climate although there are indications that it may be becoming more common. Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, 2011, sec. 3; Cook and Calvin, *Greenhouse Tomatoes Change the Dynamics*, April 2005, 69–70; USDA, FAS, *Mexico: Greenhouse and Shade House Production*, April 22, 2010, 4; Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 7–9. Government official, interview by USITC staff, June 1, 2021; industry representative, email to USITC staff, August 11, 2021.
[259] Government official, interview by USITC staff, June 1, 2021; industry representative, interview by USITC staff, April 28, 2021; USDA, FAS, *Mexico: Greenhouse and Shade House Production*, April 22, 2010, 5; Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 7.
[260] Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, 2011, sec. 4.4.
[261] Producers expressed different views regarding whether cucumbers generate enough economic returns to be grown in high-tech greenhouses. One noted using them as a rotation crop, only as needed (e.g., during a disease outbreak in higher-value tomatoes), while another producer grows cucumbers as a primary greenhouse crop. Industry representatives, interviews by USITC staff, April 28, 2021 and May 28, 2021.
[262] Based on data for tomatoes produced in Michoacán, 95 percent of medium- to high-tech PA production is cultivated for export. Research by Pratt and Ortega indicated that tomatoes serve as a good proxy for cucumbers. Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas, Jitomate, Michoacán 2018; Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 10.
[263] Production based on volume in mt. All data in this section are based on Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 17, 18, and 21, 2021.

according to a plant's individual needs.[264] Sources of water for irrigation tend to be readily available in Sonora and Sinaloa via the network of dams, reservoirs, and irrigation canals, and, as noted elsewhere, investors are sometimes willing to install irrigation systems to support export-oriented production. In Mexico, fresh market cucumbers, particularly those destined for export, are normally vertically grown (e.g., on trellises, wires, or poles) both in open field and PA systems.[265]

Growers also purchase seeds that are specific to a number of factors including the type of cucumber, growing climate, production system, pest pressures, and whether the plant will be grown vertically or on the ground.[266] Reportedly, it is common for seed companies to provide some technical training to farmers to help them maximize yields.[267]

Packing

Export-oriented producers normally centrally sort and pack fresh market cucumbers in climate-controlled packing facilities (commonly called packing houses or sheds).[268] Information from the government of Mexico indicates that producers with more than 10 ha of medium- to high-tech greenhouses are more likely to own packing houses, while smaller producers tend to send their cucumbers to third-party packers.[269] Other large non-greenhouse producers may also have their own packing houses. Typically a range of crops can be packed in the same facility, often using the same equipment, although certain packing equipment is crop specific.[270] During shed packing, cucumbers are first chilled (by water or air), an important step for removing field heat to extend shelf life.[271] Workers then sort the cucumbers by size and grade and, as needed, add protective wax or shrink-wrapping based on standards required by end customers.[272] Fresh market cucumbers that do not meet export standards are reportedly sold domestically.[273] Mexican packers are said to provide a wide range of customization

[264] Open field traditional pump or sprinkler irrigation uses 75 cubic meters of water/ton of cucumbers. A shade house is 7 to 33 percent more efficient, a high-tech greenhouse 80 percent. Hydroponic irrigation systems also are more efficient in delivering nutrients. Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 6, 15.
[265] CAADES et al., written submission (cucumbers), March 24, 2021, 7; government official, interview by USITC staff, June 1, 2021; USITC, hearing transcript, April 8, 2021, 244 (testimony of Guillermo Martinez, Frello Fresh, LLC); industry representatives, interviews by USITC staff, May 28, 2021, July 2, 2021, July 6, 2021.
[266] USITC, hearing transcript, April 8, 2021, 243 (testimony of Guillermo Martinez, Frello Fresh, LLC); industry representative, interview by USITC staff, May 28, 2021. See also e.g., Kemble, *Southeastern U.S. 2020 Vegetable Crop Handbook*, 2020, 52.
[267] Industry representative, interview by USITC staff, July 6, 2021.
[268] Mexican cucumber growers do not typically field-pack cucumbers. FPAA written submission, April 1, 2021, 1–2; USITC, hearing transcript, April 8, 2021, 239 (testimony of Craig Slate, SunFed Produce).; industry representative, interview by USITC staff, July 6, 2021.
[269] Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas, Jitomate, Michoacán 2018 and Tomate Rojo/Jitomate, Michoacán 2020.
[270] For example, machines to shrink wrap English cucumbers. Industry representatives, interviews by USITC staff, April 28, 2021 and July 6, 2021.
[271] FPAA written submission, April 1, 2021, 1–2; industry representatives, interview by USITC staff, July 6, 2021; Seminis, "Cucumber Harvest and Storage," accessed June 26, 2021.
[272] See chapter 1; USITC, hearing transcript, April 8, 2021, 136 (testimony of Richard Bowman, J&J Farms), 239 (Craig Slate, SunFed Produce).
[273] Cucumbers for export tend to demand higher quality standards than cucumbers for consumption in Mexico. Government official, interview by USITC staff, June 1, 2021; industry representative, email to USITC staff, August 23, 2021.

with packaging based on the request of their customers.[274] For example, reportedly U.S. retailers prefer various sizes in consumer packaging for different submarkets (e.g., smaller packs for urban markets than suburban).[275] Some companies pack cucumbers in modified atmosphere packaging for transport to help extend shelf life.[276] The ability to provide this range of packing options requires investment in various machines, with some packing houses said to have 6–10 different machines to meet customer specifications.[277]

Supply Chain

Preparing fresh market cucumbers for transport to the United States requires several steps. First, the cucumbers (which may be in modified atmosphere bags) are loaded into an insulated shipping box.[278] Next, the shipping boxes are combined to form a pallet before being loaded into a refrigerated truck, in a configuration that allows cool air to circulate.[279] Delays or breaks in the cold chain during the loading, transport, or unloading processes can cause the cucumbers to experience temperature swings resulting in damage to the vegetables.[280] Speed to market and temperature control throughout the transportation process determine the quality of the product at market and are the most important factors for logistics and transportation.[281]

Cucumbers consistently rank among the top five fruits and vegetables (by volume) transported by truck to the United States from Mexico.[282] Freight rates for refrigerated truck transport from Mexico to the United States are reportedly similar for all fruits and vegetables, so rates for fresh produce are applicable to fresh market cucumbers. These rates show some seasonal variation, with a decline in the third quarter of most calendar years, likely due to the wide availability of domestic produce in most regions of the United States during this period.[283] Freight rates were particularly high in 2018 due to (1) a shortage of truck drivers, which was exacerbated by the implementation of a required electronic logging device system in the United States, and (2) high fuel prices.[284] In the second quarter of that year, freight rates reached $3.21/mile, compared to an average for the 2015–20 period of $2.52/mile.[285]

According to industry representatives, freight rates can have a significant impact on the price of imported cucumbers, as described in additional detail in chapter 6 (Pricing).[286] One analysis similarly found that because refrigerated trucks are a fuel-intensive form of transportation compared to rail and

[274] Industry representatives, interview by USITC staff, June 28, 2011 and July 6, 2021; USITC, hearing transcript, April 8, 2021, 245 (testimony of Guillermo Martinez, Frello Fresh, LLC).
[275] Industry representatives, interview by USITC staff, July 6, 2021.
[276] USITC, hearing transcript, April 8, 2021, 240 (testimony of Craig Slate, SunFed Produce); Produce News, "Mexico Increasing Demand," October 28, 2016. Modified atmosphere packaging uses specialty plastic films and bags to control the respiration of fresh produce, extending the shelf life of the product.
[277] Industry representatives, interview by USITC staff, July 6, 2021.
[278] Hecht, "Shipping Vegetables from Mexico to USA," August 16, 2019.
[279] Hecht, "Shipping Vegetables from Mexico to USA," August 16, 2019.
[280] PMA, "Transportation," August 1, 2016.
[281] PMA, "Transportation," August 1, 2016.
[282] USDA, AMS, *Mexico Transport Cost Indicator Report*, May 2021, 10–12.
[283] USDA, AMS, Agricultural Refrigerated Truck Quarterly Datasets (accessed June 16, 2021).
[284] Sterk, "Truck Freight Rates Continue to Climb," October 12, 2018.
[285] USDA, AMS, Agricultural Refrigerated Truck Quarterly Datasets (accessed June 16, 2021).
[286] Industry representatives, interviews by USITC staff, August 10, 2021.

ocean shipping, the wholesale prices of fresh produce are sensitive to changes in fuel prices (which are a major component of freight rates). This is particularly true for U.S. markets, such as the U.S. East Coast, that are the furthest distance from Mexican growing regions. However, the analysis found that fuel prices affected wholesale prices less in seasons when there was more competition from vegetables grown within the U.S. region, since this competition limited the ability of sellers to pass fuel price increases (and, by extension, freight price increases) on to buyers.[287]

The majority of cucumbers shipped from Mexico to the United States are sent by refrigerated truck through the border crossing at Nogales, Arizona. Since 2000, however, border crossings in Texas (primarily at Hidalgo and Laredo) have handled an increasing share of fresh produce, including cucumbers, shipped to the United States. In 2000, 74 percent of cucumbers imported from Mexico entered into Arizona, and by 2019, this share fell to 61 percent.[288] There are several reasons for this, including Mexico's construction of additional highways linking western Mexico with Texas,[289] a route which is flatter and faster than the route to Nogales. In addition, imports into Texas can reach populous U.S. East Coast markets one to two days faster than imports into Arizona. Overall, fresh produce shipments via Texas can cost up to $1,000 less than shipments via Nogales, though Nogales remains the top point of entry for cucumbers.[290]

Once they cross the border, boxes of cucumbers are often mixed with other types of produce, such as eggplant and squash. Retail buyers prefer to have a mix of vegetables to offer and obtain this mix as efficiently as possible (e.g., from a single source or, if from multiple sources, ones in close proximity). These mixed produce shipments are then distributed from the point of import to buyers throughout the United States. [291] Retail stores are the major buyers of the fresh market cucumbers from Mexico.[292]

Cost of Production

The cost of production (COP) for cucumbers in Mexico varies by production system, although labor is an important input cost for all systems. Certain other inputs, especially fertilizer in greenhouses and drip tape in open fields, also account for a large share of production costs. Most other variable input costs, such as for agrichemicals and water, appear to be relatively low. The data presented in this section are derived from a range of sources, including industry representatives and the Mexican government. However, all are indirect sources of information, based either on secondhand accounts or on primary data for crops other than cucumbers. Government of Mexico data for tomatoes grown in medium to high-tech greenhouses and field grown asparagus using drip irrigation were used to estimate the cost

[287] Volpe, Roeger, and Leibtag, "How Transportation Costs Affect Fresh Fruit and Vegetable Prices," November 2013.
[288] USDA, AMS, Agricultural Refrigerated Truck Quarterly Datasets (accessed June 16, 2021).
[289] For example, the Durango Highway (Mexican Federal Highway 40D) was completed in 2013.
[290] Allen, "Border Battle," December 31, 2017.
[291] Industry representatives, interview by USITC staff, July 6, 2021; USITC, hearing transcript, April 8, 2021, 240 (testimony of Craig Slate, SunFed Produce).
[292] Industry representative, interview by USITC staff, July 6, 2021.

structure for producing fresh market cucumbers in these two production systems.[293] Direct, detailed COP and delivered cost data for fresh cucumbers were not available.

As discussed in detail below, labor is a major input cost with labor costs differing depending on production system. Labor is important at several stages of production including during the multiple rounds of hand harvesting that occur. In open fields, for all stages of production, labor is the largest variable cost at about 29 percent of COP (based on data for asparagus).[294] Labor's share of cost is lower in greenhouse systems (24 percent) but is still the second-largest cost (based on data for tomatoes).[295] This is lower than U.S. open field production for cucumbers where labor makes up 32 to 38 percent of COP.[296] A more detailed comparison of COP across countries can be found in chapter 5.

Data indicate that fertilizers are the largest variable input cost in greenhouses—about 40 percent of COP (based on tomatoes).[297] In open field systems fertilizer's share of COP were roughly half as much: 22 percent of total COP (based on asparagus).[298] The greenhouse COP data are based on the systems using hydroponic production practices. Because no soil is used in these systems all plant nutrients are provided through fertilizers. However, in open fields and some lower-technology PA systems fertilizers augment the nutrients plants take from the soil. For comparison, U.S. open field production has much lower fertilizer costs, just 5 to 14 percent of total COP.

The cost of irrigation appears high in open fields driven by material costs. Drip tape accounted for 22 percent of COP for asparagus grown in Sonora. Similar costs would expect to be incurred in other production systems using tape-based drip irrigation.[299] Actual water costs appear low, less than 1 percent of COP in open fields and 3 percent in greenhouses.[300] For comparison, U.S. irrigation costs can be as high as 27 percent, or as low as 8 percent, for open field production.

With the notable exception of labor, input costs are reportedly similar in Mexico and the United States because of comparable costs for many inputs including seeds, plant protection inputs, and packing materials.[301] However, because of higher yields in Mexico, the unit costs may be lower for Mexican growers. For greenhouse systems, plants, including seeds, are a notable expense, as they are for some U.S. producers, as is preparation for planting. Plants and land prep materials each account for

[293] Costs, presented in U.S. dollars/ha, are for growing the crop in one year after the production operation is established; capital costs are not included. Production costs do not include packaging and marketing. Research by Pratt and Ortega establish that greenhouse tomato production is representative of cucumber production. Michoacán was the largest cucumber-producing state for which data were available. Asparagus, like cucumbers, is a fast-growing crop that uses drip irrigation, must be harvested by hand and is prone to spoilage, with a relatively short shelf life after harvest. Drip irrigation is commonly used in Mexican fresh market cucumber production. Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas, Jitomate, Michoacán 2018 and Espárrago Mantenimiento, Sonora 2019; Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 10.
[294] Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas, Espárrago Mantenimiento, Sonora 2019.
[295] Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas, Jitomate, Michoacán 2018.
[296] See chapter 2 (United States) for U.S. COP information and data, and chapter 5 (Competitiveness Comparison).
[297] Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas, Jitomate, Michoacán 2018.
[298] Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas, Espárrago Mantenimiento, Sonora 2019.
[299] Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas, Espárrago Mantenimiento, Sonora 2019.
[300] Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas, Jitomate, Michoacán 2018 and Espárrago Mantenimiento, Sonora 2019.
[301] Industry representatives, interview by USITC staff, July 2, 2021 and July 6, 2021.

13 percent of COP (based on asparagus and tomatoes).[302] Indications are that, while they have similar purchase prices, plant protection products are a small share of Mexican COP because of reduced pest pressures from the arid climate in northwestern Mexico and the use of PA. Estimates of the cost of production per box of American slicer cucumbers for Mexican producers are included in chapter 5 (table 5.3).

Delivered Costs

There are other factors that influence delivered costs of cucumbers not captured in these proxy COP data, especially for products intended for export. These include costs related to packing, transport, and compliance as well as overhead costs such as those related to building PA. Packing material costs are likely low. One industry representative estimated packing material costs at about a penny per pound, but noted that in Mexico additional labor is used to do more specialized packing.[303] However, reportedly, certain specialized packing materials (e.g., containers, boxes, pallets) have to be imported from the United States, which can increase packing costs in Mexico.[304] Transport costs, which can be significant, are impacted by a number of factors including fuel costs and distance to the end market (see Supply Chain, above). In addition, as noted in chapter 1, Mexican fresh market cucumbers must meet export market food safety and quality standards set by governments and the private sector, in order to access these markets.[305] By one general estimate, as of the early 2000s, compliance costs for Mexican vegetable growers to meet export market standards could reach 9 percent of the total COP.[306] PA production systems also require additional investments, although such costs are reportedly outweighed by higher yields and quality (see Competitive Factors below).[307]

Labor

Labor needs for cucumber production in Mexico vary by production system and the level of technology it uses (the need for labor declines as technology use increases). Generally, labor needs are highest during planting and harvesting. Vertical production practices appear to require regular (rather than seasonal) labor because the plants need continual maintenance (e.g., pruning, guiding the vines, preventing disease from spreading).[308] As noted above, COP data for Mexico specific to cucumbers are not available but is likely similar to data for tomatoes. According to a detailed analysis conducted for the Inter-American Development Bank, open field production of tomatoes in Mexico has the highest labor

[302] Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas, Jitomate, Michoacán 2018 and Espárrago Mantenimiento, Sonora 2019.
[303] Industry representative, interview by USITC staff, May 28, 2021.
[304] Industry representative, email to USITC staff, August 11, 2021.
[305] The Mexican Association of Protected Horticulture, known by its Spanish acronym AMHPAC, offers members training and programs to help members comply with food safety and social responsibility standards. AMHPAC, Achievements, https://www.amhpac.org/es/index.php/en/inicio/logros, accessed June 22, 2021.
[306] Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, 2011, 4.6.
[307] USITC, hearing transcript, April 8, 2021, 245 (testimony of Guillermo Martinez, Frello Fresh, LLC).
[308] Industry representative, interview by USITC staff, July 16, 2021; industry representative, email to USITC staff, August 11, 2021.

needs, requiring 21 to 30 workers/ha, a figure that is likely similar for cucumbers.[309] This work is seasonal, low-skilled, hard manual labor, and almost entirely done by men. It is normally paid based on a daily or piece rate. Mexican shade houses for tomatoes often have similar working conditions and pay structures to open fields and require about 21 workers/ha.[310] However, shade houses with year-round production are more likely to mirror the working conditions and terms of medium-tech production systems. High-tech greenhouses in Mexico have the lowest labor needs–10 workers/ha–and the work is considered semi-skilled.[311] The working conditions are reportedly more comparable to those in manufacturing, and are less physically demanding. Positions are permanent and compensation packages normally include social benefits.[312] Between 85 and 90 percent of the workforce in Mexico's export-oriented horticulture industry are local workers.[313]

In Mexico, the more labor-intensive production practices, specifically trellising, are done both in the open-field and under protected agriculture. For this reason, protected agriculture in Mexico is actually less labor intensive relative to open field production, as protected agriculture environments generally include some means of mechanization. In contrast, in the United States, the use of PA would require the introduction of trellising over open field production, making PA more labor intensive than open field production in the United States.

Evidence suggests that the provision of social benefits to workers, and the benefits provided, can vary widely. It appears that producers trying to retain workers year-round (those using high-tech greenhouses and some shade house producers) are likely to offer more benefits, whereas those hiring seasonal workers may be providing minimal, if any, benefits. However, producers trying to attract repeated or returning seasonal workers may also be incentivized to provide some benefits beyond wages. Reportedly, social benefits can include transportation, free lunch, medical care, school for the children of workers, and housing. Growers have to compete with other industries to attract labor.[314] Labor costs including wages are further discussed below under Government Programs and Regulations and Factors Affecting Competitiveness.

[309] Pratt and Ortega state that evidence indicates that the same conditions exist for cucumbers. Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 20–21.
[310] Other low-technology systems have similar labor needs and working conditions as those in shade houses. Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 20–21.
[311] Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 20–21. Information from industry support this estimate for cucumber production. Industry representatives, interview by USITC staff, August 11, 2021.
[312] Workers with year-round employment may be working on several different crops throughout the year. Industry representatives, interviews by USITC staff, April 28, 2021, May 28, 2021, July 2, 2021, and July 6, 2021.
[313] Industry representative, email to USITC staff, August 23, 2021; Escobar, Martin, and Stabridis, *Farm Labor and Mexico's Export Produce Industry*, October 2019, 30. The U.S. Department of Labor identified the use of child labor in cucumber production in Mexico. It is primarily in Campeche, Colima, Nayarita, and Tabasco, which together accounted for about 3 percent of all cucumber production (by mt, including pickles) in 2020. These are not export-oriented horticulture states. USDOL and ILAB, *Child Labor and Forced Labor Reports—Mexico*, accessed June 10, 2021.; U.S. Department of Labor, 2020 List of Goods Produced by Child Labor or Forced Labor, September 2020, 22; Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed June 10, 2021. Based on initial conversations with industry representatives that labor conditions were not a factor affecting competitiveness, Commission staff did not further investigate labor conditions in any country.
[314] Industry representatives, interviews by USITC staff, April 29, 2021, July 2, 2021, July 6, 2021, and August 11, 2021. Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 20–21.

Foreign Investment and Financing

While the overall scale is relatively small, foreign investment, particularly by U.S. businesses, has benefited cucumber exports.[315] The United States is a major source of foreign investment in the overall Mexican food and agricultural sector.[316] Over the decade ending in 2019, U.S. foreign direct investment (FDI) in the sector appears to range between $8 billion and $12 billion, a small share (under 5 percent) of which may have gone to crop production.[317] A major driver of investments in horticulture crops is to provide year-round supplies of product to end customers, especially in the United States.[318]

FDI likely to benefit the Mexican cucumber industry targets export-oriented crop production and postharvest handling. The foreign firms investing in operations in Mexico can often include distributors that have vertically integrated operations (typically using PA production systems) geared toward export.[319] For example, U.S. firm Chamberlain Distributing reports a long history of investment in Mexico, including supporting research for seeds and packing materials, providing grower education, financing irrigation, building PA field technology, and investing in chillers and grading sorters (for postharvest handling).[320] Similar types of investment have also been noted by other U.S. firms.[321] Additionally, some U.S. companies will provide financing to Mexican producers, who have long faced high borrowing costs and difficulty in obtaining loans domestically, for a shipping commitment.[322] Such financing can include loans or advances to cover packaging or labor costs (known as "pick and pack" advances).[323] One U.S. investor noted that their firm targets financing at medium to large growers for products with established markets.[324]

[315] Less than 1 percent of total foreign direct investment (FDI) in Mexico was in the agriculture, forestry, and fishing sector during 2000–2018. Canales, Andrango, and Williams, "Mexico's Agricultural Sector," 2019.
[316] During 2009–18, the United States provided about 58 percent of FDI in Mexico's agriculture sector. Government of Mexico, Secretaría de Economía, Análisis De La Inversión Extranjera Directa, February 2019, 5.
[317] The majority of U.S. agricultural FDI in Mexico was for grains and oilseed milling and the beverage sector. USITC staff calculations based on data available for years during 2010–19. In some years, certain information was suppressed to protect business proprietary information. USDA and ERS, FDI table, March 12, 2021.
[318] Government official, interview by USITC staff, June 1, 2021; USITC, hearing transcript, April 8, 2021, 258, 289 (testimony of Jamie Chamberlain, Chamberlain Distributing); Canales, Andrango, and Williams, "Mexico's Agricultural Sector," 2019.
[319] Industry representative, email message to USITC staff, June 28, 2021; industry representatives, interview by USITC staff, July 6, 2021.
[320] Chamberlain Distributing, an Arizona based distributor of fruits and vegetables, reports a 50-year investment history in Mexico. They estimate recent annual investments of between $2 and $3 million. USITC, hearing transcript, April 8, 2021, 254, 258 (testimony of Jamie Chamberlain, Chamberlain Distributing). Mastronardi Produce (Canada) also operates multiple greenhouses in Mexico to grow and distribute cucumbers and other crops. Produce News, "Mastronardi Produce Rebranding Organic Line of 'Sunset' Products," June 24, 2013; HortiDaily, "Mastronardi Produce Certifies Fifth Operation," September 15, 2020.
[321] Industry representatives, interviews by USITC staff, July 2 and July 6, 2021; government official, interview by USITC staff, June 1, 2021; FPAA post-hearing written submission, April 15, 2021, Exhibit 10.
[322] Industry representatives, interview by USITC staff, May 27, 2021; USITC, hearing transcript, April 8, 2021, 105 (testimony of Dante Galeazzi, Texas International Produce Association).
[323] Industry representative, email message to USITC staff, June 28, 2021.
[324] Industry representative, interview by USITC staff, May 28, 2021.

Government Programs and Regulations

Mexico has had a long and evolving history of federal government programs supporting the agriculture industry; however, most existing government programs do not currently support vegetable growers. Current programs reflect the priorities of the administration under Mexican president Andrés Manuel López Obrador, who took office in 2018. These programs target primarily smallholders (less than 20 hectares) producing staple crops such as corn and beans, with emphasis on producers in the southern and central states of Mexico.[325] In addition, the current administration significantly reduced its overall budget for agricultural support programs due to austerity measures. Crop insurance programs have ended or been significantly reduced in recent years and farmer support programs that had previously been available to vegetable producers, including capital investment assistance for irrigation technology, are no longer in place.[326]

Past programs, including those under the previous administration of Enrique Peña Nieto (2012–18), provided more broad agriculture support. Programs impacting horticulture were not product-specific but were broadly available to producers of key fruit and vegetable crops, with a small share benefiting those cultivating cucumbers.[327] While the various programs were designed to provide benefits throughout supply chains, capital investment assistance programs were of particular relevance to fresh fruit and vegetable production.[328] This type of support likely lowered the barriers to accessing capital, which can be hard to obtain in Mexico, accelerating technology adoption, particularly for modern irrigation equipment. In addition, this type of government support for enhanced technology—including PA and irrigation—can have longer-term effects compared to one-time benefits such as direct payments and crop insurance support.

PA was considered a strategic sector by multiple administrations and received government support from at least 2001 until 2019 (see table 3.7).[329] Under the Peña Nieto administration, support was directed through the Intensive Production and Agricultural Covers subprogram of the Program for the Promotion of Agriculture (known in Spanish as PROAGRO) under the 2013–18 National Development Plan.[330] A majority of the PA support likely benefitted fruit and vegetable crops; however, the amount for cucumbers is unknown.[331] Funds were issued on a per-project basis with fixed amounts per hectare and

[325] USDA, FAS, *Mexico Announces New Ag Support Programs*, April 5, 2019, 2; USDA, ERS, "Mexico Policy," September 16, 2020; OECD Library, *Agricultural Policy Monitoring and Evaluation 2020: Mexico*, 2020.
[326] USDA, FAS, *Drought Conditions in Mexico*, June 3, 2021, 6; U.S. government representative, interview by USITC staff, June 7, 2021; Mexico News Daily, "Farmers Plead for Federal Government Support," May 4, 2021.
[327] Scheitrum, *Examining Agricultural Support and Subsidies in the U.S. and Mexico*, July 2, 2020, 11; Wu et al., "Government Support in Mexican Agriculture," 2018, 7.
[328] Scheitrum, *Examining Agricultural Support and Subsidies in the U.S. and Mexico*, July 2, 2020, 10–12; Wu et al., "Government Support in Mexican Agriculture," 2018, 7; CRS, *Efforts to Address Seasonal Agricultural Import Competition in the NAFTA Renegotiation*, December 7, 2017, 8–9.
[329] Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, 2011, Sec. 3.
[330] The administration of Felipe Calderón (2006–12) directed support through a different program under the 2007–12 National Development Plan. Wu et al., "Government Support in Mexican Agriculture," 2018, 7.
[331] In addition, reports indicate that the support targeted the "social sector," with the majority of PA structures being smaller than 5,000 m^2. Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, 2011, Sec. 3.

subject to funding caps. This support primarily went to shade houses and greenhouses projects.[332] As table 3.7 shows, government support amounts varied from year to year. Between 2011 and 2016, government support slowed relative to prior years but remained relatively steady, averaging 455.2 million pesos ($22.6 million) per year.[333] In 2019, government support for PA ended as the new administration shifted its priorities to focus on smallholders producing staple crops. As a result of both public and private capital investment, PA expanded, especially during 2009–16 when it increased 2,500 ha per year on average to reach 40,862 ha.[334] In more recent years, however, some reports indicate that the rate of expansion has slowed to less than 1,000 hectares per year.[335]

Table 3.7 Mexican government support for protected agriculture, select years, 2001–16
Government support in millions of dollars and project support in thousands of dollars; n.a. = not available.

Year(s)	Total government support amount (million $)	Per project support amount: shade houses (thousand $)	Per project support amount: greenhouses (thousand $)
2001–06	46.9	n.a.	n.a.
2007–08	69.5	n.a.	n.a.
2011	29.7	n.a.	n.a.
2012	19.8	n.a.	n.a.
2013	25.0	19.8/ha, max 119.0/project	59.5/ha, max 148.8/project
2014	21.9	14.9/ha, max 133.9/project	44.6/ha, max 133.9/project
2015	14.0	14.9/ha, max 133.9/project	44.6/ha, max 133.9/project
2016	25.0	14.9/ha, max 133.9/project	44.6/ha, max 133.9/project

Source: Wu et al., "Government Support in Mexican Agriculture," 2018; IMF, Exchange rates: Representative rates; Mexico; January 1, 2021 to July 27, 2021, accessed July 27, 2021.
Notes: No data were available for 2009 and 2010. In 2013, PA support was also available for micro-tunnels and macro-tunnels. During 2014–16, data were available for macro-tunnels and anti-hail mesh structures. Total government support amount figures for the years 2001–06, and 2007–08 reflect the total amount for those periods.

For irrigation technology support, most, if not all, of the capital investment cost-sharing programs were directed to fruit and vegetable crops, including cucumbers.[336] As noted above, virtually all fresh market cucumber production in Mexico is irrigated, likely financed by a mix of both private and public funding. Support amounts were issued on a per-project basis with fixed amounts per hectare. Between 2014 and 2016, the support amounts ranged from 10,000/ha to 15,000/ha pesos (about $496/ha to $744/ha),

[332] Additional PA systems receiving government support include micro-tunnels and macro-tunnels. Funds were also provided for training and technical assistance, insurance for greenhouses, certification of good agricultural practices and good manufacturing practices, promotion of products from protected agriculture, and agricultural waste disposal. Wu et al., "Government Support in Mexican Agriculture," 2018, 4. A report found that producers receiving government support to build greenhouses were more likely to abandon their structures due to their lack of knowledge, market, scale (size), and/or access to credit and subsidies. However, the three largest fresh cucumber-producing states had minimal abandonment rates (from zero to 2 percent as of 2011). Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, 2011, 3.2.2.
[333] Unless otherwise noted, all conversions from pesos to U.S. dollars are based on 2021 average from IMF, Exchange rates: Representative rates; Mexico; January 1, 2021 to July 27, 2021, accessed July 27, 2021.
[334] Protected agriculture is estimated to have been 790 ha in 2000. Wu et al., "Government Support in Mexican Agriculture," 2018, 1.
[335] USDA, FAS, *Mexico: Tomato Annual*, May 30, 2018, 4.
[336] Government support for irrigation technology under the Peña Nieto administration was directed through the PROAGRO Irrigation Technology subprogram. Wu et al., "Government Support in Mexican Agriculture," 2018, 5.

depending on the type of technology.[337] Support for irrigation rose from 1.3 billion pesos ($64.5 million) in 2013 to 1.7 billion pesos ($86.3 million) in 2016.[338]

Minimum Wage

Beyond agriculture support programs, the Mexican government—especially under the current administration—has put forth new policies impacting minimum wages, including those received by agricultural workers.[339] In particular, the general minimum wage, which covered most agricultural field laborers and packing house workers in Mexico, increased 75.8 percent between 2015 and 2020, reaching 123.22 pesos/day ($6.11/day) (see figure 3.3).[340] Much of this growth occurred in recent years under the López Obrador administration. Up through 2020, both agricultural day laborers and packhouse workers were subject to the general minimum wage rates for most of the country. In 2019, a separate minimum wage rate was established for the Free Northern Border Zone to make the region's wage rates more in line with wage rates in the United States and to curb migration.[341] This zone encompasses municipalities in a 25 km strip south of the US-Mexican border, including parts of the major cucumber-growing state of Sonora as well as Baja California. In addition, as of 2021, a professional minimum wage was established for agricultural day laborers, increasing their minimum wage to 160.19 pesos/day ($7.94/day).[342]

[337] During 2014–16, certain types of irrigation technologies received support including multi-floodgate, sprinkler, micro sprinklers, and drip irrigation, as did drainage on agricultural land. In 2013, support amounts for greenhouses were 30,000 pesos/2,500m^2 ($1,488/2,500m^2). For other production systems, amounts ranged from 10,000/ha to 20,000 pesos/ha (about $496/ha to $992/ha) depending on the irrigation technology. Wu et al., "Government Support in Mexican Agriculture," 2018, 3, 5.

[338] Financial support is the same for all crops; data or estimates of the share of funding given to cucumbers growers are not available. Wu et al., "Government Support in Mexican Agriculture," 2018, 1–11.

[339] Industry representatives indicate that export-oriented cucumber producers likely pay higher wages than the minimum rates required by Mexican law. Wage rates in the cucumber industry are described in additional detail in the "Factors Affecting Competitiveness" section below.

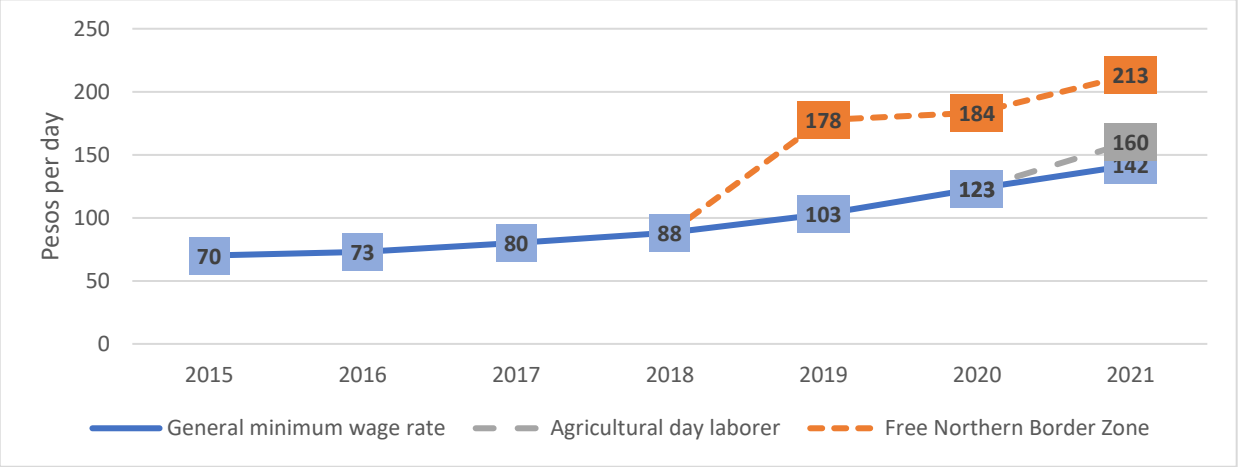
[340] As of 2021, Mexico has three types of minimum wage: (a) professional minimum wages for 61 designated professions across a broad range of sectors, including manufacturing and automotive; (b) a general minimum wage for the Free Northern Border Zone; and (c) the general minimum wage which applies to all other workers. Government of Mexico, CONASAMI, *Diario Oficial de la Federación*, December 23, 2020.

[341] Nikolewski, "New President of Mexico," December 31, 2018; *Diario Oficial de la Federación*, Resolución del H. Consejo de Representantes de la Comisión Nacional de los Salarios Mínimos, December 26, 2018.

[342] Prior to 2021, only poultry farm managers and agricultural machinery operators were included among agriculture-related professions with established minimum wages. Wage rates for packhouse workers were, and continue to be, subject to the general minimum wage.

Figure 3.3 Minimum wage rates in Mexico, 2015–21

In pesos per day. Underlying data for this figure can be found in appendix F, table F.5.



Source: Government of Mexico, CONASAMI, Tabla de Salarios Mínimos: 2015–21 (Minimum Wage Table).

Factors Affecting Competitiveness

As described in chapter 1 of this report, competitiveness of fresh market cucumbers can be measured by comparing delivered costs, product differentiation, and supplier reliability for U.S. products against those of imports. Mexico's export-oriented cucumber industry has a number factors which enhance its competitive strengths in all three of these areas. Low wage rates help reduce delivered costs and facilitate greater product differentiation through the use of production techniques that are more labor intensive but can improve quality and customization (e.g., customized packaging options).[343] Mexico's overall climate is conducive to growing cucumbers and use of PA systems. Building a PA system does require additional investment, but use of PA may also lower other input costs (e.g., pesticides). Mexico's climate and use of PA, coupled with certain production practices, increase product differentiation and reliability of supply. These factors also enhance Mexico's ability to produce all economically important cucumber varieties. Mexico's competitiveness is also helped by its geographical proximity and improved transportation linkages with the United States and the resulting access to all or most major U.S. regions and markets.[344] Although there are some factors that reduce the industry's competitiveness (such as obtaining financing, which can be a challenge for some Mexican growers, and a business environment that is generally less favorable compared to those in the United States and Canada), the positive factors generally outweigh the negative factors.[345] Key factors affecting the competitiveness of Mexico's fresh market cucumber industry are identified below and compared to those of other suppliers in the U.S. market in chapter 5.

Labor costs are likely reduced by low wage rates.

Overall labor costs, which include wages and benefits, should vary by production system and between individual growers. The nature of employment (e.g., seasonal vs. permanent), the type and amount of

[343] Industry representative, interview by USITC staff, July 6, 2012.
[344] Mexico also has duty-free access to its largest export market under the USMCA and its predecessor, NAFTA.
[345] Schwab, *The Global Competitiveness Report 2019*, 2019, 138–41, 386–89, 582–84.

work affiliated with each production system, and the production practices used therein, make it difficult to draw conclusions about overall labor needs and, therefore, costs in Mexico.[346] In addition to wages, Mexican producers providing benefits incur additional costs not reflected in wage rates. Such costs would vary substantially based on the range of benefits provided. However, those using high-tech greenhouses appear more likely to incur these associated additional labor costs. (See Labor above).

Low wage rates are a competitive advantage for Mexican producers. In addition to lowering the cost of production, low wage rates allow for more labor-intense practices such as vertical production, more frequent picking, and more customization in packing, all of which can enhance product differentiation. For example, vertical growing requires additional labor to train the vines onto the vertical structure. However, the associated costs are reportedly worth the yields and quality improvements.[347]

While wage rates for cucumbers workers can vary, overall wage rates in Mexico are comparatively low but have been rising in recent years as they have been in other markets,[348] and a minimum wage was established for agricultural day laborers in 2021.[349] While also low, agricultural wages higher than official minimum wages are paid to those working in Mexico's export-oriented states and crops. One report found that agricultural workers in the six states with the highest share of agricultural exports—including the major fresh market cucumber-producing states of Sinaloa, Sonora, and Michoacán—earn 40 percent more than workers in the states with the lowest share of agricultural exports.[350] It appears that, on average, those working in the fresh-market cucumber industry earn well above the Mexican minimum wage. By one estimate, workers in the Mexican cucumber industry earned, on average, 6,093 pesos ($320) per month in 2019.[351] Industry representatives provided estimates reflecting similar wage rates. As of 2021, workers were reported to earn $10–12 a day (roughly $260 to $312 a month), although those being paid by piece earned $15–$20 a day (roughly $390 to $520 a month).[352] These wage rates of $10 to $12 per day are roughly equivalent to what comparable workers in the United States and Canada earn hourly.[353] However, a small share of workers in the cucumbers industry (4–5 percent by one estimate) are reportedly paid less than minimum wage, which may lower labor costs for some Mexican producers.[354] Agricultural wage rates are rising because of a long-term tightening of supply driven by increased competition for workers.[355] Two key factors tightening labor supply include the departure of agricultural workers either for manufacturing work (which is reported to be seen as a better place to

[346] Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 20–21.
[347] Industry representative, interview by USITC staff, July 2, 2021; USITC, hearing transcript, April 8, 2021, 245 (testimony of Guillermo Martinez, Frello Fresh, LLC). See also chapter 2 (United States) and chapter 4 (Canada).
[348] Real agricultural wages in Mexico rose by about 12.5 percent between 2015 and 2019. Escobar et. al., "Farm Workers In Mexico's Export Agriculture," November 2020, 12.
[349] See "Government Programs and Regulations" above, chapter 2 (United States), and chapter 4 (Canada).
[350] Rural Migration News, "Workers on Mexico's Export Farms," November 19, 2019.
[351] Wages can vary by season. For example, reportedly during the low season workers on export-oriented farms earn about as much as factory workers but during the high season can earn up to 50 percent more than factory workers. Escobar, Martin, and Stabridis, *Farm Labor and Mexico's Export Produce Industry*, October 2019, 133, 136–137.
[352] Calculated monthly rate based on a 6-day work week (26-day work month). USITC, hearing transcript, April 8, 2021, 96 (testimony of Richard Bowman, J&J Family of Farms); 264 (testimony of Rob Sbragia, Tricar Sales, Inc.).
[353] See also chapter 2 (United States), chapter 3 (Canada), and chapter 5 (Cross-Country Comparison).
[354] Escobar, Martin, and Stabridis, *Farm Labor and Mexico's Export Produce Industry*, October 2019, 133.
[355] Escobar et. al., "Farm Workers in Mexico's Export Agriculture," November 2020, 1–2.

work) or for agricultural work in the United States (where wages are higher), or the shift in workers within Mexico (toward crops paying the highest wages).[356]

Producing with PA requires higher initial investment but may lower other input costs.

Building PA requires a greater initial investment than open field production. The cost of PA increases based on the level of technology used: shade houses generally cost much less to build than greenhouses.[357] In 2021, one industry representative estimated that shade houses cost between $38,000 and $45,000/ha, while glass greenhouses which tend to be higher-technology cost about $1 million/ha.[358] Other sources generally support these estimates.[359] Ranges for low- and medium-tech greenhouses vary more widely, as they appear to reflect different definitions of these environments and the technology used. Available estimates range from about $125,000/ha for lower-tech (plastic) greenhouse up to about $590,000/ha for medium-tech greenhouses.[360] The lower costs of building shade houses, coupled with large production gains (over open fields), has helped popularize their use over greenhouses in Mexico.[361] Packing houses, which are normally used in conjunction with PA cucumber production, also represent a substantial capital investment. However, the investment is said to be considered worthwhile because growers in Mexico have a long growing season, can use facilities to pack multiple crops, and can serve a wider range of customers.[362] As noted above, both private capital (foreign and domestic) and, prior to 2018, public capital have funded the building of PA and packing houses in Mexico. However, obtaining capital can be difficult, as interest rates tend to be high in Mexico and can limit the ability to build or expand PA, especially high-tech projects.[363]

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[356] Iliff, "Mexico's Boom Strains Labor Markets, Infrastructure for Suppliers," September 9, 2016; USITC, *Raspberries for Processing*, June 2021, 156–57. USITC, hearing transcript, April 8, 2021, 264 (testimony of Craig Slate, Frello Fresh, LLC); industry representative, interview by USITC staff, May 28, 2021; Escobar, Martin, and Stabridis, *Farm Labor and Mexico's Export Produce Industry*, October 2019, 133–35, 153.

[357] USDA, FAS, *Mexico: Greenhouse and Shade House Production*, April 22, 2010, 5; Valerio, "Materiales Necesarios Para Instalar Tu Primera Estructura De Casa Sombra," June 26, 2015; Transfer LBC, *Opportunities for Dutch Businesses*, April 2020, 19.

[358] USITC, hearing transcript, April 8, 2021, 311 (testimony of Jamie Chamberlain, Chamberlain Distributing). Other estimates reflect similar spreads.

[359] One estimate, however, put shade houses in Yucatan at $62,000/ha. Government official, interview by USITC staff, June 1, 2021; industry representative, interview by USITC staff, July 2, 2021; Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, 2011, sec 3.5.1; de Anda and Shear, "Potential of Vertical Hydroponic Agriculture in Mexico," January 20, 2017, 6.

[360] USITC, hearing transcript, April 8, 2021, 311 (testimony of Jamie Chamberlain, Chamberlain Distributing); Victoria, van der Valk, and Elings, *Mexican Protected Horticulture*, 2011, sec 3.5.1.

[361] Yields vary annually, by cucumber variety, production system, and by geographic location. For example, in 2020, the average yield for English cucumbers in Sinaloa was about 54 mt/ha in open fields, almost 146 mt/ha in shade houses, and 177 mt/ha in greenhouses. In Sonora, that year English cucumber yields were about 145 mt/ha in shade houses, and 273 mt/ha in greenhouses. In 2020, yields for American slicers grown in greenhouses were close to 198 mt/ha in Sinaloa and 240 mt/ha in Sonora. Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 7 and 11, 2021; USDA, FAS, *Mexico: Greenhouse and Shade House Production*, April 22, 2010, 5.

[362] Industry representative, interview by USITC staff, July 6, 2021.

[363] Industry representative, interview by USITC staff, July 6, 2021.

While the initial investment can be quite high, the use of PA appears to lower some input costs for growers (compared to open field production). Generally, the more advanced the technology used, the lower the input use and, therefore, the greater the input costs savings. For some low-tech PA systems, the savings on input costs over open field systems can be small.[364] The greatest savings however are seen by those using high tech greenhouses. For example, the environment controls offered by PA can reduce the use of both agrichemical inputs and energy, which is reported to be linked to irrigation technology.[365] One exception to this rule (higher-technology PA systems, lower input costs) is seeds, as cultivars for PA environments are reported to cost more than those for open field.[366]

Mexico's climate provides a number of competitive advantages, including increasing the supply window and enhancing quality.

Mexico's naturally favorable climate in its cucumber-growing regions contributes to the competitiveness of fresh market cucumbers in several ways. Much of the country, including the major cucumber-producing states of Sinaloa and Sonora, is arid. This dry climate is more conducive to producing horticultural products compared to more humid climates as growers face fewer weed and pest pressures.[367] This can both contribute to better quality product as plants face fewer stressors, and lower agrochemical use, since it results in lower pesticide needs and labor spent on activities like weed and pest management.[368] Reduced pest and disease pressure also reportedly allows growers to select higher-yielding seed, because higher-yielding seed cultivars often provide less pest/disease resistance.[369] In addition, greenhouses reportedly are more conducive to use in dry climates than humid ones.[370] Mexican growers also reportedly face fewer events of low temperatures and excess rainfall, which can lower cucumber yields and quality.[371] Sinaloa also has a lower freeze risk than U.S. winter vegetable producers.[372] Mild weather allows Mexico to supply cucumbers during the winter.

[364] Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 17–21.
[365] The use of precision irrigation can also lower costs by delivering exact amounts of water and fertilizer to plants. Johnson, "Nogales Spring Vegetable Supply," January 1, 2015; Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 17–18. USITC, hearing transcript, April 8, 2021, 301 (testimony of Rob Sbragia, Tricar Sales, Inc.).
[366] Johnson, "Nogales Spring Vegetable Supply," January 1, 2015.
[367] While Mexico does experience water stress, as noted above, irrigation significantly mitigates its impacts on the fresh cucumber industry. USITC, hearing transcript, April 8, 2021, 239 (testimony of Craig Slate, SunFed Produce); industry representative, interview by USITC staff, February 3, 2021; USITC, *Global Economic Impact*, June 2020, 250.
[368] Industry representative, interview by USITC staff, February 24, 2021.
[369] Industry representative, interview by USITC staff, July 2, 2021.
[370] USITC, hearing transcript, April 8, 2021, 117–18 (testimony of Gene McAvoy, University of Florida IFAS; Charles Hall, FFVA).
[371] CAADES et al., written submission (cucumbers), March 24, 2021, 5; CAADES et al., written submission (squash) March 24, 2021, 6; USITC, hearing transcript, April 8, 2021, 30 (testimony of Gerardo Lameda, Embassy of Mexico); Bareuther, "Western Mexico Spring Ag Update," April 29, 2020; Canales, Andrango, and Williams, "Mexico's Agricultural Sector," 2019.
[372] Cook, "Mexico's Agricultural Export Sector," slide 10.

Mexican production systems and practices increase product differentiation and availability.

Mexico's production systems and practices, particularly its widespread use of PA, are an important competitive advantage in its fresh market cucumber production and export. PA enhances Mexico's product differentiation in a number of ways. It increases the range of products that can be produced: largely all Persian and most English cucumbers grown in Mexico are grown in PA systems.[373] English and Persian varieties have thinner skin than American Slicers, making them more susceptible to damage from environmental factors.[374] In addition, the price premiums English and Persian cucumbers command warrant the increased cost of PA systems.[375] PA also improves the ability of Mexican growers to meet both government and industry quality and food safety standards in export markets. Since they are better protected from environmental, biological, and climatological stressors, cucumbers grown under PA generally are higher quality, which include a better appearance (preferred shape and uniform color).[376] The use of PA can also reduce the need for agrichemical inputs and minimize contact with potential contaminants present in open fields and enhance compliance with food safety standards.[377] Mexico's reliability of supply benefits from the higher yields generated in PA systems compared to open field.[378] For example, in 2020, American slicers grown in Mexico had an average yield of about 40 mt/ha in open fields, compared to about 146 mt/ha in shade houses and almost 214 mt/ha in greenhouses.[379] Growing seasons are also extended giving Mexico the ability to provide year-round supply (at least at low levels).[380]

In addition to PA, Mexico has certain widely used production practices—especially vertical production and irrigation—that help to increase the production quality and availability of Mexican fresh market cucumbers. Vertical production improves quality by, for example, providing more consistent shape and coloring as well as reducing visual blemishes like "yellow belly" that are more likely to occur in

[373] Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 4 and 7, 2021.
[374] USITC, hearing transcript, April 8, 2021, 136, 141 (testimony of Lance Jungmeyer, FPAA); Burfield, "Inside the World of Cucumbers," January 12, 2021.
[375] Industry representative, interview by USITC staff, April 28, 2021; Karp, "Market Watch: Persian Cucumbers," April 8, 2011; Burfield, "Inside the World of Cucumbers," January 12, 2021.
[376] See e.g., USITC, hearing transcript, April 8, 2021, 242–43, 246 (testimony of Guillermo Martinez, Frello Fresh, LLC), 248–9 (Rod Sbragia, Tricar Sales); U.S industry representatives, interviews by USITC staff, March 9, 2021; Johnson, "Nogales Spring Vegetable Supply," January 1, 2015.
[377] Johnson, "Nogales Spring Vegetable Supply," January 1, 2015; Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 5, 17–18. USITC, hearing transcript, April 8, 2021, 242–43, 246 (testimony of Guillermo Martinez, Frello Fresh, LLC).
[378] See e.g., Canales, Andrango, and Williams, "Mexico's Agricultural Sector: Production Potential," 2019.
[379] There was significant variation in yields by state. For example, in 2020 the top 3 producing states yields for American slicers grown in open fields ranged from a low of 36 mt/ha in Michoacán to a high of 63/ha in Sonora; in greenhouses, from a low of 114 mt/ha in Michoacán to a high of 241 mt/ha in Sonora. Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 7 and 11, 2021.
[380] See e.g., Canales, Andrango, and Williams, "Mexico's Agricultural Sector," 2019; Johnson, "Nogales Spring Vegetable Supply," January 1, 2015. Bareuther, "Western Mexico Spring Ag Update," April 29, 2020; U.S industry representatives, interviews by USITC staff, February 3, 2021 and March 9, 2021.

cucumbers grown on the ground.[381] Such production is also reported to facilitate compliance with food safety requirements because the cucumbers avoid soil-based contamination.[382] Reliability of supply is enhanced by the increase in yields. The use of specific cultivars bred for specific production system and growing practices (e.g., vertical growth) also helps maximize quality and yields.[383] Irrigation is important for reliability of supply given Mexico's dry climate and water scarcity (including occasional droughts).[384] Lack of adequate water can stress plants causing lower yields and can lower the quality of cucumbers; in severe cases it can lead to crop failure.[385] These production practices, coupled with Mexico's climate, result in high yields in the country's open field production. Yields of American slicers grown in open fields in Mexico were almost double those grown in the U.S. Southeast, about 40 mt/ha vs. 21/ha, respectively, during 2016–20.[386] As indicated above, when these production practices are coupled with the use of PA, yields rise substantially.

[381] Industry representative, interview by USITC staff, May 28, 2021; USITC, hearing transcript, April 8, 2021, 244 (testimony of Guillermo Martinez, Frello Fresh, LLC).
[382] CAADES et al., written submission (cucumbers), March 24, 2021, 7.
[383] USITC, hearing transcript, April 8, 2021, 243–44 (testimony of Guillermo Martinez, Frello Fresh, LLC); industry representatives, interviews by USITC staff, May 28, 2021 and July 2, 2021.
[384] The adoption of modern irrigation in the vegetable sector has been particularly beneficial during times of drought in Mexico including 2021 when it experienced a "30-year" drought with Sinaloa and Sonora among the worst affected states. See e.g., World Bank, CIAT, and CATIE, *CSA in Sinaloa*, 2014; Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 6; *Mexico News Daily*, "Day Zero for Water," August 12, 2019**;** WRI, Aqueduct Country Rankings, and Aqueduct Water Risk Atlas: Overall Water Risk, both accessed June 10, 2010; USDA, FAS, *Drought Conditions in Mexico*, June 3, 2021.
[385] Government official, interview by USITC staff, June 7, 2021; industry representative, interview by USITC staff June 1, 2021.
[386] Data for 2015 are not available for the United States. See table 4.3 in chapter 4 and table 2.3 in chapter 2.

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Chapter 4
The Industry in Canada

The Canadian fresh market cucumber industry is an export-oriented industry focused primarily on the U.S. market. Canada's exports to the United States grew steadily during 2015–20 due to increasing demand for burpless varieties, such as English and Persian cucumbers, which are mainly produced in high-technology (high-tech) greenhouses and make up the majority of Canadian fresh market production.

Canada's fresh market cucumber industry faces a number of conditions, some of which enhance its competitiveness while others diminish it. Canada's competitiveness is diminished by high labor costs, which account for a third of the cost of production in Canada, raising overall delivered costs for Canadian producers. However, an accessible foreign worker program may serve to mitigate these higher labor costs and offset shortages of domestic agricultural workers. Additionally, Canada's competitiveness is enhanced by its high-tech greenhouse operations which allow Canada to extend its growing season, produce higher yields than open field production, and grow the increasingly popular burpless varieties. Conversely, the high costs associated with greenhouse construction and operations raise delivered costs.

Production, Trade, and Consumption

Production

Canada is a minor cucumber producer, accounting for less than 1 percent of global production in 2019.[387] Overall production, which averaged 275,182 metric tons (mt) between 2015–20, increased by 24.5 percent over this period, driven by increased production in high-tech greenhouses (see table 4.1). Given Canada's colder climate, greenhouse production of cucumbers is particularly important. Between 2015 and 2020, greenhouse production increased by 30.9 percent to 243,855 mt, which was 81.0 percent of total Canadian cucumber production in 2020. This increase in greenhouse production was driven by a 33.4 percent (1,247 hectares (ha)) increase in greenhouse harvested area (table 4.2). Yields of greenhouse cucumber production, primarily grown for the fresh market, are typically about double those of open field production (table 4.3), which in Canada is primarily for cucumbers for pickling.[388] Cucumbers grown in open fields in Canada are primarily grown on the ground.[389]

[387] FAO, "Crops: Cucumbers," FAOSTAT database, accessed March 3, 2021; Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, May 6, 2020.
[388] Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, May 6, 2020; USITC, hearing transcript, April 8, 2021, 26 (testimony of Nadia Bourély, Embassy of Canada). Official Canadian government statistics indicate 2 to 1 greenhouse to open field yields, while other sources report greenhouse yields in some areas are much higher (about 30 to 1). Government of Canada, written submission to USITC, April 27, 2021, 7–8.
[389] Industry representative, interview by USITC staff, July 1, 2021.

Table 4.1 Cucumbers: Canadian production, by production system, 2015–20

In metric tons and percentages; mt = metric tons.

Production System	2015	2016	2017	2018	2019	2020
Open field (mt)	55,532	64,280	62,204	57,295	59,344	57,306
Greenhouse (mt)	186,274	189,672	206,192	228,725	240,410	243,855
All production systems (mt)	241,806	253,952	268,396	286,020	299,754	301,161
Open field (%)	23.0	25.3	23.2	20.0	19.8	19.0
Greenhouse (%)	77.0	74.7	76.8	80.0	80.2	81.0
All production systems (%)	100.0	100.0	100.0	100.0	100.0	100.0

Sources: Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, May 6, 2020.

Table 4.2 Cucumbers: Canadian area harvested, by production system, 2015–20

In hectares and percentages; ha = hectares.

Production System	2015	2016	2017	2018	2019	2020
Open field (ha)	2,684	2,769	2,369	2,354	2,431	2,277
Greenhouse (ha)	3,739	4,006	4,322	4,560	4,740	4,986
All production systems (ha)	6,423	6,775	6,691	6,914	7,171	7,263
Open field (%)	41.8	40.9	35.4	34.0	33.9	31.4
Greenhouse (%)	58.2	59.1	64.6	66.0	66.1	68.6
All production systems (%)	100.0	100.0	100.0	100.0	100.0	100.0

Sources: Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, May 6, 2020.

Table 4.3 Cucumbers: Canadian yields, by production system, 2015–20

In metric tons per hectare.

Production System	2015	2016	2017	2018	2019	2020
Open field	20.7	23.2	26.3	24.3	24.4	25.2
Greenhouse	49.8	47.3	47.7	50.2	50.7	48.9
All production systems	37.6	37.5	40.1	41.4	41.8	41.5

Sources: Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, May 6, 2020.

Cucumber production in Canada is primarily concentrated in Ontario, which supplied 74.9 percent of Canadian production in 2020 (figure 4.1).[390] Over 80 percent of Ontario's production (185,442 mt) is grown in high-tech greenhouses, mostly for the fresh market, making the province the largest greenhouse producer of cucumbers in Canada.[391] A majority of greenhouse producers in Canada harvest cucumbers from the beginning of spring through the fall, though a small number of producers can produce year-round.[392] Ontario is also the largest producer of open field cucumbers, which are grown primarily for pickling, with 40,306 mt grown in 2020. Ontario harvests pickling cucumbers in the summer. The remainder of Canada's cucumber production is mainly spread between two other provinces that vary in terms of production systems. Quebec, which grows 52.2 percent of its cucumbers in open fields, is the second-largest producer of cucumbers in Canada.[393] British Columbia, on the Pacific coast of Canada, is the third largest producer of cucumbers and the second largest producer of greenhouse cucumbers in the country, with nearly all cucumbers in the province grown in high-tech greenhouses.[394]

[390] Ontario cucumber production in 2020 was 229,872 mt. Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, May 6, 2020.

[391] Canada's high-tech greenhouses consistently have certain characteristics including a permanent glass structure with climate control, growing lights, advanced irrigation techniques and alternatives to traditional soil. OGVG, "Ontario Greenhouse Vegetable Growers," accessed June 16, 2021; Government of Canada, Province of Alberta, "Commercial Greenhouse Vegetable Production," September 2018, 2; Campbell, "Growing Greenhouse Cucumbers," January 15, 2021. For more information on high-tech greenhouses, see section on "Production Systems and Practices."

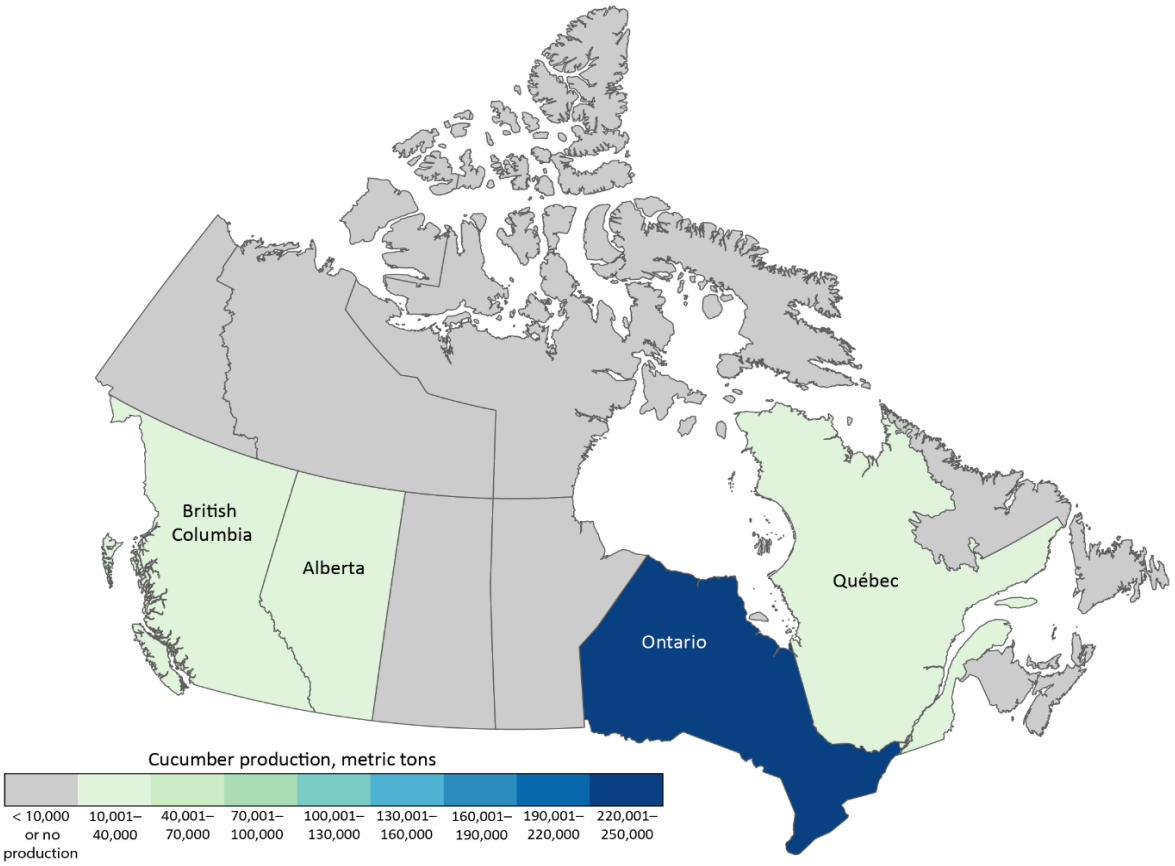
[392] Government official, email to USITC staff, July 1, 2021; Blue Book Services, "Cucumbers," accessed March 4, 2021; Canadian Food Focus, "What's in Season?" October 4, 2020.

[393] Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, May 6, 2020.

[394] Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, May 6, 2020.

Figure 4.1 Cucumber production in Canada, by province, 2020

In metric tons. Underlying data for this figure can be found in appendix F, table F.6



Sources: Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, May 6, 2020.
Note: Data include both open field and greenhouse production.

Trade

Canada is the fourth-largest exporter of cucumbers in the world with 172,344 mt exported in 2020, representing 57.2 percent of its total production.[395] The United States is the largest export destination for Canadian cucumbers, accounting for virtually all exports in 2020.[396] Canadian exports of cucumbers to the United States, 80 percent of which were greenhouse grown in 2020, increased by 46,677 mt (37.1 percent) between 2015 and 2020.[397] Canadian cucumber exports have strong seasonal patterns, with over 90 percent of Canadian exports to the United States in 2019 occurring between March and October, and 40 percent concentrated within just two months of that period, July and August (see

[395] IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed May 11, 2021; Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021.
[396] IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed May 11, 2021.
[397] USITC DataWeb/Census, HTS statistical reporting numbers 0707.00.2000, 0707.00.4000, 0707.00.5010, 0707.00.6010, accessed July 12, 2021.

chapter 6 for an in-depth analysis of seasonal trade trends).[398] Canada's imports of fresh cucumbers remained largely unchanged over the period, decreasing by under 1 percent to 50,228 mt in 2020.[399] Mexico is the largest import source of cucumbers to Canada comprising 82.8 percent of imports in 2020. The United States was the second largest at 7,573 mt in 2020, a 10.0 percent increase since 2015.[400]

Consumption

Despite an overall decrease in vegetable consumption in recent years,[401] Canadian consumer demand for cucumbers showed a slight increase over 2015–20. The apparent consumption of cucumbers in Canada has increased by 7.4 percent between 2015–20, with approximately 70 percent domestically sourced (table 4.4). Per capita consumption averaged 4.8 kg over the period, compared to 5.1 kg in the United States. Demand for greenhouse-grown English and Persian cucumbers has increased.[402] Approximately 55 percent of Canadian production is exported, and the rest is consumed domestically. To supplement domestic production, Canada imports product, primarily during their off-season months when domestic product is not available.[403] Imports, primarily from Mexico, account for approximately 30 percent of domestic consumption.

Table 4.4 Cucumbers: apparent consumption in Canada, 2015–20
In metric tons, kilograms, and percentages; mt = metric tons; kg = kilograms.

Item	2015	2016	2017	2018	2019	2020
Production (mt)	241,806	253,952	268,396	286,020	299,754	301,161
Imports (mt)	50,609	54,653	54,407	54,341	52,861	50,228
Exports (mt)	125,681	144,973	149,355	156,001	167,708	172,345
Apparent consumption (mt)	166,734	163,632	173,448	184,360	184,907	179,044
Per capita consumption (kg)	4.7	4.5	4.7	5	4.9	4.7
Percent of production exported (%)	52.0	57.1	55.6	54.5	55.9	57.2

Sources: Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, May 6, 2020. IHS Markit, Global Trade Atlas, HS heading 0707.00, accessed July 27, 2021; and UN, Department of Economic and Social Affairs, Population Division (2019), accessed May 10, 2021.
Notes: Canada export data do not break out domestic Mexican exports from re-exports. Apparent consumption is calculated as production plus imports, minus exports.

[398] USITC DataWeb/Census, HTS heading 0707.00, accessed July 12, 2021.
[399] IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed May 11, 2021.
[400] On July 1, 2018, Canada imposed a 10 percent ad valorem "surtax" on U.S. cucumbers in retaliation for the United States' application of section 232 tariffs on Canadian steel and aluminum. Imposed at the start of the main harvest season in the United States, U.S. cucumber exports to Canada decreased by 16.0 percent to 5,215 mt in 2018, then increased by 46.6 percent (2,248 mt) in 2019 when the Canadian surtax was removed in May 2019. Government of Canada, Department of Finance, "Updated - Countermeasures in Response to Unjustified Tariffs," May 23, 2019; USTR, "United States Announces Deal with Canada and Mexico to Lift Retaliatory Tariffs," May 17, 2019. IHS Markit, Global Trade Atlas database, HTS heading 0707.00, accessed May 11, 2021.
[401] Tugault-Lafleur, "Canadians' Consumption of Fruit and Vegetables," February 28, 2019.
[402] USITC, hearing transcript, April 8, 2021, 27 (testimony of Nadia Bourély, Embassy of Canada); USITC, hearing transcript, April 8, 2021, 35 (testimony of Andre Solymosi, British Columbia Vegetable Marketing Association); industry representative, email to USITC staff, July 1, 2021.
[403] Industry representative, email to USITC staff, July 1, 2021.

Industry Structure

In Canada, producers of cucumbers destined for the fresh market operate primarily in high-tech greenhouses. Virtually all the cucumbers produced in greenhouses are burpless varieties such as English, Persian, and mini cucumbers.[404] While there is some evidence of open field growers producing American slicers for the fresh market, the majority of open field cucumber production is destined for pickling.[405] Although the share of fresh market production that is organic is unknown, this segment is reportedly growing, as the techniques typically employed in Canadian greenhouses often already meet or come close to meeting the standards required for USDA organic certification.[406] Regardless of variety, the Canadian cucumber industry is export-oriented, exporting roughly 57.2 percent of total cucumber production in 2020.

Industry Composition

The Canadian cucumber industry is highly fragmented at the grower level, although consolidation is occurring. In Canada, there are over 3,300 registered greenhouse operations and over 4,500 open field vegetable operations.[407] Some share of these growers produce fresh market cucumbers, at times as part of a range of horticultural crops. Most growers are smaller and operate at one location.[408] However, there are some relatively large growers, such as Mastronardi Produce, Red Sun Farms, and Nature Fresh. They primarily have greenhouse operations in multiple locations including the United States and Mexico to ensure a year-round supply to their customers.[409] While the number of large growers is limited, according to the 2016 farm census, farming operations appear to be consolidating.[410] Growers of all sizes normally pack their own produce.[411]

[404] USITC, hearing transcript, April 8, 2021, 24, 34.
[405] Industry representative, interview by USITC staff, Philadelphia, PA, August 10, 2021; Les productions Margiric, "Our Products: Cucumbers," accessed August 12, 2021.
[406] One industry representative indicated that while there are likely many growers of organic cucumbers in Canada, not all are getting USDA certified. Industry representative, interview by USITC staff, August 11, 2021. Hortidaily, "Canadian Greenhouse Cucumber Supply Strained," August 16, 2018.
[407] Operations include greenhouse vegetables and greenhouse flowers but excludes cannabis. Government of Canada, Statistics Canada, Table 32-10-0018-01 Estimates of greenhouse total area and months of operation, April 26, 2021; Government of Canada, Statistics Canada, Table 32-10-0403-01 Farms classified by farm type, May 10, 2017.
[408] Government of Canada, Statistics Canada, Table 32-10-0403-01 Farms classified by farm type, May 10, 2017; Government of Canada, Statistics Canada, Table 32-10-0019-01 Estimates of specialized greenhouse operations, greenhouse area, and months of operation, April 26, 2021; industry representative, interview by USITC staff, July 16, 2021; industry representative, interview by USITC staff, August 11, 2021.
[409] Equitable Food Initiative, "Mastronardi Produce Certifies Fifth Operation," September 17, 2020; Manning, "New Mastronardi Produce Greenhouse," December 31, 2019; Red Sun Farms, "Locations," accessed September 7, 2021; Nature Fresh Farms, "Home," accessed September 7, 2021; HortiDaily, "Nature Fresh Farms Doubles Ohio Operations," September 10, 2021; industry representative, interview by USITC staff, June 24, 2021.
[410] Government of Canada, "The Daily—2016 Census of Agriculture," May 10, 2017.
[411] Government official, email to USITC staff, July 1, 2021; industry representative, interview by USITC staff, July 16, 2021; Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; Sijmonsma, "Quebec's Largest Cucumber Grower Ready to Pick," December 20, 2016.

Regardless of farming operation size, products sold outside a province must abide by certain marketing regulations set at the provincial level. In most provinces growers utilize collective marketing efforts either through marketing boards, licensed marketers, or cooperatives.[412] In Ontario and British Columbia growers are legally required to utilize marketers (either marketing boards or individual licensed marketers) to negotiate prices.[413] In Alberta, most growers are part of a cooperative system which collectively markets their product.[414] However, the larger greenhouse operations, particularly in Ontario, are more vertically integrated and often have their own marketing licenses[415]

Production Systems and Practices

While the majority of fresh market cucumbers was greenhouse grown, a small portion (likely less than 5 percent) of production for the fresh market (by mt) was in open fields during 2015–20.[416] Virtually all fresh market cucumbers produced in greenhouses are of a burpless variety, primarily English, followed by Persian and other minis, while Canadian fresh market cucumbers production in open fields allows for limited production of American slicers.[417] Data from Ontario (which accounts for roughly three-quarters of total cucumber production) indicate that as of 2021, 17 percent of production from open fields was destined for the fresh market, with the remainder destined for pickling.[418]

Greenhouse

High-tech greenhouse cucumber production plays a crucial role in the Canadian fresh market cucumber industry given the colder weather and climate faced by Canadian farmers.[419] Canadian greenhouses extend the growing seasons, and, when coupled with certain production practices, generate high yields (compared to open fields).[420] Most cucumber growers cycle crops two to four times per year from late

[412] Government official, email to USITC staff, July 1, 2021.
[413] Government official, email to USITC staff, July 1, 2021; Government of Canada, Province of Ontario, "Overview of the Farm Products Marketing Act," February 12, 2021; Government of Canada, Province of British Columbia, Natural Products Marketing (BC) Act, Pub. L. No. [RSBC 1996] CHAPTER 330, May 25, 2016.
[414] Government official, email to USITC staff, July 1, 2021.
[415] Government official, email to USITC staff, July 1, 2021; industry representative, interview by USITC staff, July 16, 2021.
[416] Data are not available on total Canadian fresh market cucumber production in open fields. Staff estimate was calculated based on data from Ontario. OPVG, "Cucumbers," accessed September 1, 2021; Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021.
[417] Industry representative, interview by USITC staff, June 24, 2021; USITC, hearing transcript, April 8, 2021, 23–24 (testimony of Nadia Bourély, Embassy of Canada); Government of Canada, Province of Alberta, "Commercial Greenhouse Vegetable Production," September 2018, 6.
[418] Data are not available on total Canadian fresh market cucumber production in open fields. Staff calculated Ontario open field production for the fresh market based on data from the Ontario Processing Vegetable Growers and Statistics Canada. OPVG, "Cucumbers," accessed September 1, 2021; Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021.
[419] Martin, "Late April's Heavy Snowfall," April 22, 2021, sec. Local News; Charles, "How Canada Became A Greenhouse Superpower," June 16, 2016, sec. Producers.
[420] Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; Government of Canada, Province of Alberta, "Commercial Greenhouse Vegetable Production," September 2018, 2; industry representative, interview by USITC staff, July 16, 2021; OGVG, "Ontario Greenhouse Vegetable Growers," accessed June 16, 2021.

February to mid-November.[421] While there is some evidence of year-round growing activities, the highest level of production occurs in the summer months corresponding with longer days. Meanwhile, given the high cost of operating in the winter months, operations are typically limited to planting for spring harvests.[422] It is more expensive to produce cucumbers in a high-tech greenhouse, so producers focus on growing more delicate but premium-priced burpless fresh market cucumber varieties, such as English or Persian.[423] Unlike production in the United States and Mexico, greenhouse growers in Canada do not commonly rotate between a mix of crops, and tend to only produce one product.[424]

Greenhouse producers across Canada use very similar high-tech systems and production practices when producing fresh market cucumbers. Growers do not use less permanent protected agriculture structures and medium- and lower-technology greenhouses for fresh market cucumber production.[425] Canadian greenhouses are defined by the Canadian Horticulture Council as a permanent climate-controlled structure completely enclosed in plastic or glass.[426] Cucumbers generally start as seedlings.[427] They are staked and tied to vertical ropes or trellises to which both increases growing area and results in more uniform and aesthetically desirable fresh market cucumbers.[428] Plants are grown either hydroponically in nutrient-infused water solutions or planted in reusable mineral fibers like coconut husks and rockwool.[429] Canadian greenhouses use high levels of technology including automated irrigation and climate control. Normally plants are both watered and fertilized through drip irrigation.[430] Excess water is collected and recycled, reducing waste. In winter months, greenhouses are heated by either electricity, natural gas, or wood furnaces.[431] Also in winter, when there are fewer hours of sunlight, some greenhouses employ the use of high-pressure sodium grow lights.[432] Although the greenhouse structure acts as a barrier to most pests, there are some pest issues. To address these, producers use beneficial insects such as ladybugs.[433]

[421] Government official, email to USITC staff, July 1, 2021; Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; Government of Canada, Province of Alberta, "Commercial Greenhouse Vegetable Production," September 2018, 5; Rettke, "Production Ramping Up," April 6, 2018.
[422] Government of Canada, Province of Alberta, "Commercial Greenhouse Vegetable Production," September 2018, 6; Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; Government official, email to USITC staff, July 1, 2021.
[423] USITC, hearing transcript, April 8, 2021, 24 (testimony of Nadia Bourély, Embassy of Canada).
[424] Government official, email to USITC staff, July 1, 2021.
[425] Government official, email to USITC staff, July 1, 2021.
[426] CHC, "Resolutions as Adopted," March 2014.
[427] Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; Noal Farm, "Awesome Greenhouse Cucumber Farm and Harvest," January 19, 2020.
[428] USITC, hearing transcript, April 8, 2021, 244; Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; industry representative, interview by USITC staff, July 16, 2021.
[429] Nature Fresh Farms, "The Greenhouse Education Center," May 8, 2018; Mastronardi Produce, "The Sunset Difference," accessed September 7, 2021.
[430] OGVG, "Ontario Greenhouse Vegetable Growers," accessed June 16, 2021.
[431] OGVG, "Ontario Greenhouse Vegetable Growers," accessed June 16, 2021; Government of Canada, Province of Alberta, "Commercial Greenhouse Vegetable Production," September 2018, 2.
[432] Nature Fresh Farms, "Technology 101," February 22, 2017.
[433] Nature Fresh Farms, "The Bug Battle," March 28, 2016.

Packing

Packing operations are mechanized and typically take place in packing houses.[434] Large greenhouse operations may have packing operations at the greenhouse. Most other growers pack in a separate packing house, which they usually own.[435] Fresh market cucumbers are taken from harvesting crates and loaded onto automated trolleys to be graded and sorted. Much of the packing operation is automated, allowing for large volumes of cucumbers to be graded, sorted, and wrapped in a short amount of time.[436] Because the English and Persian cucumbers grown in greenhouses are thinner skinned varieties, they are then individually wrapped in plastic to protect the skin and retain moisture. Open field cucumbers may be waxed for protection during long-distance shipping.[437] All cucumbers are then packed into boxes and shipped to customers. Packing practices are the same for product designated for both the domestic market and export to the United States.[438]

Cucumber packing is regulated by the Canadian federal government under the Safe Food for Canadians Act and the Safe Food for Canadians Regulations.[439] Cucumbers must be boxed with others of similar characteristics, meaning seedless and English cucumbers typically grown in greenhouses cannot be mixed with seeded cucumbers such as slicers. Boxes must be sufficiently filled to prevent movement but cannot be overpacked. Cucumbers packed either too tightly or not tightly enough are linked to damage while in transit. Packaging must also be properly marked to identify volume and grade. Furthermore, for cucumbers sold within Canada, all shrink-wraps must be clear.[440] All cucumbers exported to the United States are subject to U.S. laws and regulations, described in greater detail in chapters 1 and 2.[441]

Supply Chain

Canadian fresh market cucumbers are primarily destined for the fresh whole market although some are processed into fresh sliced products. Cucumbers destined for the fresh market are typically packed and stored in refrigerated facilities, shipped in cooled containers, and packaged in smaller containers with

[434] Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; Sijmonsma, "Quebec's Largest Cucumber Grower Ready to Pick," December 20, 2016.
[435] Government official, Canada, email to USITC staff, July 1, 2021; industry representative, interview by USITC staff, July 16, 2021; Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; Sijmonsma, "Quebec's Largest Cucumber Grower Ready to Pick," December 20, 2016.
[436] Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; Sijmonsma, "Quebec's Largest Cucumber Grower Ready to Pick," December 20, 2016.
[437] OGVG, "Ontario Greenhouse Vegetable Growers," accessed June 16, 2021; Government of Canada, Food Inspection Agency, "Cucumbers," April 25, 2011.
[438] Industry representative, interview by USITC staff, July 16, 2021; Campbell, "Growing Greenhouse Cucumbers," January 15, 2021.
[439] Government of Canada, Safe Food for Canadians Act, Pub. L. No. S.C. 2012, c. 24, June 17, 2019; Government of Canada, Safe Food for Canadians Regulations, Pub. L. No. SOR/2018-108, June 17, 2019.
[440] Government of Canada, Safe Food for Canadians Regulations, Pub. L. No. SOR/2018-108, June 17, 2019; Government of Canada, Safe Food for Canadians Regulations, Pub. L. No. SOR/2018-108, June 17, 2019; Food Inspection Agency, "Cucumbers," April 25, 2011.
[441] Government official, interview by USITC staff, July 13, 2021; government official, interview by USITC staff, July 7, 2021.

measures to protect the product.[442] The majority of cucumbers shipped from Canada to the United states are sent by refrigerated trucks or containers to maintain the cold chain and ensure freshness.[443] Delays or breaks in the cold chain during the loading, transport, or unloading processes can cause the cucumbers to experience temperature swings resulting in damage to the vegetables. Speed to market and temperature control throughout the transportation process determine the quality of the product at market and are the most important factors for logistics and transportation.[444]

According to industry representatives, freight rates can have a significant impact on the price of imported cucumbers, as described in additional detail in chapter 6 (Pricing).[445] One analysis similarly found that because refrigerated trucks are a fuel-intensive form of transportation compared to rail and ocean shipping, the wholesale prices of fresh produce are sensitive to changes in fuel prices (which are a major component of freight rates). This is particularly true for U.S. markets that are the furthest distance from Canadian growing regions, such as the U.S. West Coast.[446] This may be why Canadian cucumbers are most often found east of the Mississippi River.[447] However, the analysis found that fuel prices affected wholesale prices less in seasons when there was more competition from vegetables grown within the U.S. region, since this competition limited the ability of sellers to pass fuel price increases (and, by extension, freight price increases) on to buyers.[448]

All types of fresh market cucumbers are sold to retail operations, wholesalers, and food service distributors.[449] However, American slicers are primarily sold to domestic entities while greenhouse-grown burpless varieties are sold to buyers in both Canada and the United States, especially in the retail sector.[450] The food service industry sometimes purchases pre-sliced fresh market cucumbers to use in pre-packaged salads and restaurant salad bars.[451] Fresh market cucumbers are typically exported to states in the Northeast and Midwest United States, and are reportedly seen as complements to the U.S. growing operations due to the lack of overlap with the growing season and varieties grown in the U.S.

[442] Government of Canada, written submission to USITC, April 27, 2021, 5, 9; Government official, email to USITC staff, July 1, 2021; PMA, "Transportation," August 1, 2016.
[443] PMA, "Transportation," August 1, 2016.
[444] PMA, "Transportation," August 1, 2016.
[445] Industry representative, interview by USITC staff, July 16, 2021; industry representatives, interview by USITC staff, August 10, 2021.
[446] Volpe, Roeger, and Leibtag, "How Transportation Costs Affect Fresh Fruit and Vegetable Prices," November 2013.
[447] Industry representative, interview by USITC staff, July 16, 2021.
[448] Volpe, Roeger, and Leibtag, "How Transportation Costs Affect Fresh Fruit and Vegetable Prices," November 2013.
[449] The Canadian pickling cucumber industry is part of an integrated North American pickle and relish supply chain where cucumbers are shipped to processors in the United States and the final product is shipped back to Canada. Cucumbers destined for pickling can be shipped in a wide variety of containers, including bulk, because the market can accept a lower-quality product. Government of Canada, written submission to USITC, April 27, 2021, 5, 9, 20; Government official, email to USITC staff, July 1, 2021.
[450] Government of Canada, written submission to USITC, April 27, 2021, 19–21.
[451] Government of Canada, written submission to USITC, April 27, 2021, 8.

Southeast.[452] This regionality of exports is largely due to the concentration of growing operations in Ontario, and its established distribution networks in the United States.[453]

Cost of Production

Labor costs are a major input cost for producing cucumbers in Canada, although specific costs likely vary by production system and practices. While data specific to costs of cucumber production are not currently available, data on greenhouse vegetable production provide a sense of both the cost structure and cost of production for producing fresh market cucumbers in Canada. As discussed above, the vast majority of fresh market cucumber production in Canada is in high-tech greenhouses.[454] In 2020, Canadian greenhouse operating expenses for vegetable production exceeded $1.1 billion.[455] Production costs include expenses for seeds, water and irrigation, labor, fertilizers, fuel and equipment, energy, and land and rent. Labor accounted for a 30.6 percent share of expenses.[456] Energy costs, including natural gas, heating oil, and electricity, made up 14.0 percent of operating expenses.[457] In Canada, high-tech greenhouses need to provide heating and some run grow lights, particularly in months with fewer daylight hours.[458] Plant materials (seeds, seedlings, cuttings, etc.) made up 10.4 percent of operating expenses. "Other crop expenses," which include fertilizer, pesticides, irrigation, pollination, packaging, and growing mediums, accounted for 19.6 percent of operating expenses.[459]

Delivered Costs

In addition to the cost of production data presented above, other factors such as the capital investment required to set up a greenhouse, costs related to packaging, and freight influence delivered costs. Establishing a greenhouse operation is more capital intensive than open field production. Building a single high-tech greenhouse requires an investment of over $660,000 on average, not including land costs.[460] Additionally, new greenhouses typically require two to three years of lead time to begin

[452] USITC, hearing transcript, April 8, 2021, 25 (testimony of Nadia Bourély, Embassy of Canada).
[453] Government of Canada, written submission to USITC, April 27, 2021, 22; Government official, email to USITC staff, July 1, 2021.
[454] Government of Canada, written submission to USITC, April 27, 2021, 4; Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021.
[455] Government of Canada, Statistics Canada, Table 32-10-0025-01 Specialized greenhouse producers' operating expenses, April 26, 2021.
[456] Government of Canada, Statistics Canada, Table 32-10-0025-01 Specialized greenhouse producers' operating expenses, April 26, 2021.
[457] Government of Canada, Statistics Canada, Table 32-10-0025-01 Specialized greenhouse producers' operating expenses, April 26, 2021.
[458] Government of Canada, written submission to USITC, April 27, 2021, 13–14.
[459] Government of Canada, Statistics Canada, Table 32-10-0025-01 Specialized greenhouse producers' operating expenses, April 26, 2021.
[460] Unless noted otherwise, all values are denoted in US dollars. Exchange rate was calculated by USITC staff using the twelve-month prior average exchange rate of CA$0.7892 – $1. Government of Canada, Bank of Canada, "Currency Converter," accessed September 7, 2021; Government of Canada, written submission to USITC, April 27, 2021, 12–14.

operation due to construction and permitting requirements. The fixed costs associated with setting up a greenhouse operation can approach up to $2 million per acre total (about $4.9 million per ha).[461]

Packaging, particularly the specialized packaging required for burpless cucumbers, also raises delivered costs. While packaging costs can vary, one industry representative estimated that packaging (including boxes, labels, shrink-wrap, and palletization) generally costs around $1.50 per box, or around 15 percent of a box's sales price. Costs for specialty packaging, including clamshells, bags, and top-seal wraps, can be higher.[462] There are also reports that the costs of certain packaging, particularly shrink-wrap, have been increasing over the past five years.[463] As mentioned above, freight rates can also have a significant impact on delivered cost.

Labor

Labor needs vary by production system and production practices used, although producing cucumbers, in general, is labor intensive. Greenhouse vegetable operations tend to have higher labor needs per hectare compared to open field production in Canada. One reason is the extended growing season in greenhouses, and those workers being employed for longer periods and in some cases, year round.[464] Work in greenhouse cultivation is considered semiskilled.[465] In greenhouse systems daily maintenance activities include pruning and wrapping the main cucumber vine along wires extending from the ceiling of the greenhouse, as optimal growing conditions can lead to vines growing several inches in one day.[466] Workers normally use vehicles such as scissor lifts and cherry pickers to facilitate these activities as well as harvesting and cutting. The use of this equipment allows farm workers to cover more ground more quickly, requiring fewer workers per hectare.[467] Once the cucumber plant has reached maturity and begins producing, harvesting takes place daily and can last for several weeks or even months.[468] Furthermore, workers can transport harvested cucumbers in wheeled crates enabling more cucumbers to be harvested at one time, per worker.[469] When the growing cycle ends and the vines stop producing, greenhouse workers cut down the vines and install the next batch of seedlings. Open field cultivation is more seasonal in nature. Open field production requires less daily maintenance of plants with labor

[461] Government of Canada, written submission to USITC, April 27, 2021, 13–14; industry representative, interview by USITC staff, July 16, 2021.
[462] Industry representative, interview by USITC staff, July 16, 2021.
[463] Davidson, "Balancing Supply with Demand," February 29, 2016.
[464] Government of Canada, Province of Alberta, "Commercial Greenhouse Vegetable Production," September 2018, 5, 9; Blue Book Services, "Cucumbers," accessed March 4, 2021. LaPlante et. al, "Canadian Greenhouse Operations," June 17, 2021.
[465] Industry representative, interview by USITC staff, July 16, 2021.
[466] Industry representative, interview by USITC staff, August 11, 2021; Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; Charles, "How Canada Became A Greenhouse Superpower," June 16, 2016, sec. Producers; Noal Farm, "Awesome Greenhouse Cucumber Farm and Harvest," January 19, 2020.
[467] Noal Farm, "Awesome Greenhouse Cucumber Farm and Harvest," January 19, 2020; Industry representative, interview by USITC staff, August 11, 2021.
[468] Eppich, "Why Greenhouse Cucumber Popularity Continues to Grow," March 11, 2021; Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; Government of Canada, Province of Alberta, "Commercial Greenhouse Vegetable Production," September 2018, 9.
[469] Noal Farm, "Awesome Greenhouse Cucumber Farm and Harvest," January 19, 2020.

needs peaking during planting and harvesting.[470] In addition, Canadian open field production does not generally use trellises, which require additional labor for installation and maintenance.[471]

A discussion of wage rates in Canada is contained below under the subheading "Government Programs and Regulations".

Foreign Worker Programs

In order to have sufficient labor, Canadian farmers rely heavily on foreign workers.[472] One Canadian cucumber producer reported that temporary foreign workers (TFWs) make up about 70 percent of employees in one of their growing facilities.[473] Reliance on foreign worker programs imposes additional costs on Canadian producers related to Canadian policies governing foreign workers which require administrative fees and certain benefit offerings. All temporary foreign workers must be covered under one of the federal foreign agricultural worker programs and sponsored by an employer within Canada engaged in primary agriculture. There are two main programs used by cucumber growers in Canada: the Seasonal Agricultural Worker Program (SAWP) and the temporary foreign worker agricultural stream. The most used program by cucumber producers is the SAWP.[474] Under the SAWP, Canadian cucumber producers can hire temporary foreign workers (TFWs) from Mexico and/or participating Caribbean countries for up to eight months between January 1 and December 15 of a given year.[475] Employers are responsible for covering transportation to and from Canada, housing, and transportation to and from the work site. Additionally, employers are responsible for covering health insurance and healthcare costs until a TFW qualifies for local provincial public health care.[476] Canadian cucumber producers are also able to hire TFWs for up to two years from any country under the temporary foreign worker agricultural stream. Like the SAWP, employers must cover transportation costs, healthcare, and housing. However, unlike SAWP, employers are permitted to charge a nominal rent for housing costs: $23.68 weekly unless set to a lower amount by provincial regulations.[477]

Cucumber producers who hire foreign workers under one these two programs must meet certain requirements. Regardless of the program used, employers must apply for a Labour Market Impact Assessment (LMIA) to begin the process to hire foreign workers. Once a LMIA request has been approved, employers are subject to several inspections to ensure TFWs have adequate housing, access

[470] Open field production techniques in Canada are reportedly similar to open field techniques utilized in the United States. Industry representative, interview by USITC staff, August 11, 2021; TRUE FOOD TV, "Cucumber, How Does It Grow?" April 27, 2019.
[471] Government representative, email message to USITC staff, July 1, 2021.
[472] Government of Canada, written submission to USITC, April 27, 2021, 13; Canadian government official, email to USITC staff, July 1, 2021; USITC, hearing transcript, April 8, 2021, 37–38; industry representative, interview by USITC staff, August 11, 2021; Farm & Food Care, "Seasonal Workers in Canada," July 23, 2019.
[473] Industry representative, interview by USITC staff, August 11, 2021.
[474] Industry representative, interview by USITC staff, August 11, 2021.
[475] In 2021, SAWP work permits were extended to nine months to accommodate a quarantine period due to the COVID-19 pandemic. Government of Canada, Employment and Social Development, "Hire a Temporary Worker through the Seasonal Agricultural Worker Program—Overview," November 23, 2015.
[476] Government of Canada, Employment and Social Development, "Hire a Temporary Worker through the Seasonal Agricultural Program—Program Requirements," November 23, 2015.
[477] Government of Canada, Employment and Social Development, "Hire a Temporary Foreign Worker through the Agricultural Stream," November 23, 2015.

to healthcare, and satisfactory working conditions. All TFWs must be provided with the same minimum wage, labor conditions, human rights, and social protections as Canadian citizens working in the cucumber industry.[478]

Government Programs and Regulations

Canadian government programs, laws, and regulations affect the cucumber industry in several ways. First, the Canadian government operates agricultural loan and grant programs funded at both the federal and provincial level, some of which may benefit cucumber producers.[479] Second, as discussed above, the Canadian federal government regulates how cucumbers are packaged, labeled, and marketed. Third, Canadian federal and provincial government regulations affect labor supply and cost, since they determine the minimum wage and the number of foreign workers available to producers.

Loan and Grant Programs

At the Canadian federal level, farmers producing qualifying crops, including cucumbers, are eligible for funds under the Canadian Agricultural Loans Act (CALA) and the Canadian Agricultural Partnership (CAP). The CALA and CAP programs provide government-backed loans and funding opportunities to help farmers raise capital for farming operations. This Canadian federal government support is provided to the agricultural sector broadly, and the cucumber industry is among many crop producers that may benefit.[480] In addition, some programs such as the fuel charge exemption program help to reduce the costs of greenhouse operations. Under this exemption, greenhouse operators are eligible to pay only 20 percent of the fuel charges stipulated under the Greenhouse Gas Pollution Pricing Act (GGPPA) and the Fuel Charge Regulations.[481] The GGPPA sets minimum national carbon pricing standards to meet emissions goals under the Paris Agreement on Climate Change.[482] The Fuel Charge Regulations are enabled by the GGPPA to set carbon prices and, in the case of greenhouse operations, provides for exemptions.[483]

At the provincial government level, there are greenhouse-specific support programs that have been used by cucumber producers. For example, in 2016, the Ontario government provided one greenhouse cucumber grower with a CAD$1 million (roughly $790,000) grant to expand operations.[484] In January

[478] Government of Canada, Employment and Social Development, "Hire a Temporary Foreign Worker through the Agricultural Stream," November 23, 2015; Government of Canada, Employment and Social Development, "Hire a Temporary Worker through the Seasonal Agricultural Program," November 23, 2015.
[479] Unless otherwise noted, the term "provincial" includes both provinces and territories in Canada.
[480] Government of Canada, Agriculture and Agri-Food Canada, "Canadian Agricultural Loans Act Program," January 14, 2020; Government of Canada, Agriculture and Agri-Food Canada, "Canadian Agricultural Partnership," May 6, 2016.
[481] Government of Canada, Greenhouse Gas Pollution Pricing Act, Pub. L. No. S.C. 2018, c. 12, s. 186, § 36, June 29, 2021; Government of Canada, Fuel Charge Regulations, Pub. L. No. 2018, c. 12, s. 187, § 5, December 4, 2020.
[482] Government of Canada, Greenhouse Gas Pollution Pricing Act, Pub. L. No. S.C. 2018, c. 12, s. 186, § 36, June 29, 2021.
[483] Government of Canada, Fuel Charge Regulations, Pub. L. No. 2018, c. 12, s. 187, § 5, December 4, 2020.
[484] The 2016 grant was funded through the Southwestern Ontario Development Fund. Davidson, "Balancing Supply with Demand," February 29, 2016; Hill, "Updated: Leamington's Lakeside Produce Expanding," February 2, 2016, sec. Local News.

2021, the government of Ontario announced investments of over $2.85 million across 12 projects to support greenhouse growers through the Greenhouse Competitiveness and Innovation Initiative (GCII). The GCII is a cost-sharing program funded by the Ontario Ministry of Agriculture, Food and Rural Affairs and administered by the Agricultural Adaptation Council. The second phase of the program kicked off in 2020 and provides a grant of up to 50 percent of total eligible costs on projects that increase industry innovation, resilience, and economic growth.[485]

Agricultural Product Marketing

The federal government oversees the marketing of agricultural products destined for interprovincial and export markets through the Agricultural Products Marketing Act (APMA).[486] Under the APMA, provincial governments are granted the authority to regulate the marketing of local agricultural products for the purposes of interprovincial trade and exports.[487] In Ontario, the provincial-level Farm Products Marketing Act (FPMA) is the legal foundation for agricultural marketing regulations. The FPMA establishes marketing boards for various agricultural products.[488] As described above, producers in Ontario are required to use marketing boards to negotiate prices with buyers. For example, while some large producers may have their own marketing licenses, under the FPMA, the Ontario Greenhouse Vegetable Growers is the marketing board responsible for licensing growers, packers, and marketers of Ontario greenhouse tomatoes, cucumbers, and peppers.[489] A similar marketing regime exists in British Columbia.[490] However, as noted above, provincial governments are not required to regulate marketing and some, such as Quebec, allow growers to negotiate directly with buyers.[491]

Greenhouse and Production Regulations

Greenhouse operations are highly regulated at the provincial level. Many of these regulations pertain to environmental protection. In Ontario, for example, greenhouse operators must have a water license known as a "Permit to Take Water" as well as approval to discharge sewage, particularly any waste that contains pesticides. Operators must also follow local ordinances and are subject to inspections.[492] For example, many Ontario greenhouse operators are subject to recently enacted local light abatement

[485] Projects target three categories: biosecurity, environmental stewardship, and production and marketing development. Government of Ontario, "Ontario Supporting Competitiveness in the Greenhouse Sector," January 27, 2021; AAC, "GCII," accessed September 3, 2021; ACC, *GCI Initiative Phase II—Program Guide Version Two*, June 2020, 4.
[486] The term "marketing" refers to negotiations and establishment of market prices and terms of sale for agricultural products in addition to the advertisement of products.
[487] Government of Canada, Agricultural Products Marketing Act, September 11, 2021.
[488] Government of Canada, Province of Ontario, OMAFRA, "Overview of the Farm Products Marketing Act," February 12, 2021.
[489] OGVG, "Who We Are," accessed June 16, 2021.
[490] BCVMC, "Orderly Marketing of BC Vegetables," accessed September 3, 2021; Government of Canada, Province of British Columbia, Natural Products Marketing (BC) Act, May 25, 2016.
[491] Government official, email to USITC staff, July 1, 2021.
[492] Government of Canada, Province of Ontario, "Rules for Greenhouse Operators," July 8, 2021.

regulations which could limit future growth.[493] Other provinces with greenhouse operations maintain similar environmental regulations.[494]

Minimum Wage

Wages are the largest variable cost associated with cucumber production in Canada, regardless of type of growing operation, and this cost is influenced by minimum wage regulations.[495] The provincial governments in Canada set a minimum hourly wage for workers on farms. As of June 1, 2021, hourly minimum wage rates ranged from CAD$11.45 to CAD$16.00 ($9.04 to $12.63), and the average rate in the largest cucumber-producing provinces (Ontario, Quebec, British Columbia, and Alberta) was CAD$14.49 ($11.24).[496] Canadian provinces tend to update minimum wage rates fairly often. For example, the Ontario minimum wage was set to increase three times between 2018 and 2022.[497]

Factors Affecting Competitiveness

As described in chapter 1 of this report, competitiveness of fresh market cucumbers can be measured by comparing delivered costs, product differentiation, and supplier reliability for U.S. products against those of imports. Certain key factors contribute to the competitiveness of Canadian cucumbers in the U.S. market. The Canadian industry uses high-tech greenhouse production to produce highly differentiated, premium cucumbers. However, despite government programs that facilitate access to foreign labor, high labor costs limit the competitiveness of Canadian cucumbers. Key factors affecting the competitiveness of the Canadian industry are identified below and compared to those of other suppliers in chapter 5.

High labor costs likely raise overall delivered costs.

Labor costs in the Canadian cucumber industry are similar to those in the United States and likely raise delivered costs, particularly compared to the costs of production in Mexico. As discussed above, labor costs in Canada account for almost one-third of greenhouse operating costs, so a small change in labor availability or wage rates can have a significant effect on total delivered cost. According to Statistics Canada, payroll expenses (wages plus benefits) for greenhouse operators increased 7.5 percent in 2020 and have been increasing since 2015.[498] Since 2017, the provincial government in Ontario has been

[493] Beytes, "Dealing with Canada's Light-Pollution Laws," April 1, 2021; Wilhelm, "Leamington Council Passes Bylaw" December 8, 2020, sec. Local News; Greenhouse Canada, "North America's Greenhouse Capital Passes Light Abatement By-law," December 12, 2020; Hohenstein, "Light Abatement Bylaws in Effect—Now What?" June 15, 2021.
[494] Government of Canada, Province of Alberta, "Commercial Greenhouse Vegetable Production," September 2018, 3; Government of Canada, Province of British Columbia, Ministry of Agriculture, *Greenhouse*, May 2014, 2–4.
[495] Government of Canada, Statistics Canada, Table 32-10-0136-01 Farm operating revenues and expenses, annual, March 26, 2021; Government of Canada, Statistics Canada, Table 32-10-0025-01 Specialized greenhouse producers' operating expenses, April 26, 2021; Retail Council of Canada, "Minimum Wage by Province," accessed September 7, 2021.
[496] Retail Council of Canada, "Minimum Wage by Province," accessed September 7, 2021.
[497] Government of Canada, Province of Ontario, "Your Guide to the Employment Standards Act," March 25, 2021.
[498] Government official, email to USITC staff, July 1, 2021; Government of Canada, Statistics Canada, Table 32-10-0025-01 Specialized greenhouse producers' operating expenses, April 26, 2021.

implementing a series of minimum wage increases. Some cucumber producers reported that the cumulative increase is limiting their ability to compete with producers in other countries.[499]

An additional risk for Canadian producers is that, as mentioned above, they are heavily dependent on foreign workers to fill their labor needs. This dependence upon temporary foreign workers (TFWs) and the costs in addition to wages associated with housing and transporting TFWs increases actual labor costs in Canada. Furthermore, industry representatives report that foreign worker labor costs are increasing and issues around COVID-19 pandemic-related travel and visa restrictions are further limiting labor supply.[500] One potential advantage for Canada, however, is that industry representatives believe that the TFW programs in Canada may be easier to access and use than the H-2A visa program used in the United States due to their flexibility and the presence of a two-year option.[501]

High-tech greenhouses require more capital and raise certain production and input costs.

Establishing a high-tech greenhouse operation in Canada is more capital intensive than open field production and adds to the cost of producing burpless fresh market cucumbers. Building a high-tech greenhouse requires an investment of over $660,000 on average, not including land costs. Additionally, new greenhouses typically require two to three years of lead time to begin operation due to construction and permitting requirements. The fixed costs associated with setting up a greenhouse operation are reported to approach up to $2 million per acre total.[502] Greenhouse growers are eligible for CALA and CAP.[503] While these government programs geared towards providing capital to agricultural production may help alleviate some of these costs, industry representatives have reportedly seen little evidence greenhouse operators are utilizing CALA and CAP.[504] Starting in 2021, some producers in Ontario may also be able to offset some high greenhouse investment costs using the provincial level GCII.[505]

Despite lowering certain input costs, such as pesticides, greenhouse production generally results in a higher delivered cost for Canadian burpless cucumbers because of high heating and regulatory costs. As

[499] Industry representative, interview by USITC staff, August 11, 2021; USITC, hearing transcript, April 8, 2021, 37–38 (testimony of Glen Snoek, Ontario Greenhouse Vegetable Growers) and 42–43 (testimony of Andre Solymosi, British Columbia Vegetable Marketing Commission.
[500] Government official, interview by USITC staff, March 2, 2021; Triandafyllidou, Nalbandian, "Can Crisis Be an Opportunity for Canada's Migrant Farmworkers?" June 11, 2020.
[501] Under the temporary foreign worker agricultural stream, eligible workers can remain in Canada for up to two consecutive years. Government of Canada, Employment and Social Development, "Hire a Temporary Foreign Worker through the Agricultural Stream–Program Requirements," November 23, 2015; Industry representative, interview by USITC staff, August 11, 2021; DiStefano, "Why the U.S. Mushroom Business Is Migrating to Canada," July 23, 2020; Keung, "Push for Permanent Residency for Migrant Workers," October 30, 2017.
[502] Government of Canada, written submission to USITC, April 27, 2021, 13–14; industry representative, interview by USITC staff, July 16, 2021.
[503] Government of Canada, Canadian Agricultural Loans Act, accessed June 16, 2021; Government of Canada, Agriculture and Agri-Food Canada, "Canadian Agricultural Partnership," May 6, 2016.
[504] Industry representative, interview by USITC staff, August 11, 2021.
[505] Government of Canada, Province of Ontario, "Ontario Supporting Competitiveness in the Greenhouse Sector," January 27, 2021; AAC, "GCII," accessed September 3, 2021; ACC, *GCI Initiative Phase II - Program Guide Version Two*, June 2020, 4.

discussed earlier, greenhouse production has more opportunities for automation, which may increase efficiency, limit waste, and reduce some input costs compared to open field systems.[506] This nominally reduces certain input costs of Canadian burpless cucumbers. However, despite these efficiencies, it costs more in Canada to grow fresh market cucumbers in greenhouses than in open fields. This is primarily because day-to-day production costs remain high due to the necessity of providing heating (and, if operating in the winter, running grow lights).[507] The federal government has efforts in place to help reduce fuel and other select input costs for greenhouse operations, such as the fuel charge exemption. However, as indicated above, there are several regulations, particularly environmental, that affect greenhouse operations, likely raising production costs. These regulations are primarily at the provincial level. Some industry representatives have expressed the view that these regulations are limiting the growth of greenhouse operations as provincial governments place moratoriums on issuing new permits and water licenses.[508]

Canada's high-tech greenhouse operations enhance reliability of supply and product differentiation.

While costly, the use of high-tech greenhouses increases the reliability of supply of Canadian fresh market cucumbers because the controlled growing environment facilitates higher yields and extends the growing season.[509] Official government statistics indicate that Canadian cucumber yields (including pickling cucumbers) in greenhouses were roughly twice those of open field production.[510] Greenhouses are completely enclosed, and the crops inside are protected from most pests, diseases, and weather-related issues faced in open field systems.[511] Vertical growing methods are also a factor in increasing yields as they allow for greater output per ha.[512] With cucumbers growing in monitored climate-controlled environments, Canadian producers can also ensure a steady supply for the market over an extended growing season.[513] Additionally, greenhouse operations allow for multiple harvests per year.

[506] Greenhouse cucumber production may become more automated in the near future as pilot programs utilizing robotics and artificial intelligence are being developed. Such automation would be expected to impact labor costs as well as overhead costs. Vineland Research and Innovation Centre, "An Automated Workforce to Harvest Canada's Greenhouse Cucumbers," November 19, 2019.
[507] Government of Canada, written submission to USITC, April 27, 2021, 12–14.
[508] Industry representative, interview by USITC staff, July 16, 2021.
[509] Industry representative, interview by USITC staff, July 16 and August 11, 2021.
[510] Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, May 6, 2020. As noted above, while official government data report a two-to-one ratio for greenhouse to open field yields, there are some reports that greenhouse yields are much higher (about 30 to 1). Government of Canada, written submission to USITC, April 27, 2021, 7–8.
[511] Rich et al., "Considerations for Managing Greenhouse Pests," June 2020, 3.
[512] Campbell, "Growing Greenhouse Cucumbers," January 15, 2021; industry representative, interview by USITC staff, July 16, 2021.
[513] Industry representative, interview by USITC staff, July 16, 2021; industry representative, interview by USITC staff, August 11, 2021; Purdy, "High-Tech Vegetables: Canada's Booming Greenhouse Vegetable Industry," March 2005, 4; Eppich, "Why Greenhouse Cucumber Popularity Continues to Grow," March 11, 2021; Charles, "How Canada Became A Greenhouse Superpower," June 16, 2016, sec. Producers.

However, production remains limited in the winter months due to the high cost of operating during the coldest and lowest sunlight months of the year, somewhat dampening Canada's reliability of supply.[514]

Greenhouse production also enables the Canadian cucumber industry to obtain a high degree of product differentiation. First, the protected environment enables producers to grow more delicate varieties that feature a thinner skin but can be preferred for their less bitter flavor.[515] Additionally, regardless of variety, greenhouse cucumbers tend to be preferred by consumers because they are more consistent in their shape, size, and uniformity of color, and viewed as a higher quality.[516] This is due in part to the increased vertical area for growing which allows cucumbers to grow unimpeded. The use of hydroponic and drip irrigation techniques also allows farmers to optimize the nutrients needed for each cucumber plant and enhance its appearance.[517]

[514] Industry representative, interview by USITC staff, July 16, 2021; industry representative, interview by USITC staff, August 11, 2021; Rettke, "Production Ramping Up," April 6, 2018; Davidson, "Balancing Supply with Demand," February 29, 2016.
[515] Industry representative, interview by USITC staff, July 16, 2021; industry representative, interview by USITC staff, August 11, 2021; Eppich, "Why Greenhouse Cucumber Popularity Continues to Grow," March 11, 2021; Charles, "How Canada Became A Greenhouse Superpower," June 16, 2016, sec. Producers.
[516] Eppich, "Why Greenhouse Cucumber Popularity Continues to Grow," March 11, 2021; Canadian Food Focus, "What's in Season?" October 4, 2020; Campbell, "Growing Greenhouse Cucumbers," January 15, 2021.
[517] Eppich, "Why Greenhouse Cucumber Popularity Continues to Grow," March 11, 2021; Campbell, "Growing Greenhouse Cucumbers," January 15, 2021.

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Chapter 5
Cross-country Comparison of Competitiveness

Several countries, including the United States, supply the U.S. market with fresh market cucumbers with Canada and Mexico being the dominant foreign suppliers. The competitiveness of these suppliers, however, somewhat varies. The Commission's research showed that the United States as a whole and the U.S. Southeast are both high-cost producers of moderately differentiated products, supplying primarily American slicer cucumbers. U.S.-produced American slicer cucumbers are mostly grown using open field production practices on the ground, which can result in cucumbers with less uniform shape and color. Canada is also a high-cost supplier of fresh market cucumbers but offers more highly differentiated goods than the United States, supplying significant quantities of increasingly in-demand burpless cucumbers (English, Persian, and other mini cucumbers), mostly grown in high-technology greenhouses, as well as a small amount of open field American slicers. Mexico is a medium-cost supplier of highly differentiated products, supplying American slicers grown under protected agriculture (PA) (mainly shade houses) and in open fields, often with vertical production practices such as trellising, as well as burpless cucumbers, which are largely grown using PA and comprise an increasing share of Mexican production. All three countries are reliable suppliers.

This chapter includes a cross-country comparison that draws from chapters 2–4 of the report, which assesses the competitive strengths and weaknesses of the fresh market cucumber industries in the United States, with a focus on the U.S. Southeast, Canada, and Mexico.[518] It identifies and evaluates several key competitive factors for fresh market cucumbers in a qualitative framework (described in chapter 1). The comparison of competitive factors in this chapter focuses on cucumbers for the fresh market.

Competitive factors influence the ability of an industry to supply products with the characteristics demanded by buyers, who base their purchasing decisions on three primary criteria: delivered cost, product differentiation, and reliability of supply. Delivered cost reflects the cost to produce and deliver fresh market cucumbers, including fixed costs such as PA structures and variable costs such as labor, seed, chemical inputs, packing, transportation, trade, and compliance costs. Product differentiation refers to the ability to provide fresh market cucumbers in the varieties and packaging wanted by buyers and with the desired product characteristics such as shape, coloring, size, or cultivation method (organic or conventional). Reliability of supply refers to the ability of suppliers to deliver an agreed-on quantity of product to a specified location at a contracted time, which can depend on the weather, the type of production system used, the efficiency of supply chains, the functioning of marketing information systems, and other supply and production factors.

[518] In 2020, Canada and Mexico accounted for 95.7 percent of the U.S. imports of fresh cucumbers. USITC, DataWeb/Census, HTS heading 0707.00, accessed July 30, 2021. This includes imports of fresh cucumbers for fresh market consumption and for pickling.

Industry Comparison

Comparing industry orientation (home market or export market), production systems and practices, and yields can give an idea of the relative strengths and weaknesses of a country's industry compared with its competitors. Both Canada and Mexico are highly export-oriented, with 57.2 percent and 70.0 percent of production exported in 2020, respectively (table 5.1).[519] The United States focuses on the domestic market, with only 2.3 percent of its production exported in 2020. Yields are significantly higher in countries where PA and vertical production practices (e.g., trellising) are widely used, like Canada and Mexico, which had higher levels of productivity in 2020 (compared to the United States), with yields of 41.5 and 73.5 metric tons (mt) per hectare (ha), respectively.[520] Growers in Mexico and Canada typically use vertical production practices to achieve greater production per surface area. Growers in Mexico, where wage rates are lower, also tend to harvest more frequently and enjoy a climate that allows for a longer growing season and reduces pest pressure and risk of weather damage, further boosting yields.

Table 5.1 Cucumbers: industry summary of production, area harvested, and yield, selected countries and regions, 2020

Production and exports are in metric tons (mt), yield is in metric tons per hectare (mt/ha), and shares and ratios are in percentages; ** = < 0.05 (rounds to zero); n.a. = not available.

Country or region	Production (mt)	Yield (mt/ha)	Protected agriculture share of production (%)	Exports (mt)	Exports to production ratio (%)
United States	635,735	17.3	3.5	14,357	2.3
Southeast	304,907	19.0	**	n.a.	n.a.
Canada	301,161	41.5	81.0	172,344	57.2
Mexico	1,157,198	73.5	60.9	809,814	70.0

Source: USDA, NASS, Vegetables Summaries 2017, 2018, 2019, and 2020; USDA, NASS, QuickStats, Census, Cucumbers, under protection, production, accessed May 11, 2021; official U.S. domestic export statistics using USITC DataWeb/Census, Schedule B heading 0707.00, accessed March 12, 2021; compiled from Statistics Canada, Table 32-10-0365-01 Area, production and farm gate value of marketed vegetables, accessed April 21, 2021 and July 27, 2021; Statistics Canada, Table 32-10-0456-01 Production and Value of Greenhouse Fruits and Vegetables, accessed May 12, 2021; Government of Mexico, SIAP, Anuario estadístico de la producción agrícola: Pepino, accessed May 3, 2021; IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed July 19, 2021.

Notes: Values in 2020 were relatively similar to average values across the 2015–19 time period. The U.S. Southeast includes Florida, Georgia, and North Carolina. Export data are based on exports under HS 0707.00 which includes cucumbers for pickling and for the fresh market. U.S. national and regional production and yields include pickling cucumbers and do not include PA production. U.S. national and regional shares of protected agriculture production are based on USDA Census data from 2019. Canadian and Mexican production and yield statistics include open field and PA production of fresh market and pickling cucumbers.

U.S. yields are significantly lower than those in Canada and Mexico. Although U.S. yield statistics do not include the estimated 3.5 percent of U.S. production that took place under PA in 2020 with corresponding higher yields (table 5.1), including this small share of production would not be expected

[519] Trade statistics include fresh market and pickling cucumbers. For Mexico, the majority of fresh market cucumber production is exported (about 91 percent on average during 2015–20), largely to the United States. Government of Mexico, SIAP, Anuario estadístico de la producción agrícola: Pepino, accessed May 3, 2021; IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed July 12, 2021.

[520] Yield statistics include both open field and PA (greenhouse production for Canada). In Mexico, yields in PA are over three times higher than open field production, and in Canada greenhouse yields are typically about double that of open field yields. Government of Mexico, SIAP, Anuario estadístico de la producción agrícola: Pepino, accessed May 3, 2021; Statistics Canada, Table 32-10-0365-01, Area, production, and farm gate value of marketed vegetables, accessed April 21, 2021; Statistics Canada, Table 32-10-0456-01, Production and value of greenhouse fruits and vegetables, accessed May 12, 2021.

to result in significantly higher average national or regional U.S. yields.[521] Lower relative yields can be attributed to the open field production systems used by U.S. growers, which expose crops to weather elements and greater pest pressures. Open field production in the United States most often involves cucumber plants on the ground and does not benefit from yield gains from vertical production practices. Further, U.S. growers tend to harvest less frequently compared to growers in Mexico. These growing practices, climate risks, and pest pressures contribute to lower U.S. productivity of 17.3 mt per hectare nationwide, and 19.0 mt per hectare in the Southeast (table 5.1). U.S. yields are also lower compared to Canadian and Mexican yields because of a higher prevalence of pickling cucumber production in the United States, which have a single machine harvest that yields fewer cucumbers per harvest compared to hand-picked fresh market cucumbers. Yield data for U.S. fresh market cucumbers alone are available from the U.S. Census of Agriculture in 2015 and indicate an average yield of 22.2 mt per hectare nationally, which is still significantly below total yield data for Canada and Mexico.[522] The U.S. Southeast has slightly higher yields compared to national U.S. yields, likely because of a longer growing season and lower prevalence of pickling cucumber production. Considering fresh market cucumbers only, the southeastern states had yields ranging from 18.2 mt per hectare in North Carolina to 31.4 mt per hectare in Georgia (highest of all states) in 2015.[523]

Competitive Factor Comparison

To analyze the competitive factors affecting the fresh market cucumber sectors across the countries that are major suppliers to the U.S. market, the Commission used a framework that draws together various aspects of the competitive conditions in food and agricultural trade.[524] This framework is introduced in chapter 1 of this report, which includes figure 1.2 that illustrates which competitive factors for agriculture contribute to delivered costs, product differentiation, and reliability of supply.

The level of competitiveness of producers in each of the selected countries and regions in terms of delivered cost, product differentiation, and reliability of supply of domestic fresh market cucumber production is summarized in table 5.2. Countries have been assigned one of three broad designations—high, medium, or low—on each factor in terms of their competitiveness in the U.S. market. The competitive factor categories are based on data and information largely available for all countries and summarized from the country profiles in chapters 2–4. Assessments for the United States are at the national level, with a separate assessment for the Southeast (Florida, Georgia, and North Carolina), the focus of this study. Competitiveness assessments focus on fresh market cucumbers sold in the U.S. market. These assessments are inherently subjective, based on analysis by Commission staff of the factors described below using available data, hearing testimony, and communication with industry experts.

[521] USDA, NASS, QuickStats, Census, Cucumbers, under protection, production, accessed May 11, 2021.
[522] USDA, NASS, QuickStats, Census, Cucumbers, fresh market – yield, accessed September 5, 2021.
[523] USDA, NASS, QuickStats, Census, Cucumbers, fresh market – yield, accessed September 5, 2021.
[524] The Commission uses Michael Porter's theory of competitive advantage as a starting point from which to develop a framework for analyzing competitive conditions affecting agricultural trade. For more information on this framework and its limitations, refer to USITC, *China's Agricultural Trade*, March 2011, E-3 to 3-8; Porter, *Competitive Strategy*, 1980 and Porter, *Competitive Advantage*, 1985.

- **Delivered cost** assessments were largely based on the cost of producing and delivering cucumbers (fixed costs and variable costs such as labor and seed and chemical input costs); costs for packing, storing, and transporting the cucumbers; and other transaction costs, such as tariffs and exchange rate effects. A high delivered cost makes producers less competitive.
- **Product differentiation** was assessed based on producers' ability to deliver products desirable to buyers and end consumers, such as cucumbers with desirable traits, including uniform shape, size, and color; and longer shelf life. The ability to supply different varieties of cucumbers (e.g., burpless cucumbers) and certified organic product was also considered, along with products' branding and packaging. High product differentiation makes producers more competitive.
- **Reliability of supply** was evaluated by considering the volume of exported cucumbers as compared to domestic production and consumption (for Canada and Mexico); variability in year-to-year production and exports; the prevalence of year-round supply; off-season production; and the quality of market infrastructure and logistics chains. High reliability of supply makes producers more competitive.

Table 5.2 Comparison of competitive factor categories for fresh market cucumbers in selected countries, 2015–20

Country or region	Delivered cost	Product differentiation	Reliability of supply
United States	High	Medium	High
Southeast	High	Medium	Medium
Mexico	Medium	High	High
Canada	High	High	Medium

Source: Compiled by USITC staff.
Note: The comparison is based on cucumbers for fresh consumption and does not consider competitive factors of cucumbers for pickling. For the United States, the national level competitive analysis considers the U.S. fresh market cucumber industry for the entire United States. The Southeast analysis considers competitiveness of the industry in Florida, Georgia, and North Carolina.

Delivered Cost

Delivered cost for fresh market cucumbers includes fixed and variable costs of production for growing, harvesting, and packing cucumbers together with costs of delivering the product to a specified location. Fixed capital costs include the cost of PA structures (e.g., greenhouses and shade houses), land, and machinery; and variable costs include input costs (labor for sowing, harvesting, and packing; seeds; and chemicals), packaging costs (e.g., boxes and labels), certifications, and shipping and storage costs. Delivered costs are affected by the variety of cucumbers being produced, the types of production system and practices used, productivity/yields, shipping distances, and freight costs. These costs are spread among the different players in the supply chain.

Although precise comparisons of delivered cost are difficult to make, given the gaps and uncertainties in available data and differences in the types and characteristics of cucumbers supplied, it is possible to classify the profiled country industries into broad categories in terms of delivered cost based on the in-depth analyses in chapters 2–4 and production cost and price comparisons in this section. As shown in table 5.2, Canada and the United States, including the U.S. Southeast, are considered high-cost producers of cucumbers and Mexico a medium-cost producer. This assessment is based on a number of information sources including available comparable data for the United States and Mexico for the costs of production (as reported by growers in both countries), as well as shipping point prices.

Cost of production data for American slicer cucumbers, presented in table 5.3, show the United States is a higher cost producer than Mexico.[525] High labor costs are a primary contributor to higher production costs in the United States and are further discussed below. In the United States, high labor costs contribute to lower productivity and less product differentiation as most growers do not use more labor-intensive growing practices that can increase yields (e.g., vertical production practices) and improve the appearance of the product (e.g., trellising and more precise packing and sorting). The industry in Mexico benefits from lower labor costs relative to the United States, which is especially important for a labor-intensive crop such as fresh market cucumbers. Mexican growers have higher capital costs compared to U.S. growers tied to the common use of PA, such as greenhouses and shade houses, but also higher productivity compared to U.S. open field production.[526] Although directly comparable production cost estimates reported by growers and shipping point prices are not available for Canada, high labor costs relative to Mexico and higher capital costs relative to the United States likely contribute to higher production costs for Canadian cucumber producers. Canadian production in high-tech greenhouses requires significant capital investment, although these costs can be offset by greater productivity and higher prices.[527]

Lower production costs in Mexico can on average be offset by higher freight costs to reach the U.S. markets, as reported by industry and indicated by USDA's Agricultural Marketing Service data on terminal market prices (table 5.3), and this may be particularly true in the U.S. markets that are a greater distance from the Mexican growing regions.[528] U.S. product benefits from lower freight costs when supplying local markets compared to product from Canada, which is grown primarily in Ontario and reaches the East Coast markets in the United States, and from Mexico, which primarily enters through Texas and Arizona for distribution across the United States.

[525] Cost of production data include cost to grow, harvest, and pack cucumbers but does not include distribution or delivery costs and therefore is distinct from delivered costs discussed in the previous paragraph.
[526] In Mexico, building a high-tech greenhouse costs over $1 million per hectare, while the cost of building medium-tech and low-tech greenhouses is lower. One estimate however, put shade houses in Yucatan at $62,000 per hectare. Government official, interview by USITC staff, June 1, 2021; industry representatives, interviews by USITC staff, July 2 and July 16, 2021; Victoria, van der Valk, and Elings, "Mexican Protected Horticulture," 2011, 44; de Anda and Shear, "Potential of Vertical Hydroponic Agriculture in Mexico," January 20, 2017, 6.
[527] For example, building a high-tech greenhouse in Canada requires an investment of close to $1 million on average, not including land costs, and can approach up to $2 million per acre (or about $4.9 million per hectare). Government of Canada, written submission to USITC, April 27, 2021, 13–14; industry representatives, interview by USITC staff, July 16, 2021.
[528] This will vary by terminal market, with freight costs for Mexican product to reach terminal markets in the western United States lower than freight costs to reach elsewhere in the United States. Freight costs for western U.S. markets are generally low enough that they do not offset Mexico's production cost advantage. Terminal market prices are average prices at terminal markets across the United States and include freight costs to respective markets.

Table 5.3 Cost of production estimates, and average shipping point and terminal market prices for American slicer cucumbers, by country and region

In U.S. dollars per 1⅑ bushel box; n.a. = not available.

Country or region	Production cost estimate	Shipping point price, 2015–20 average	Terminal market price, 2015–20 average
United States	7–8	16.65	21.71
Southeast	7–8	16.72	21.84
Canada	n.a.	n.a.	22.68
Mexico	5–6	15.82	23.59

Sources: Industry representative, interviews by USITC staff, March 10 and February 24, 2021; USITC, hearing transcript, April 8, 2021, 68 (testimony of Charles Hall, Florida Fruit and Vegetable Growers Association), 176 (testimony of Caleb Burgin, M.F. Burgin, Inc. d/b/a Burgin Farms); industry representative, email message to USITC Staff, October 11, 2021; USDA, AMS, Market News, custom report, shipping point report, accessed March 16, 2021; USDA AMS, Market News, custom report, terminal market (non-organic) report, accessed March 16, 2021.
Notes: Cost of production estimates are reported by industry representatives, and costs included in the column vary by industry source, but typically reflect the cost to grow, harvest, and pack a one and one-ninth bushel box of cucumbers and do not include distribution or delivery costs. Cost per box varies by yield per hectare, and costs generally decrease as yields increase. Variation in yields per hectare may in part explain differences in cost per box. A box of cucumbers (1⅑ bushel) typically weighs around 25 kg or 55 lbs. At the time of this report, USDA AMS did not collect shipping point data for Canada because there were insufficient resources to cover new markets. Government representative, email message to USITC staff, September 17, 2021. Shipping point prices are not available for cucumbers from Canada. Shipping point and terminal market prices are based on voluntary surveys and represent a small share of sales in the U.S. market. More information on the limitations of these data is presented in chapter 6.

Production Cost Shares

Published production cost data availability and reliability vary among the three countries. Government surveys of actual production costs incurred by growers are often not conducted for specialty crops such as cucumbers, and such cucumber data were not available for any of the countries considered. Instead, the following analysis used "cost and return" worksheets or "budgets" for establishing and growing cucumbers (in the United States) or similar horticultural crops with similar production systems (asparagus and tomatoes in Mexico, and greenhouse vegetables in Canada) that were developed and published by universities, researchers, or government agencies.[529] Cost and return worksheets typically represent hypothetical costs for the production of a given product in a specific area or region grown under specific growing conditions described in the worksheet. The Commission obtained these data for each of the selected countries from separate sources, since common surveys or data sources were not available, likely making them less reliable for comparison purposes. While comparing costs internationally can be complicated by differences in cost definitions, in the treatment of establishment costs and time requirements, in the cucumber types and production systems used, and the year when the estimates were made,[530] the following analysis compares the shares of individual line items in the

[529] For the United States, see Sánchez et al., *Agricultural Alternatives: Cucumber Production*, 2018, 6; Mississippi State University, *Traditional Vegetables 2018 Planning Budgets*, December 2017, 19; McMinn, Rainey, and McWhirt, *Cucumber Production Enterprise Budget*, 2017, 1–3; Fonsah, Kichler, and Shealey, *Cucumber on Plastic Budget*, 2021; Center for Crop Diversification, *Cucumber, Fresh Market, Trickle Irrigated - Kentucky Estimated per Acre Costs and Returns*, 2017. For Canada, see Statistics Canada, Table 32-10-0025-01, Specialized Greenhouse Producers' Operating Expenses (Vegetable), May 6, 2020. For Mexico, see Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas: Jitomate (Michoacán 2018) and Espárrago Mantenimiento (Sonora 2019); Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 10.

[530] USITC, *Conditions of Competition for Certain Oranges and Lemons*, July 2006, 3-15 to 3-16. For a broader discussion of the challenges of international comparisons of costs of production, see AAEA, *Commodity Costs and Returns Estimation Handbook*, February 2, 2000.

budgets in an effort to reveal the specific costs that are driving overall costs of cucumber production in the United States, Mexico, and Canada.

In terms of cost shares, labor accounts for the largest single portion of costs for all countries, with the exception of greenhouse production systems in Mexico, where it is second to fertilizers (table 5.4).[531] Labor cost shares are similar across all three countries, although slightly higher in the United States, possibly because of higher wage rates (see comparison in the Labor Costs section below). However, since Mexican growers use more labor-intensive production practices, the differences in wage rates are not fully reflected in differences across labor cost shares of production. Other significant cost shares include irrigation for the United States and Mexico and energy costs for Canada. The cost of irrigation appears higher in open field systems than in greenhouse systems and is largely driven by material costs of replacing tape-based drip irrigation.[532] Canadian growers, primarily using greenhouses, incur additional energy and electricity costs to provide a source of heat and to run grow lights, particularly in months with fewer daylight hours.[533] As such, energy costs are a significant portion of Canadian production costs.

[531] Greenhouse cost of production data for Mexico in table 5.4 are based on the use of hydroponic production practices. Because no soil is used in these systems, all plant nutrients are provided through fertilizers, increasing its usage.
[532] The greenhouse irrigation cost share for Mexico includes only the cost of water and not the cost of irrigation supplies.
[533] Government of Canada, written submission to USITC, April 27, 2021, 13–14.

Table 5.4 Production cost shares for fresh market cucumbers and proxies (vegetables, tomatoes, and asparagus) by major cost categories
In percentages; n.a. = not available.

Category	United States	Canada	Mexico	Mexico
Production system	Open field	Greenhouse	Greenhouse	Open field
Labor	33	31	24	29
Plant materials	7	10	13	n.a.
Irrigation	25	n.a.	3	22
Fertilizer	5	n.a.	40	22
Plant protection products	5	n.a.	1	9
Energy costs	n.a.	14	n.a.	n.a.
Other	20	45	19	19

Sources: For the United States, Sánchez et al., *Agricultural Alternative: Cucumber Production, 2018*, 6; Mississippi State University, *Traditional Vegetables 2018 Planning Budgets*, December 2017, 19; McMinn, Rainey, and McWhirt, *Cucumber Production Enterprise Budget*, 2017; Fonsah, Kichler, and Shealey, *Cucumber on Plastic Budget*, 2021; Center for Crop Diversification, *Cucumber, Fresh Market, Trickle Irrigated - Kentucky Estimated per Acre Costs and Returns*, 2017. For Canada, Statistics Canada, Table 32-10-0025-01 Specialized Greenhouse Producers' Operating Expenses (Vegetable), May 6, 2020. For Mexico, Government of Mexico, FIRA, Agrocostos: Sistema de Costos Agrícolas; Jitomate (Michoacán 2018) and Espárrago Mantenimiento (Sonora 2019); Pratt and Ortega, *Protected Agriculture in Mexico*, May 2019, 10.
Notes: Shares are based on costs per acre or hectare. Note that overall costs will vary based on yield. The U.S. cost shares do not sum to 100 because they are median values, and the Mexican open field costs do not sum to 100 percent, due to rounding across line items. Certain line items may not appear in all budgets or may reflect varying production practices by region. Plant materials include costs such as seeds and seedlings. Capital costs and packaging costs are not included, except in the case of Canada where these costs cannot be broken out from Statistics Canada "other" categories. Line items included in the "Other" row are not consistent across the 4 COP estimates. United States: U.S. cost of production estimates come from five enterprise budgets developed by agricultural extension departments across several regions of the United States (although they are concentrated in the U.S. Southeast). These budgets reflect the costs to cultivate an acre of hand-planted and hand-harvested cucumbers for the fresh market, grown on plastic using drip irrigation. The U.S. cost shares of total production presented are the median value for these costs across the five budgets used. Other costs for the United States include equipment repair, fuel, interest, insurance, land costs, land preparation, machinery, and overhead/management. Canada: Canadian cost shares are not cucumber specific and represent total greenhouse operating expenses for vegetables in Canada in 2020. Other costs for Canada include two "other" line items listed in the Canada specialized greenhouse operating expenses. The first "other" line item is "other crop expenses" that accounts for 20 percent, and includes: fertilizers, pollination, irrigation, containers, packaging, bioprograms, and growing mediums such as soil, peat moss, vermiculite, perlite, sand, Styrofoam, and sawdust. The second is "other operating expenses" that accounts for the remaining 25 percent of costs, and includes: interest, land taxes, insurance, advertising, repairs to farm buildings, machinery, agricultural equipment, vehicles, contract work, and telephone and telecommunications services. Mexico: Mexican cost shares are estimated from proxy crops for cucumbers, i.e., they are based on data for high-tech greenhouse tomatoes using hydroponics and field grown asparagus using drip irrigation. Other costs for tomatoes include pollinators, outside services, and land preparation materials, and for asparagus other costs include crop insurance, burning, waste removal, social security, outside services, technical assistance, and transportation of harvesting equipment. Water cost shares for Mexico include the cost of water only, not fixed costs for irrigation supplies.

While the share of open field production costs spent on plant protection products in table 5.4 is lower for the United States (5 percent) than for Mexico (9 percent), the types of agrichemicals included in the U.S. cost of production estimates varied, which contributed to a wide range of cost shares across the budgets examined.[534] Some budgets from the U.S. Southeast had higher shares for these costs, which could be an indication that greater pest pressures in the Southeast lead to higher plant protection product costs. As a result, plant protection products may account for a larger share of the cost of production in the United States than reported in the table, especially in the U.S. Southeast where climate-related pest pressures are high. Reportedly, plant protection products are a relatively small share of production costs in Mexico and Canada because of reduced pest pressures from the arid climate in northwestern Mexico and the use of protected agriculture in both countries.[535] With the notable exception of labor, other input costs are reportedly similar in the United States, Mexico, and

[534] Plant protection products include herbicides, fungicides, and pesticides.
[535] Nature Fresh Farms, "The Bug Battle," March 28, 2016; Rich et al., "Considerations for Managing Greenhouse Pests," November 5, 2020, 3; USITC, hearing transcript, April 8, 2021, 239 (testimony of Craig Slate, SunFed Produce); industry representative, interview by USITC staff, February 3, 2021.

Canada because of comparable prices for many inputs including seeds, chemical inputs, as well as packing materials.[536] However, because of higher yields in Canada and Mexico, the unit costs for these inputs may be lower for those growers.

Labor Costs

As noted above, labor costs are one of the largest contributors to the delivered cost of fresh market cucumbers. However, as with other cost comparisons, comparing labor costs across countries is not entirely straightforward. How labor costs are measured and valued is critical for establishing costs of production and for accurately portraying labor's relative share of the total cost of production.[537] Adjustments for currency valuation and the cost of living may be necessary. These labor cost comparisons face other data limitations, including: the highly heterogenous characteristics of farms, farmers, and agricultural wage workers; and the structure of the worker-employer relationship across and within countries.[538]

The International Labour Organization (ILO) publishes data on average wages and earnings across broad employment categories for a number of countries, including the United States and Mexico but excluding Canada.[539] This dataset is constructed and harmonized by the ILO to compare wages and earnings across countries. Hourly earnings for U.S. skilled agricultural, forestry, and fishery workers are significantly higher than for Mexico in both nominal terms and purchasing power parity terms (PPP) (table 5.5).[540] As a point of reference for Canada, according to official Canadian government statistics, the average offered hourly wage for work in natural resources, agriculture, and related production occupations in the province of Ontario (the main cucumber-producing province) was $12.92 in 2019.[541] Wage rates

[536] Industry representatives, interviews by USITC staff, July 2 and July 6, 2021.
[537] AAEA, *Commodity Costs and Returns Estimation Handbook*, February 1, 2000, 8-1**.** The American Agricultural Economics Association has since changed its name to the Agricultural and Applied Economics Association, which has kept the acronym AAEA.
[538] Labor costs comparisons are further complicated by countries' differing reliance on two distinct types of farm labor: (1) hired labor without farm ownership claims, and (2) unpaid farm labor and salaried farm labor having ownership claims. AAEA, *Commodity Costs and Returns Estimation Handbook*, February 1, 2000, 8-1.
[539] The terms and conditions of employment vary tremendously, with work categories that affect how waged agricultural workers are regulated and paid (e.g., permanent full-time workers, seasonal workers, and piece-rate workers). Changes in the labor market structures, along with variable and deficient application of labor laws, create a situation where employees may find themselves without the explicit and implicit protections of a worker-employee relationship. Hurst, *Agricultural Workers and their Contributions*, 2007, 23–31.
[540] PPP is helpful for evaluating wages given different price levels between countries. Wages are still approximately six times higher in the United States than in Mexico in PPP terms (table 5.5).
[541] Quarterly wages for "natural resources, agriculture and related production occupations" for Ontario were averaged across the year and converted from Canadian dollars to U.S. dollars using the exchange rate from August 31, 2021 (0.793154). Statistics Canada, Table 1410-0356-01, Job Vacancies and Average Offered Hourly Wage by Occupation, accessed August 17, 2021.

reported by the ILO and the government of Canada for agricultural, forestry, and fishery workers are similar to those reported for cucumber workers by industry representatives.[542]

Table 5.5 Hourly earnings for skilled agricultural, forestry, and fishery workers in selected countries, 2019

In U.S. dollars. PPP = 2017 purchasing power parity.

Country	Hourly earnings (nominal)	Hourly earnings (PPP)
Mexico	1.38	2.47
United States	15.07	15.07

Source: ILO, Mean Nominal Hourly Earning of Employees by Sex and Occupation, accessed August 17, 2021.
Notes: Data for hourly earnings are from separate databases with different data sources and year availability. Mexico uses the International Standard Classification of Occupations, while the United States uses a nonstandard national classification. The ILO does not provide data for Canada in this data series. In this dataset, nominal totals are converted to U.S. dollars using exchange rates. PPP totals are converted to U.S. dollars using 2017 purchasing power parity rates for private consumption expenditures. PPP rates are currency conversion rates that account for differences in price levels between countries to equalize purchasing power of different currencies.

Shipping Costs

Shipping costs contribute to delivered cost, vary by supplier and destination, and are very volatile. In the U.S. market, domestic and imported fresh market cucumbers are generally transported in refrigerated trucks or containers. Truck freight is the most common form of transportation for both domestic and imported product, although some imports arrive via sea freight.[543] Comparative advantages for shipping costs can shift depending on the location of the point of delivery in the United States. U.S. cucumbers can have a large freight cost advantage in their localized market compared to imported products. For example, U.S. cucumbers produced in the Southeast have a freight cost advantage in markets in the U.S. Southeast relative to imports from Mexico, and product from New Jersey has a freight cost advantage in the Philadelphia and New York regions compared to products from Mexico. Cucumbers from Ontario typically have competitive freight rates in the Northeast United States, and cucumbers from Mexico have more competitive freight rates in the western United States compared to cucumbers from Ontario or the U.S. Southeast.

Product Differentiation

A country's ability to supply a broad range of premium products with desirable characteristics increases its ability to compete via product differentiation. Canada and Mexico are suppliers of premium products (burpless, mini, and/or American slicers grown using protected agriculture and/or vertical production practices)—that is, products with the highest level of product differentiation (figure 5.1). The U.S. industry, including the U.S. Southeast, supplies less-differentiated products (primarily open field, American slicers), but benefits from consumer preferences for local produce.[544] Nationally, the U.S.

[542] Industry representatives reported that workers in the Mexican cucumber industry reportedly earned about $10–$12/day although if paid by the piece they can earn $15–$20/day. In the United States, equivalent workers' wages average about $14/hour (inclusive of H-2A and domestic workers). In Canada, agricultural minimum wages ranged between about $9–$12/hour on June 1, 2021, depending on the province. USITC, hearing transcript, April 8, 2021, 96 (testimony of Richard Bowman, J&J Family of Farms) and 264 (testimony of Rod Sbragia, Tricar Sales, Inc.); USDA, NASS, *Farm Labor*, May 26, 2021.
[543] Industry representatives, interviews by USITC staff, July 2 and July 16, 2021.
[544] Industry representatives, interviews by USITC staff, May 10 and August 27, 2021; academic professional, email message to USITC staff, July 28, 2021; Kemble, *Southeastern U.S. 2020 Vegetable Crop Handbook*, 2020, 52.

industry supplies a small amount of burpless cucumbers, and has limited acreage grown under protected agriculture, which is necessary for growing these premium varieties. The United States also has more limited use of vertical production practices, which tend to improve cucumber quality when used.

Figure 5.1 Types and production methods of fresh market cucumbers supplied to the U.S. market by country or region

A blue colored cell in a column under a particular product means that this country's or region's product is supplied in significant quantities to the U.S. market. A white cell indicates that it is not supplied, or only supplied in small quantities. Underlying data for this figure can be found in appendix F, table F.7.

Country or region	American slicer	Burpless	Local grown	Protected agriculture	Vertical Production
United States (national)	■		■		
Southeast	■		■		
Canada	■	■		■	■
Mexico	■	■		■	■

Source: Compiled by USITC.
Note: There is some limited production of burpless cucumbers and cucumbers grown under protected agriculture and/or with vertical production practices in the United States, including in the U.S. Southeast, but the majority of production is open field, and grown on plastic beds on the ground. There is also a minimal amount of organic production in the United States and the U.S. Southeast, this is estimated to be less than 10 percent of total U.S. production.

Purchasers look at product characteristics as well as cost in making their buying decisions. The more differentiated the product, the more likely it is that product characteristics will be the basis of the purchasing decision, potentially making delivered cost less important. Similar products are differentiated from one another according to factors such as actual and perceived quality, brand identity, packaging, and labeling. Certain cucumber varieties, namely burpless cucumbers, are considered premium products. Cucumbers grown with certain production practices, such as under protected agriculture and/or with vertical production practices, have more desirable shapes and colors and are also considered premium products. American slicers grown without protected agriculture or vertical production practices may have less-desirable shapes and colors and may be considered lower value. Additionally, U.S. buyers place a premium on locally grown produce, with state-level marketing programs promoting local fruits and vegetables in retail stores. Additionally, organic certification is another segment in which demand is growing and can differentiate fresh market cucumbers.

Product differentiation is considered high in both Canada and Mexico based on the industries' ability to supply burpless cucumbers and American slicer cucumbers with desirable color, shape, and size traits. The use of protected agriculture and vertical production practices results in straighter cucumbers with smaller, even sizes, and uniform, unblemished green color—traits highly valued by buyers. In Mexico, the use of more frequent harvesting, more labor-intensive sorting and packing practices, and more capital-intensive packing facilities also results in a preferred product. In Canada, high-tech greenhouses using vertical production practices, which require more daily attention, ensuring a high quality and consistent production. Meanwhile, a large focus on the production of premium burpless varieties helps Canada meet growing demand for these products. Product differentiation is slightly lower in the United States, which primarily produces non-premium varieties grown without labor- and capital-intensive production systems and practices. Nonetheless, U.S. products are better positioned for the U.S. market in terms of preferences for locally grown compared to imported products. Although organic cucumber

production appears to be a lesser focus for producers across all three countries, industry representatives indicate that demand for these products is growing. While all three countries seem to be equipped to serve the organic market to an extent, industry representatives indicate that Canada's current practices in its high-tech greenhouses would allow it to easily meet USDA organic standards if there were an increase in demand. Meanwhile, the U.S. southeastern growers who currently face high production costs for organic product due to pest pressures may be able to increase organic production if higher demand were to allow for a price premium to offset these costs.

Reliability of Supply

Reliability of supply refers to the ability of a supplier to deliver a specified quantity of a product of a particular quality to a given location at a contracted time. The inherent risks in agricultural production, which can impact both the quantity and quality of supply, make this competitiveness factor particularly important for purchasers. Several aspects affect reliability of supply for seasonal, perishable products like fresh market cucumbers. Particularly important is the ability to supply consistent quality and quantities of product despite weather fluctuations and pest pressure. Additionally, the ability to be a year-round supplier, including the ability to supply during the off-season, is important for competitiveness. Geographic location of production and the length of the growing season affect the reliability of supply of fresh market cucumbers. If all the production of a country is concentrated in one small area, an adverse weather event may severely limit supplies. The reliability of the supply chain, including storage and transportation infrastructure as well as market information systems, is also important. To be a reliable supplier to the export market, a country must have an exportable surplus. Export-focused industries with consistent levels of exports tend to be considered more reliable suppliers.

All the profiled industries (including that of the United States and the U.S. Southeast) are broadly considered to be reliable suppliers to the U.S. market for fresh market cucumbers, but not to an equal degree. Mexico and the United States (nationally) are highly reliable suppliers, designated as "high" for reliability of supply (table 5.2). By comparison, Canada and the U.S. Southeast are reliable suppliers, designated as "medium" for reliability of supply. The Mexican industry exports significant quantities of product to the United States year-round, including from late fall to early spring, which is the off-season for much of the United States.[545] Mexico has diverse growing areas and widely uses protected agriculture, which lessens the risk for damage to crop quality and yields from weather events or pest or disease outbreaks.[546] The Mexican industry is highly export-oriented, with consistent levels of exports to the United States, representing about 91 percent of annual production of fresh market cucumbers on average during 2015–20.[547] Similar to Mexico, the U.S. industry is a year-round supplier because it is

[545] Late fall to early spring reflects harvest season for cucumbers grown under PA. Industry representative, interview by USITC staff, March 9, 2021. Note that while growers have the ability to harvest year-round under PA in Mexico, some industry representatives report that the actual growing season is much shorter (November–March) and based on demand. Industry representatives, interview by USITC staff, August 11, 2021.
[546] Around 61 percent of Mexican fresh market cucumber production was in PA in 2020. Government of Mexico, Anuario estadístico de la producción agrícola: Pepino, accessed May 4 and 7, 2021.
[547] Government of Mexico, SIAP, Anuario estadístico de la producción agrícola: Pepino, accessed May 3, 2021.

geographically spread out.[548] For the United States as a whole, this lengthens the growing season and reduces production risks from regional weather events and pest breakouts.

Canada, and the U.S. Southeast are also considered reliable suppliers, although slightly less so than Mexico and the United States nationally. Although the use of high-tech greenhouses allows Canada to provide a more consistent quality of cucumbers than the United States nationally, which has limited use of PA, Canadian exports to the United States are concentrated during the summer months, with limited exports to the United States during the winter season.[549] About 40 percent of Canadian exports to the United States are concentrated into just two months (July and August), which fall during the United States' primary production period (June–October).[550] Production in high-tech greenhouses (81.0 percent of production) extends Canada's growing season and protects crops from climatological issues impacting yields.[551] The U.S. Southeast is not considered a highly reliable supplier largely because of the significant risk to product quality and yields from weather-related events and pest pressures.[552] This is particularly significant because of the region's hot, humid, and rainy climate, and reliance on open field production systems.

[548] Harvest seasons for U.S. States, Mexico, and Canada are presented in figure 1.1 in chapter 1 of this report.
[549] Canada's harvest season is from mid-February to mid-November and reflects the harvest season in greenhouses, as nearly all of Canada's fresh market cucumbers are grown in high-tech greenhouses. However, exports to the United States are concentrated in the summer months. Government official, email message to USITC staff, July 6, 2021; IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed July 27, 2021.
[550] USITC DataWeb/Census, HTS heading 0707.00, accessed July 12, 2021.
[551] Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, accessed April 21, 2021; Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, accessed April 21, 2021; IHS Markit, Global Trade Atlas database, HS heading 0707.00, accessed July 27, 2021.
[552] Industry representatives, interviews by USITC staff, May 10, May 26, and August 10, 2021; USITC, hearing transcript, April 8, 2021, 117–118 (testimony of Gene McAvoy, University of Florida).

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Chapter 6
U.S. Import and Price Trends

The analysis in this chapter includes information on the recent trends in U.S. imports of fresh and chilled cucumbers, including information on seasonal trends for these imports.[553] It also describes monthly price trends for fresh market cucumbers in the United States, including an analysis and comparison of U.S. produced (grown) and imported fresh market cucumbers in the U.S. market. As noted in the request for this report, the U.S. import and price analyses, when possible, focus on the U.S. Southeast. The major cucumber producers in the U.S. Southeast are Florida, Georgia, and North Carolina. These states primarily grow American slicer cucumbers for the fresh market, so when possible, the analysis isolates American slicer varieties. Pickling cucumbers, as well as English, Persian, and Japanese cucumbers for the fresh market are sold at different price points than American slicers and are not considered directly interchangeable products by industry.[554] However, the import trend discussion in this chapter includes all cucumbers because the Harmonized Tariff Schedule of the United States (HTS) classification structure does not differentiate between varieties.[555]

The United States primarily imports cucumbers from Mexico and Canada. When all supplier sources are combined, U.S. imports of all cucumbers follow a clear seasonal pattern of higher volumes in the months from November through May, and lower volumes in the months from June through October. Mexico, the major supplier of fresh market cucumbers to the United States, can supply product year-round, and the volume of imports from Mexico in both periods (November through May, and June through October) has increased over the past few decades.[556]

Industry representatives throughout the supply chain generally agree that, while U.S. demand for cucumbers is consistent and strong year-round, buyers are price conscious, and cucumber prices tend to respond very quickly to sudden increases or decreases in supply. As a result, cucumber prices vary widely throughout the season and change daily.[557] The highly perishable nature of cucumbers also

[553] The Harmonized Commodity Description and Coding System (Harmonized System or HS) heading 0707.00, cucumbers, including gherkins, fresh or chilled will be referred to as cucumbers throughout this chapter.
[554] Prices for English varieties are not directly comparable to those of American slicer varieties grown in the U.S. Southeast because in most months long English seedless cucumbers receive a price premium. USDA, AMS, *Market News*, custom report, terminal market (non-organic), average prices of long English seedless cucumbers compared to average prices for American slicer cucumbers, accessed March 16, 2021.
[555] Industry representatives noted that a portion of all U.S. imports, up to 18 percent, are likely to be long English seedless cucumbers, referring to U.S. imports of "greenhouse" cucumbers from 2017–19, as defined by the HTS, in the USDA's Economic Research Service (ERS), *Vegetables and Pulses Outlook*, VGS-365, December 17, 2020, because this is the most typical variety grown in a greenhouse. FPAA, written submission to USITC, March 29, 2021, 8.
[556] USITC DataWeb/Census, U.S. imports of cucumbers monthly figures, imports for consumption, first unit of quantity, HTS statistical reporting numbers 0707.00.2000, 0707.00.4000, 0707.00.5010, 0707.00.5090, 0707.00.6010, 0707.00.6030, 0707.00.6050, accessed June 16, 2021.
[557] USITC, hearing transcript, April 8, 2021, 304 (testimony of Rod Sbragia, Tricar Sales, Inc.) and 226 (testimony of Brian Robinson, BTR Farms); industry representatives, interview by USITC staff, August 10, 2021.

contributes to prices that fluctuate quickly based on supply and demand, since cucumbers cannot be held in inventory to smooth out supply.[558]

This chapter uses the USDA's Agricultural Marketing Service (AMS) pricing data, which are highly regarded sources of pricing information but still have limitations described in detail in this chapter. The AMS data show that cucumber imports are priced below U.S.-grown (domestic) cucumbers at the point of shipment in about half of instances, but imported cucumbers are often priced above domestic cucumbers in wholesale markets (where the cost of freight and other markups are included in the price). Between 2015 and 2020, average import prices were below domestic prices at the point of shipment about 49 percent of the time.[559] The addition of transportation costs and other markups appeared to erode the relative price advantage of Mexican cucumbers in the East Coast wholesale market, the region where most cucumbers from the U.S. Southeast are sold. This is because of the longer distance in transportation from Mexico. Average prices for imported product were below those for the U.S. Southeast product in East Coast wholesale markets only 8 percent of the time from 2015 to 2020.[560]

Seasonal Import Trends

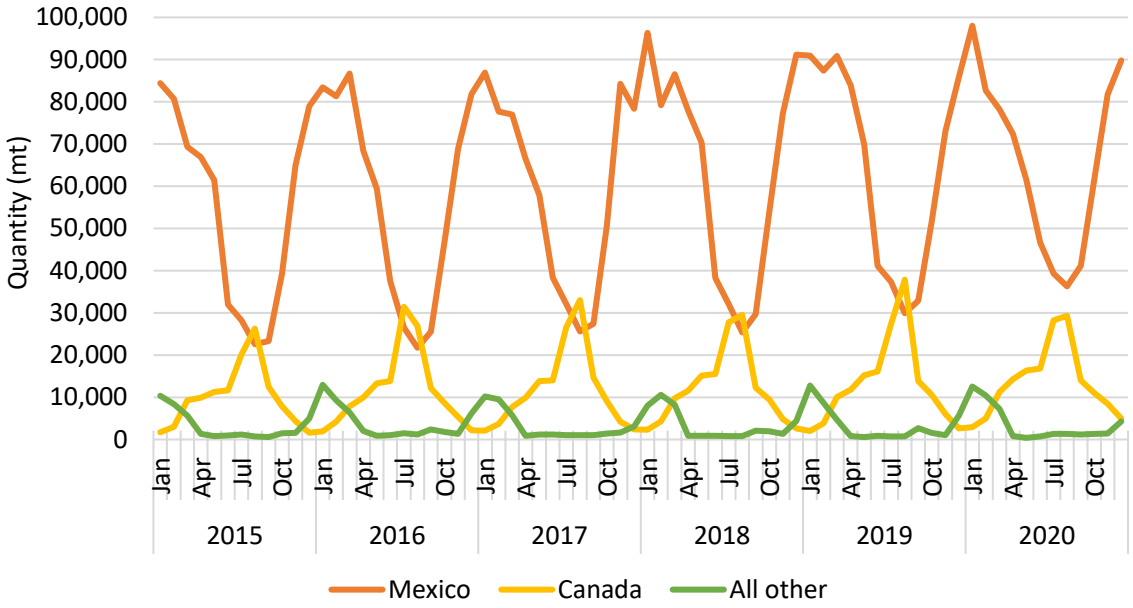
In most months, U.S. imports of all types of cucumbers from Mexico far exceed cucumber imports from other supplier countries and follow a clear seasonal pattern.[561] During 2015–20, about 75 percent of total annual imports from Mexico by volume in each year entered during the months from November through May.[562] These imports coincide in the U.S. market with supply from Florida and to a lesser extent, Georgia and California. U.S. imports from Mexico are generally at their highest from January to March and reach their lowest levels during the summer months (figure 6.1). During early spring Mexico supplies start to drop as Florida supplies ramp back up.[563] The remainder of U.S. imports from Mexico (about a quarter by volume) enter during the period from June through October, coinciding with a

[558] Cucumbers are susceptible to wrinkling and shriveling, and typically last no more than two weeks. Manjunatha and Anurag, "Effect of Modified Atmosphere Packaging and Storage," November 2014. FPAA, written submission to USITC, April 15, 2021, 3–4 and 13.
[559] Average shipping point prices for cucumbers from Mexico were lower in 32 of 65 months with comparable data from 2015 to 2020. In 7 other months, there were missing data for the United States. USDA, AMS, *Market News*, custom report, terminal market (non-organic), accessed March 16, 2021. USITC staff acknowledge that whether the average prices for imported product are higher or lower than the average prices for U.S.-grown product, the possibility still may exist that imported product puts downward pressure on prices of U.S. product.
[560] Average terminal market prices for cucumbers from Mexico were lower than for U.S.-grown product in 6 of 71 months of comparable data from 2015 to 2020; in February 2016, there were missing data for the United States.
[561] As noted in chapter 2 ("The Industry and Market in the United States") in the "Trade" section, nearly all cucumber imports from Mexico are for the fresh market. Based on U.S. Census data, Commission staff estimated that 95.5 percent of U.S. imports of cucumbers from Mexico by quantity were intended for the fresh market and 96.5 percent by value. For more information see appendix E ("Modeling").
[562] USITC DataWeb/Census, U.S. imports of cucumbers monthly figures, imports for consumption, first unit of quantity, HTS statistical reporting numbers 0707.00.2000, 0707.00.4000, 0707.00.5010, 0707.00.5090, 0707.00.6010, 0707.00.6030, 0707.00.6050, accessed June 16, 2021.
[563] There is typically a period of lower supply of cucumbers from Florida in January and February each year compared to the rest of their production season. Government representative, interview by USITC staff, October 5, 2021.

period in which there is ample U.S.-grown supply. This domestic summer supply comes from states in the Northeast and Midwest, as well as North Carolina, Georgia, and California.[564]

Figure 6.1 Monthly U.S. cucumber imports from Mexico, Canada, and all other sources, by quantity, 2015–20

In metric tons (mt). Underlying data for this figure can be found in appendix F, tables F.8, F.9, and F.10.



Source: USITC DataWeb/Census, imports for consumption, first unit of quantity, HTS statistical reporting numbers 0707.00.2000, 0707.00.4000, 0707.00.5010, 0707.00.5090, 0707.00.6010, 0707.00.6030, 0707.00.6050, accessed June 16, 2021.

Canada is the second-largest supplier of imported cucumbers to the U.S. market.[565] During 2015–20, Canada supplied 15.7 percent of U.S. imports by quantity, compared to Mexico's 79.7 percent share; see table 2.4 in chapter 2 for more details. Canadian cucumber industry representatives have noted that both greenhouse and open field cucumbers from Canada are imported at times that are considered complementary to production in the U.S. Southeast.[566] However, U.S. growers of American slicer cucumbers who harvest in the summer compete directly with U.S. imports from Canada of similar product.[567] In addition, in months when there are high volumes of American slicers from various sources

[564] USITC DataWeb/Census, U.S. imports of cucumbers monthly figures, imports for consumption, first unit of quantity, HTS statistical reporting numbers 0707.00.2000, 0707.00.4000, 0707.00.5010, 0707.00.5090, 0707.00.6010, 0707.00.6030, 0707.00.6050, accessed June 16, 2021. As noted in chapters 2 and 7, most states in United States that produce fresh market cucumbers harvest from June through October. FPAA, written submission to USITC, March 29, 2021, 9.

[565] USITC staff estimated that 82 percent of U.S. imports of cucumbers from Canada by quantity were for the fresh market and 95 percent by value. See appendix E.

[566] Greenhouse-grown cucumbers are usually long, English, seedless, and these varieties are not typically grown in United States. FPAA, written submission to USITC, March 29, 2021, 8. In addition, USITC staff estimates that about 18 percent of U.S. imports from Canada by quantity are cucumbers for pickling, which do not compete directly with the fresh market cucumbers such as the American slicer varieties grown in the U.S. Southeast. See appendix E. USITC, hearing transcript, April 8, 2021, 27–28 (testimony of Nadia Bourély, Government of Canada).

[567] Industry representative, interview by USITC staff, August 10, 2021.

(the United States and Mexico) in the U.S. East Coast wholesale marketplaces, average prices for English cucumber varieties from Canada decline substantially, e.g. each April and May from 2015 to 2020.[568] Imports from Canada typically peak in the period from July through September, which is usually a relatively lower period of supply from southeastern U.S. growers as well as from Mexico and Honduras (figure 6.1).[569]

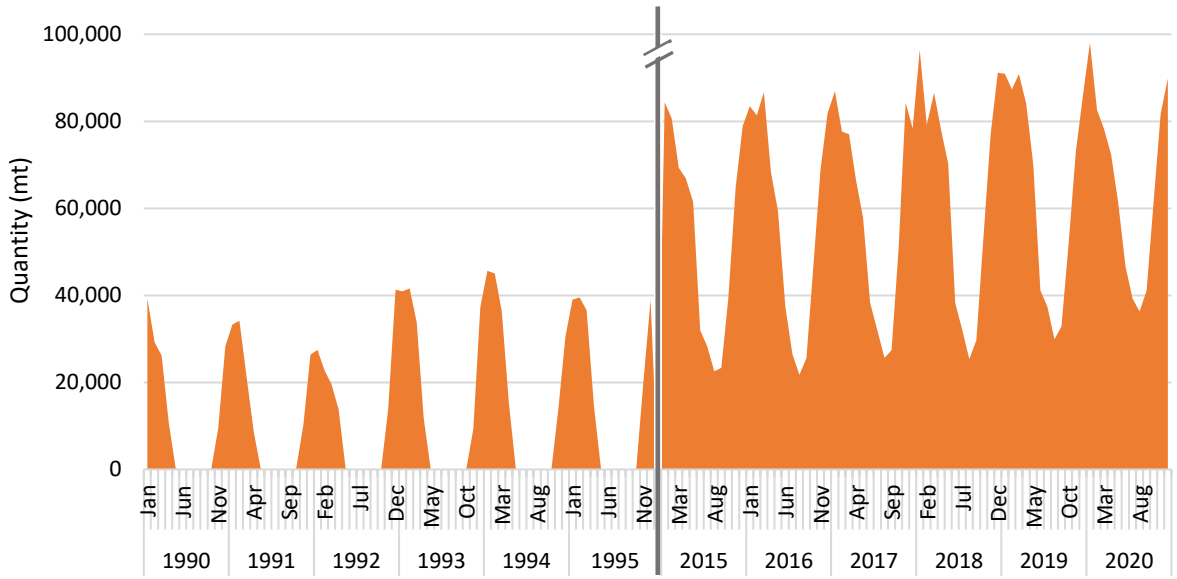
U.S. imports of cucumbers from other supplier countries played a minor role in the U.S. market (figure 6.1). These suppliers, which primarily include Honduras, along with limited imports from the Dominican Republic and Spain, accounted for 4.5 percent of total U.S. imports from 2015–20. U.S. imports from these suppliers peak in the winter months, which overlaps with the main cucumber import period from Mexico.

Although there was a distinct seasonal pattern in U.S. imports of cucumbers from Mexico during 2015–20, U.S. imports during Mexico's lower-volume period (summer season) have increased substantially over the past 30 years (figure 6.2). Industry representatives have reported that improved growing methods in Mexico, such as increased use of irrigation and shade structures, have resulted in a longer production period.[570] This enabled U.S. imports from Mexico during the summer season to rise from just under 0.1 percent of the annual total in 1990 to 22.3 percent in 2015, and to 28.5 percent in 2020. Thus, in recent decades, U.S. imports from Mexico have been competing with the U.S. Southeast cucumbers for longer periods each year.

[568] USDA, AMS, *Market News,* custom report, terminal market (non-organic), accessed March 16, 2021.
[569] Other suppliers of cucumbers to the United States include the Dominican Republic and Spain. See chapter 2 (The Industry and Market in the United States) for more information.
[570] USITC, hearing transcript, April 8, 2021, 161–162 (testimony of Dick Minor, Minor Brothers Farm); industry representative, interview by USITC staff, August 10, 2021. The Herfindahl-Hirschman Index (HHI) measures import concentration and can be used to demonstrate that U.S. imports of cucumbers from Mexico have become less concentrated within certain months, i.e., the HHI dropped from 1,673 in 1990 to 801 in 2020. Staff calculation, USITC DataWeb/Census, HTS heading 0707.00, accessed June 10, 2021; CBS, "Import Concentration," accessed August 17, 2021.

Figure 6.2 Monthly U.S. cucumber imports from Mexico, by quantity, 1990–95 and 2015–20

In metric tons (mt). Underlying data for this figure can be found in appendix F, table F.11.



Source: USITC DataWeb/Census, imports for consumption, first unit of quantity, HTS statistical reporting numbers 0707.00.2000 0707.00.4000, 0707.00.5010, 0707.00.5090, 0707.00.6010, 0707.00.6030, 0707.00.6050, accessed June 16, 2021.

Seasonal Price Trends

Seasonality in cucumber production contributes to price variation. Because the various U.S. and Mexican cucumber-growing regions have different but overlapping production periods, there are often short periods of high supply and low prices in the U.S. market (when production from many regions overlaps) and relatively scarce supply and higher prices (when fewer regions are shipping cucumbers). The highest prices are reported to come at the end of the growing seasons, periods referred to as "shoulder periods."[571] In particular, June and September are months in which U.S. and import volumes are declining as supply switches sources and, as a result, prices increase in the U.S. market.[572]

Even during peak harvest seasons, prices may vary, in part because climate conditions limit the time in which farmers in the United States can plant to a brief period, and rainy periods right before or during harvests can limit harvests or affect quality. As a result, there can be temporary gluts or shortages in supply to during the main production season, leading to price swings.[573] Some of these temporary price swings are smoothed by the prevalence of contract sales, which can provide grower-shippers with a fixed price over longer periods of time, as described in the next section.

[571] USITC, hearing transcript, April 8, 2021, 304 (testimony of Rod Sbragia, Tricar Sales, Inc.).
[572] There is some variability as to when a "shoulder period" may take place since the harvest times for cucumbers depend on weather conditions, which means that prices for cucumbers in the U.S. market may start to increase earlier or later than June or September by a month or so. USDA, AMS, *Market News,* custom report, shipping point report, sorted for cucumbers, conventional, medium, slicers, and origin accessed March 16, 2021.
[573] USITC, hearing transcript, April 8, 2021, 304 (testimony of Rod Sbragia, Tricar Sales, Inc.).

Types of Cucumber Sales and Implications for Pricing

In the United States there are several different ways that cucumbers can be bought and sold, and the sales type affects pricing. The two main types are advance contracts and spot market sales.[574] Contract sales are the most prevalent sales type for large food retailers and food service; while spot market sales are typically used by restaurants, smaller retailers, and institutions (such as schools and jails).[575] For example, a large food retailer reported that over 90 percent of its fresh produce is purchased under contract sales arrangements.[576] For perspective, the top five U.S. food retailers account for about half of grocery market produce sales.[577] Based on available data and information, it is not clear exactly what share of total cucumber sales are contract sales, but three U.S. growers that testified at the Commission hearing noted that they sell about 60–80 percent of their product to retail and 20–40 percent to other sources (food service or wholesale markets).[578]

There is reportedly a great deal of variation in the duration and structure of cucumber contracts, and this variation affects price trends. Cucumber contracts can be short, multi-week contracts or up to a year or longer.[579] The duration of a contract varies, with some industry representatives suggesting that larger buyers want longer-term contracts, with a minimum of three months in duration, though contracts of six months or longer are typical for some buyers.[580] Some representatives report that the duration of the contract may impact the price received. For example, growers are typically offered lower prices for shorter-term contracts (e.g., 6 months) because buyers put a higher value on the steady supply provided by a longer-term contract (e.g., 12 months).[581] Further, different growers may negotiate different prices with the same retailer over the same time period.[582] In addition, industry representatives report that the increasing consolidation of buyers, for both the retail and food service

[574] Spot market sales sometimes include open-ticket and consignment sales, described later in this section. USITC, hearing transcript, April 8, 2021, 145 (testimony of Richard "Dick" Bowman, J&J Family Farms), 145 (testimony of Marie Bedner, Bedner Growers, Inc.), 145 (testimony of Lance Jungmeyer, FPAA), 194–195 (testimony of William L. Brim, Lewis Taylor Farms), 195–196 (testimony of Sam Watson, Chill C Farms), and 305 (testimony of Guillermo Martinez, Frello Fresh); industry representatives, interviews by USITC staff, March 9, 2021 and June 24, 2021.
[575] Government representative, interview by USITC staff, September 3, 2021; USITC, hearing transcript, April 8, 2021, 163 (testimony of Dick Minor, Minor Brothers Farms).
[576] Industry representatives, interview by USITC staff, May 26, 2021.
[577] Statista, *Online and Offline Grocery Market Share*, March 2018.
[578] USITC, hearing transcript, April 8, 2021, 163 (Dick Minor, Minor Brothers Farms), 203 (testimony of William L. Brim, Lewis Taylor Farms), 203 (testimony of James M. Alderman, J. Alderman Farms), and 204 (testimony of Caleb Burgin, M.F. Burgin, Inc. d/b/a Burgin Farms).
[579] USITC, hearing transcript, April 8, 2021, 145 (testimony of Dick Bowman, J&J Family Farms), 145–6 (testimony of Lance Jungmeyer, FPAA) and 194 (testimony of William L. Brim, Lewis Taylor Farms).
[580] USITC, hearing transcript, April 8, 2021, 287 (testimony of Craig Slate, SunFed Produce); industry representative, interview by USITC staff, March 10, 2021.
[581] USITC, hearing transcript, April 8, 2021, 306 (testimony of Jaime Chamberlain, Chamberlain Distributing, Inc.).
[582] USITC, hearing transcript, April 8, 2021, 307 (testimony of Jaime Chamberlain, Chamberlain Distributing, Inc.).

sectors, has impacted the ability of growers and distributors to negotiate favorable contract and pricing terms, as the buyers have increased their market power. [583]

Some industry representatives report that contracting with buyers does not guarantee a purchase because contracted purchases are typically only a portion of any buyer's overall supply of cucumbers. When prices decline, buyers may choose to buy on the spot market rather than under an existing contract.[584] This is possible because buyers do not always fulfill contract obligations; even when they do, commitments to purchase a certain volume of cucumbers are often for the duration of the contract and not for any particular week.[585] As a result, some U.S. growers report that if prices of imported products are lower, buyers with whom they have contracted may inform them that they will not be accepting any U.S. deliveries that week.[586] Alternatively, some U.S. growers report that buyers might quote them the price to purchase the same product from Mexico, and growers will meet it even if it is below their cost of production, to prevent a complete loss of the sale, as even in optimal conditions, cucumbers have about a two-week storage limit.[587]

It is unclear from the publicly available information on cucumbers whether prices in cucumber contract sales are generally higher, lower, or comparable to prices in spot market sales. One industry representative with experience buying cucumbers under contract estimated that the contract price had been higher than the spot market price about 48 percent of the time during the previous two years.[588] In some cases, contracting may allow retailers to obtain lower prices than they would for the same product on the spot market because they are committing to purchase a substantial volume of cucumbers over a long period. However, some industry representatives noted that contract prices tend to be higher than spot market prices because retailers typically have quality standards that some of the product available in other markets would not meet. Because of these potential quality differences, the products sold in the two markets may not be directly comparable, resulting in different prices.[589]

Spot market sales are transactions made on a daily basis. The sales are also known as free on board (f.o.b.) sales because the agreed price is typically based on the day's f.o.b. price as reported by the USDA's Agricultural Marketing Service (AMS), which does not include the cost of transport.[590] However,

[583] USITC, hearing transcript, April 8, 2021, 315 (testimony of Bret Erickson, J&D Produce Inc.); industry representative, interview by USITC staff, March 10, 2021.
[584] Not all growers agree with this assessment, however, with one grower noting that they have legal recourse if their buyer does not fulfill the contract and buy their production. USITC, hearing transcript, April 8, 2021, 188–9 (testimony of Caleb Burgin, M.F. Burgin, Inc. d/b/a Burgin Farms), 194 (testimony of William L. Brim, Lewis Taylor Farms), 195 (testimony of Sam Watson, Chill C Farms), and 251 (testimony of Rod Sbragia, Tricar Sales, Inc.).
[585] USITC, hearing transcript, April 8, 2021, 188–89 (testimony of Caleb Burgin, M.F. Burgin, Inc. d/b/a Burgin Farms).
[586] USITC, hearing transcript, April 8, 2021, 188–89 (testimony of Caleb Burgin, M.F. Burgin, Inc. d/b/a Burgin Farms).
[587] Manjunatha and Anurag, "Effect of Modified Atmosphere Packaging and Storage," November 2014; USITC, hearing transcript, April 8, 2021, 189–90 (testimony of Caleb Burgin, M.F. Burgin, Inc. d/b/a Burgin Farms), 194 (testimony of William L. Brim, Lewis Taylor Farms), and 196 (testimony of James M. Alderman, J. Alderman Farms, Inc.).
[588] Industry representative, email correspondence with USITC staff, October 1, 2021.
[589] Industry representative, interview by USITC staff, June 24, 2021; USITC hearing transcript, April 8, 2021, 205 (testimony of James M. Alderman, J. Alderman Farms).
[590] For additional details on USDA's definition of the f.o.b. price, see USDA, AMS, "Common Types of Sales," accessed October 6, 2021.

while the f.o.b. price is the basis for negotiating the spot market price, the cost of freight also affects total delivered cost and can be a factor in the choice buyers make when selecting a source. For example, one wholesaler in the U.S. Northeast reported that they have no need to purchase cucumbers from Mexico during the summer months because high-quality cucumbers produced within the U.S. Northeast are readily available and significantly cheaper due to the freight savings.[591] Another wholesaler reported that even though grower-shippers always seek to receive the reported f.o.b. price when they sell on the spot market, numerous other factors can affect whether they are able to get that price for their cucumbers.[592] Spot market sales are the type most heavily represented in AMS pricing data, as described in the next section.

Spot market sales arrangements can sometimes include consignment and what industry representatives refer to as "open ticket" sales.[593] In a consignment arrangement, goods are left with a third party for sale; for cucumbers, this is typically a wholesaler.[594] In the open ticket arrangement, the product is sent to the buyer without a set price, and the price is determined upon the buyer's receipt of the product. This practice is risky for producers because it leaves all pricing power in the buyer's hands. U.S. producers, exporters, and wholesalers generally agreed that this sales channel is considered a last resort and is not prevalent.[595]

Price Data Sources and Limitations

The main data source for information on prices of cucumbers in the U.S. market is AMS. AMS collects pricing data at the shipping point and terminal (wholesale) markets, through voluntary reporting from telephone and in-person interviews with sellers and buyers.[596] These data are available for a wide range of fresh market agricultural products, including cucumbers, and allow for monthly analysis as well as the ability to differentiate by cucumber type (organic or conventional), variety (slicing, pickling, long seedless, Japanese, Persian, and lemon), and other characteristics (e.g., package type and item size).

In some investigations, particularly when AMS data are not available for a product, the Commission has used import average unit values (AUVs) to consider pricing trends for imported agricultural products. However, U.S. import AUVs are not used in this investigation's pricing analysis. U.S. import AUV data are not reliable for cucumbers because the HTS heading used for cucumbers combines all varieties, including cucumbers for pickling. Additionally, prices can vary widely within the same variety of cucumbers, depending on size, grade, and packaging type.

[591] Industry representative, interview by USITC staff, August 10, 2021.
[592] Industry representative, interview by USITC staff, August 10, 2021.
[593] Western Growers, "Price After Sale," October 31, 2013.
[594] Industry representatives, interviews by USITC staff, February 3, 2021, and August 10, 2021; Investopedia, "Consignment," updated October 28, 2020; Western Growers, "Price After Sale," October 31, 2013.
[595] USITC, hearing transcript, April 8, 2021, 284 (testimony of Rod Sbragia, Tricar Sales, Inc.) and 285 (testimony of Jaime Chamberlain, Chamberlain Distributing, Inc.).
[596] USDA, AMS, *Market News*, "Fruit and Vegetable, Help, Types of Reports," accessed June 11, 2021.

USDA AMS Data

Shipping Point

AMS's shipping point data cover the major fruit and vegetable growing areas and the prices of products sold on the open market by the first handlers at the point of production (for domestic products) or the port of entry (for imports).[597] The prices include brokerage fees and commission, Customs fees and duties, packaging, and freight costs prior to first sale, paid by the shipper or the seller.[598] AMS considers these prices to represent the most uniform level of trading.[599]

The main limitations of the shipping point data are that the prices AMS collects represent a relatively small share of the U.S. market and do not include Canada in its coverage of shipping point locations.[600] This is because shipping point data do not fully reflect the growing portion of the market that is served by contract sales. To the extent contract sales are reported to AMS as part of the collection of shipping point data, they are reported only on the day the contract is established and do not affect average shipping port prices thereafter.[601] As a result, shipping point data reflect mostly spot market sales.[602]

Industry representatives also report that shipping point pricing data may not reflect actual prices, in part because the data are based on a limited number of market participants who voluntarily report prices.[603] The representatives also report concerns resulting from AMS's policy to protect the confidentiality of sources by generally not publishing prices unless three or more sellers are reporting. They note that due to grower consolidation and the number of different varieties and packaging sizes, AMS may be limited in the prices it can report.[604] Some representatives also note that AMS does not use invoices of actual sales to confirm reported prices.[605] Shipping point data are reported for major, but not all, cucumber shipping locations.

[597] USDA, AMS, Market News, "Fruit and Vegetable, Help, Types of Reports," accessed June 11, 2021; USDA, AMS, Market News, "Fruit and Vegetable, Help, Shipping Point Report vs Terminal Report," accessed June 11, 2021.
[598] USDA, AMS, Market News, "Fruit and Vegetable, Help, Shipping Point Report vs Terminal Report," accessed June 11, 2021.
[599] USDA, AMS, Market News, "Fruit and Vegetable, Help, Types of Reports," accessed June 11, 2021.
[600] Canada has only recently become a major player in terms of U.S. imports of cucumbers, and the AMS had insufficient resources to cover additional markets during 2015 to 2021. USITC, hearing transcript, April 8, 2021, 306 (testimony of Guillermo Martinez, Frello Fresh, LLC) and 333 (testimony of Jaime Chamberlain, Chamberlain Distributing, Inc.); FPAA, written submission to USITC, March 29, 2021, Exhibit 6 (pdf 117–18); government official, emails to USITC staff, June 22, 2021 and September 17, 2021.
[601] AMS, government official, interview by USITC staff, May 21, 2021; government official, email to USITC staff, June 22, 2021 and September 17, 2021.
[602] Government official, interview by USITC staff, May 21, 2021.
[603] USITC, hearing transcript, April 8, 2021, 306 (testimony of Martinez); FPAA, written submission to USITC, March 29, 2021, 74.
[604] FPAA, written submission to USITC, March 29, 2021, 75; industry representative, interview by USITC staff, March 9, 2021; industry representative, interview by USITC staff, April 28, 2021.
[605] USITC, hearing transcript, April 8, 2021, 333 (testimony of Jaime Chamberlain, Chamberlain Distributing).

Terminal Market

AMS's terminal market reporters record prices at terminal (wholesale) markets in 13 major U.S. cities where products are sold by wholesalers to buyers in wholesale lots.[606] The buyers at U.S. wholesale markets sometimes include major retailers, but are more often small retailers, restaurants, and institutions (e.g., schools and jails).[607] Terminal market data reflect the spot market prices wholesalers receive for sales of product that are less than a carload or truckload and are the prices of sales by first receivers.[608] While the terminal market reports sometimes include bulk orders by large retailers, they do not include true contract sales.[609]

The main limitation of terminal market data in analyzing price trends is that the prices contained in this report are less uniform than at the shipping point and represent a relatively small share of sales of produce made through the terminal markets (or any other wholesale channel).[610] Wholesale prices include freight charges and various other markups, thus are less of a direct measure of prices compared to shipping point data. An increased prevalence of direct retailer-grower or retailer-shipper contracts means that the AMS terminal market report represents only a small share of total sales in the U.S. market. The wholesale market share has been declining over time, and U.S. industry and academia reported that as early as 2000 less than 30 percent of the national volume of produce was sold through the wholesale markets.[611] The top eight grocery retailers are reported to account for more than 50 percent of U.S. retail food sales, and much of their supply does not move through terminal markets because large retailers now purchase the bulk of their produce directly from growers.[612] Product intended for food service also travels through the wholesale markets less frequently than in the past, and some industry representatives report that a significant share of U.S. Southeast production is intended for the food service industry.[613]

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[606] USDA, AMS, Market News, "Fruit and Vegetable, Help, Types of Reports," accessed June 11, 2021; USDA, AMS, Market News, "Fruit and Vegetable, Help, Shipping Point Report vs Terminal Report," accessed June 11, 2021; USDA, AMS, Market News, "Fruit and Vegetable, Help, Terminal Report Availability," accessed October 11, 2021.
[607] Industry representatives, interviews by USITC staff, August 10, 2021; government official, interview by USITC staff, September 3, 2021.
[608] USDA, AMS, *Market News*, "Fruit and Vegetable, Help, Types of Reports," accessed June 11, 2021; USDA, AMS, "Market News, Fruit and Vegetable, Help, Shipping Point Report vs Terminal Report," accessed June 11, 2021.
[609] FPAA, written submission to USITC, April 15, 2021, 4–5 and 11; FPAA, written submission to USITC, March 29, 2021, 118; AMS, government official, interview by USITC staff, May 21, 2021; government official, email to USITC staff, June 22, 2021.
[610] The terminal market data share some of the same limitations as the shipping point data, i.e., a lack of contract prices, limited coverage of certain locations, and voluntary non-confirmed reports of prices. An additional limitation of the terminal market data is that some produce may travel through other wholesale markets beyond the 13 terminal markets AMS covers.
[611] FPAA, written submission to USITC, April 15, 2021, 12; Cook, Roberta, "The U.S. Fresh Produce Industry: An Industry in Transition," 2002, 18; government official, interview by USITC staff, September 3, 2021.
[612] USDA, ERS, "Retail Trends," May 25, 2021; FPAA, written submission to USITC, April 15, 2021, 12.
[613] Industry representative, interview by USITC staff, February 3, 2021; Although this hearing witness used squash as an example, this statement exemplifies more broadly the changing relationship between growers and buyers and the trend of more direct sales to chain stores and food service customers. USITC, hearing transcript, April 8, 2021, 256 (testimony of Jaime Chamberlain, Chamberlain Distributing, Inc.).

Packaging Types and Product Item Size in AMS Cucumber Data

Variations in packaging and product item size make cucumber price comparisons difficult, but AMS data allow for comparisons of similarly sized and packaged cucumbers. AMS data are reported by packaging type, with several different types of packaging used for each variety. The most frequently reported packaging type to AMS for American slicer varieties of cucumbers in both the United States and Mexico is the "one and one-ninth bushel" boxes (i.e., 1⅑ bushel cardboard carton or wooden crate). One representative noted that this package type can hold 72–75 cucumbers and weighs about 55 pounds.[614] However, industry representatives report that the number of cucumbers per package (counts) and weights of packages vary, even when the producer uses the same type or size of packaging.[615]

The AMS shipping point and terminal market data report one and one-ninth bushel boxes of conventional slicing cucumbers in large, medium, and small item sizes; each cucumber size commands a different price range. These data show that prices for medium cucumbers are consistently higher than prices for large or small cucumbers, on a dollar-per-pound basis. Pricing data for U.S.-grown large and small cucumbers are very sparse in shipping point data, while terminal market data for large and small sizes are not available for all months for both Mexico and the United States. As a result, most of the analysis will focus on medium-sized cucumbers in one and one-ninth bushel boxes. However, industry representatives noted discrepancies between item sizing in the United States and Mexico, and that there is also variation in uniformity of the product. These same representatives noted that Mexican cucumbers are more uniform in size, which to buyers signifies higher quality.[616]

Comparisons of U.S. Domestic and Imported Cucumber Prices Using USDA AMS Data

The analysis below focuses on AMS shipping point and terminal market data for medium-sized, American slicer cucumbers in one and one-ninth bushel boxes, as well as the most frequent prices reported.[617]

According to AMS shipping point reports, average prices of imported cucumbers are similar in terms of range and are synchronized during certain months of the year, rising and falling together. Compared to one another, imported cucumbers were priced below domestically grown product at the U.S. shipping point. Although less uniform, wholesale (terminal) market price history shows how the relationship between foreign and domestic prices change at various points in the supply chain, (especially where freight costs are added) and that prices for imported cucumbers differ by region. According to AMS terminal market reports, the imported product was often priced higher than the U.S.-grown product. Average prices for Mexican cucumbers in the East Coast wholesale market are typically higher than

[614] FPAA, written submission to USITC, affidavit of Guillermo Martinez, Frello Fresh, March 29, 2021, 3.
[615] FPAA, written submission to USITC, March 29, 2021, Exhibit 6 (pdf 117–18).
[616] USITC, hearing transcript, April 8, 2021, 251–2, and 276-78 (testimonies of Rob Sbragia, Tricar Sales, Inc., and Jaime Chamberlain, Chamberlain Distributing).
[617] Industry representatives, interviews by USITC staff, February 1, 2021, March 9, 2021, and August 27, 2021. (FFPA, Bridges Produce, & FFVA). See also, USITC, hearing transcript, April 8, 2021, 248 (testimony of Rod Sbragia, Tricar Sales Inc.).

average prices for similar product in West Coast and Midwest wholesale markets due to the greater distance from Mexico.

Prices for U.S.-grown cucumbers vary widely throughout the year as seasons change and as supply from different U.S. and import sources become more or less available.[618] The AMS shipping point average prices for U.S.-grown medium conventional American slicing cucumbers in one and one-ninth bushel boxes ranged from $9.51 to $29.35 per box from 2015 to 2020. For most months over the period, average shipping point prices for U.S.-grown product hovered between $15 and $22 dollars per box.[619] Foreign cucumbers had a similar, though slightly lower, range of average prices over the period, but price movements in certain months were synchronized with those of U.S.-grown product. For foreign cucumbers from Central America and Mexico entering the United States from 2015 to 2020, average prices ranged from $8.62 to $29.25 per box, and most monthly averages hovered in the range of $10 to $20 per box.[620]At the terminal market, when comparing average prices for cucumbers from the U.S Southeast and Mexico sold in seven East Coast wholesale markets, the prices track very closely to one another. The AMS East Coast average prices for U.S.-grown medium conventional American slicing cucumbers in one and one-ninth bushel boxes ranged from $14.34 to $35.00 per box from 2015 to 2020, while cucumbers from Mexico ranged from $17.25 to $37.13 per box.[621]

AMS Shipping Point Prices Comparison

Average prices for imported cucumbers from Central America and Mexico recorded at the U.S. port of entry were lower than averages for domestically grown product in 32 of the 72 months during 2015–20 (figure 6.3).[622] Prices for imported cucumbers tended to be lower than those for domestic cucumbers more frequently in November through May than in June through October; from 2015 to 2020, foreign product was priced lower in 23 of 35 months between November through May.[623]

During the period 2015–20, imported cucumbers were priced lower than domestic cucumbers for at least some months in each year. Most years, foreign cucumbers were priced lower 5 to 8 months out of the 10 or 11 months each year with data to compare. Notably in 2019, foreign cucumbers were priced lower in only 2 of the 11 months for which data were available to compare, and there were more months when the price difference was negligible. As noted by chapter 3, Mexico's domestic

[618] USITC, hearing transcript, April 8, 2021, 304 (testimony of Rod Sbragia, Tricar Sales, Inc.) and 226 (testimony of Brian Robinson, BTR Farms).
[619] Average monthly shipping point prices for domestic medium-sized conventional slicing cucumbers at the shipping point can be found in appendix F, table F.19.
[620] Average monthly shipping point prices for foreign medium-sized conventional slicing cucumbers at the shipping point can be found in appendix F, table F.20.
[621] Average monthly terminal market prices for domestic and foreign medium-sized conventional slicing cucumbers can be found in appendix F, tables F.21 and F.22.
[622] During the same period, domestic product average prices were lower in 17 of those months. For the 23 remaining months, either no U.S.-grown product prices were available to compare, as is the case every February and in January 2020, or the price difference was negligible.
[623] Average prices for the imported product were lower than averages for the domestic product in 9 of the 30 months in the June–October period with comparable data.

consumption had a spike from 2018 to 2019 and exports from Mexico increased by only 14,960 metric tons, the smallest yearly increase from 2015 to 2020.[624]

Over the period, certain months had consistent patterns in the relationship between foreign vs. domestic prices. For example, in May and June, average prices for imported product were always lower or negligible. In September, the average prices for foreign product were always higher or negligible.

On average, prices for imported cucumbers at shipping points were 4.6 percent lower than prices for U.S.-grown cucumbers. The yearly relative difference fluctuated during 2015–20 but trended downwards. In 2015, the average prices for imported cucumbers were 14.4 percent lower than average prices for U.S.-grown cucumbers. In 2020, however, imported cucumbers were only 2.6 percent lower than the average price for U.S.-grown cucumbers. Average prices for imported cucumbers trended upwards over the period, while average prices for U.S.-grown cucumbers trended down.

Figure 6.3 Average monthly price difference between foreign and domestic medium-sized conventional slicing cucumbers, AMS shipping point, 2015–20

In U.S. dollars per 1⅑ bushel crate or carton. Red cells and a negative value (minus sign) indicate the foreign price in the specific month and year was lower than the domestic price. The darker the red, the lower the foreign price comparatively. When the cell is blue and no minus sign is present, the foreign price was higher than the domestic price. The darker the blue the higher the foreign price comparatively. White cells indicate a negligible difference. n.a. = not available. Underlying data for this figure can be found in appendix F, table F.12.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	-4.06	n.a.	-10.80	-2.77	-2.90	-3.68	-2.18	-2.33	4.73	1.87	1.36	-4.00
2016	-4.74	n.a.	-3.39	-4.16	-5.41	-3.12	1.00	2.70	7.80	-0.52	0.36	0.84
2017	-0.30	n.a.	-3.68	-0.63	0.30	-3.06	-2.31	1.93	4.75	-0.15	-3.21	-5.13
2018	-5.39	n.a.	2.68	-3.52	-1.53	-0.09	-0.44	6.66	8.32	0.39	-3.85	-4.56
2019	0.08	n.a.	0.68	0.04	-1.98	-1.69	2.99	3.51	5.44	4.60	0.15	-0.42
2020	n.a.	n.a.	-1.73	-2.90	-6.66	-7.18	0.32	-1.23	-0.53	2.41	-2.71	-5.78

Source: USDA, AMS, *Market News,* custom report, shipping point report, sorted for cucumbers, conventional, medium, slicers, and origin accessed March 16, 2021.
Note: Domestic includes cucumbers shipped from Florida, Georgia, Michigan, New York, and North Carolina; while, foreign includes product shipped from Central America and Mexico.

U.S. Southeast Cucumbers Compared to Mexican Cucumbers in AMS Shipping Point Data

A comparison of average prices for cucumbers sourced from the U.S. Southeast and Mexico also shows 32 of 72 months when the average prices of Mexican product were lower than the U.S. Southeast product (figure 6.4). In the U.S. winter season, the U.S. Southeast's main harvest period, average prices of Mexican product were lower in 23 of 35 months in November through May with comparable data, and in the U.S. summer season (the U.S. Southeast's lower-volume period) average prices of Mexican product were lower in 9 of 28 months in June through October with comparable data.

On average, prices for Mexican cucumbers at shipping points were 5.4 percent lower than U.S. Southeast cucumbers. The yearly relative difference fluctuated over the period but trended downwards.

[624] On average, exports increased by more than double (34,916 metric tons) in all other years between 2015 and 2020.

In 2015, Mexican cucumbers were 12.6 percent less expensive at shipping points than U.S. Southeast cucumbers on average compared to 3.9 percent less expensive in 2020. Imported prices at shipping points trended upwards over the period, while U.S. Southeast cucumber prices trended down.

Figure 6.4 Average monthly price difference between U.S. Southeast and Mexican medium-sized conventional slicing cucumbers, AMS shipping point, 2015–20

In U.S. dollars per 1⅑ bushel crate or carton. Red cells and a negative value (minus sign) indicate the foreign price in the specific month and year was lower than the domestic price. The darker the red, the lower the foreign price comparatively. When the cell is blue and no minus sign is present, the foreign price was higher than the domestic price. The darker the blue, the higher the foreign price comparatively. White cells indicate a negligible difference. n.a. = not available. Underlying data for this figure can be found in appendix F, table F.13.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	-4.00	n.a.	-10.80	-2.77	-2.90	-3.68	-3.04	-3.08	4.17	1.87	1.36	-4.00
2016	-4.32	n.a.	-3.90	-4.16	-5.41	-3.12	-0.12	2.05	8.38	-0.52	0.36	0.84
2017	-0.96	n.a.	-4.20	-0.63	0.30	-3.06	-6.45	n.a.	3.85	-0.15	-3.21	-5.13
2018	-5.65	n.a.	1.70	-3.52	-1.53	0.06	-0.23	4.51	6.51	0.39	-3.85	-4.56
2019	-0.43	n.a.	0.39	0.04	-1.98	-1.69	4.15	n.a.	6.85	4.43	0.15	-0.42
2020	n.a.	n.a.	-2.03	-2.90	-6.66	-7.18	0.54	-1.52	-1.06	2.41	-2.71	-5.78

Source: USDA, AMS, *Market News,* custom report, shipping point report, sorted for cucumbers, conventional, medium, slicers, and source accessed March 16, 2021.
Note: U.S. Southeast includes cucumbers shipped from Florida, Georgia, and North Carolina.

AMS Terminal Market Prices Comparison

Cucumbers (medium-sized, conventional, American slicer varieties, in 1- and 1/9-bushel packages) grown in the U.S. Southeast are mostly sold in seven terminal markets on the East Coast—Atlanta, Baltimore, Boston, Columbia (South Carolina), Miami, New York, and Philadelphia. As noted above, terminal market data are reported at physical locations across the United States and are the prices received by wholesalers for sales in quantities of less than a carload or truckload. These prices include freight costs and other markups charged by the wholesaler.[625]

Mexican cucumbers lose a portion of the relative price advantage that was apparent in most months of the shipping point data. That is, at the wholesale market prices for Mexican product are mostly higher than average prices for U.S.-grown product. Average prices for Mexican product are lower than U.S. Southeast prices in only 6 months of 71 months with comparable data from 2015 to 2020 (figure 6.5). Prices for cucumbers from the U.S. Southeast are lower in 59 of 71 months.[626]

On average, prices for Mexican cucumbers at East Coast wholesale markets were 13 percent higher than U.S. Southeast cucumbers. The yearly relative difference in prices fluctuated during 2015 to 2020,

[625] Shipping point and terminal market data follow similar seasonal trends, track closely with one another, and as expected, in most months the average wholesale market prices are higher than the shipping point average prices. However, prices in national level shipping point and terminal market are not entirely comparable due to their varying level of source coverage and different collection methods. USDA, AMS, Market News, "Fruit and Vegetable, Help, Shipping Point Report vs Terminal Report," accessed June 11, 2021.
[626] Comparable data for U.S. Southeast cucumbers are missing for February 2016. Price differences between Mexican and U.S. Southeast product were negligible in six months of the period.

largely due to events in the transportation industry, but the difference trended downwards. In 2015, average prices for Mexican cucumbers were 16 percent higher, on average, than prices for U.S. Southeast cucumbers and in 2020, dropped in value to being 10 percent more expensive. Based on terminal market data for 2015–20, there does not appear to be a clear seasonal trend as to when Mexican prices are closer to the price for cucumbers from the U.S. Southeast in the East Coast wholesale markets. However, years 2018–20 appear to have more volatile swings (darker blues and darker reds) in relative differences in Mexican and U.S. Southeast prices than the preceding years. Part of this volatility can be attributed to fluctuations in freight rates as well as to the global COVID-19 pandemic, which caused fluctuations in consumer demand and supply of produce.[627]

Figure 6.5 Average monthly price difference between U.S. Southeast and Mexican medium-sized conventional slicing cucumbers, AMS East Coast terminal markets, 2015–20

In U.S. dollars per 1⅑ bushel crate or carton. Red cells and a negative value (minus sign) indicate the foreign price in the specific month and year was lower than the domestic price. The darker the red, the lower the foreign price. When the cell is blue and no minus sign present, the foreign price was higher than the domestic price. The darker the blue the higher the foreign price comparatively. White cells indicate a negligible difference. n.a. = not available. Underlying data for this figure can be found in appendix F, table F.14.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	2.75	2.80	1.48	2.56	2.38	4.41	4.84	-0.82	2.99	3.49	5.89	5.25
2016	5.83	n.a.	2.41	4.28	0.57	1.13	0.65	3.06	4.78	3.30	3.87	3.31
2017	1.92	1.71	1.72	3.30	3.47	5.45	1.55	0.40	3.29	3.14	1.62	1.48
2018	-1.57	-1.01	3.52	2.26	2.92	3.58	3.87	4.14	8.85	5.54	2.90	4.96
2019	4.12	-0.03	3.67	2.29	1.55	1.49	1.25	0.14	2.70	1.12	4.20	3.75
2020	8.34	8.99	2.13	4.06	-0.87	-3.24	2.73	3.33	0.64	3.10	2.34	-1.69

Source: USDA, AMS, *Market News*, custom report, terminal market (non-organic) report, sorted for cucumbers, conventional, slicers, medium, and source, accessed March 16, 2021.
Note: Southeast includes Florida, Georgia, and North Carolina. East coast terminal markets include Atlanta, Baltimore, Boston, Columbia, Miami, New York, and Philadelphia.

Regional Comparison of AMS Terminal Market Data

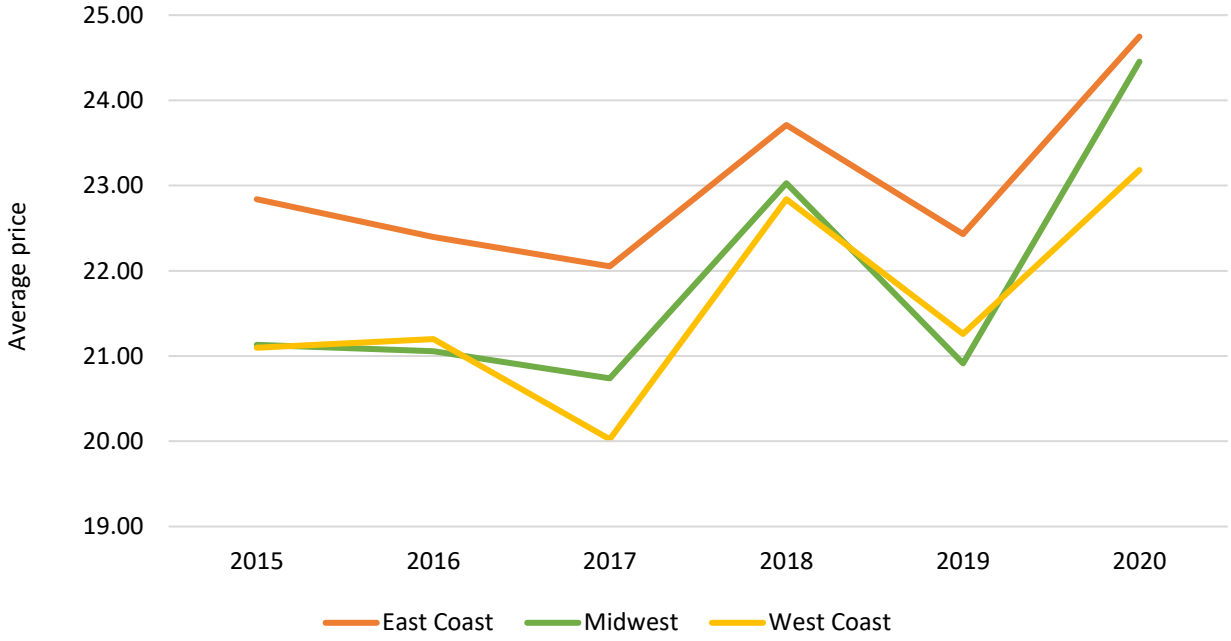
Average prices for Mexican cucumbers vary across wholesale market geographic clusters, which means that there are regional differences in cucumber prices (figure 6.7). The U.S. Southeast cucumber industry has stated that they believe Mexican producers may be trying to undercut them on price, in part because they believe Mexican cucumbers are sometimes priced higher in terminal markets in California than in markets on the East Coast, even though the transportation costs are lower from Mexico to California.[628] East Coast average prices are consistently higher than for those in the West

[627] As noted in chapter 3 ("The Industry in Mexico" in the "Supply Chain" sections), freight rates were particularly high in 2018 due to a combination of a truck driver shortage that was exacerbated by implementation of a required electronic logging device system in the United States, along with high fuel prices. In 2020, the COVID-19 pandemic exacerbated trucking labor shortages and equipment availability, which has caused ongoing increases in freight rates. In general, the global pandemic caused fluctuations in consumer demand for and the supply of fresh produce. Sterk, "Truck Freight Rates Continue to Climb," October 12, 2018; Mexicom Logistics, "Why Are Freight Rates Still Going Up?" August 31, 2021; OECD, "Food Supply Chains and COVID-19: Impacts and Policy Lessons," June 2, 2020, 5–7 and 2–5.
[628] FVAA, written submission to USITC, March 29, 2021, 3.

Coast and Midwest for medium conventional slicer variety cucumbers. However, in 2018 for the West Coast, and in 2020 for the Midwest, the relative difference between the averages for these respective regions and the East Coast average decreased. Midwest and West Coast average prices for cucumbers were very close, except in 2020 when Midwest average prices increased, diverging from the West Coast average prices. One government representative explained that Mexican prices in the West Coast may converge with Mexican prices on the East Coast in the winter months when the West Coast region switches supply from Baja to more distant Mexican supply located in the Mexican interior.[629]

Figure 6.6 Average prices of Mexican medium-sized conventional slicing cucumbers in U.S. terminal markets, by region, 2015–20

In U.S. dollars per 1⅑ bushel carton or crate. Underlying data for this figure can be found in appendix F, table F.15.



Source: USDA, AMS, *Market News*, custom report, terminal market (non-organic) report, accessed March 16, 2021.
Note: Axis does not start at zero because prices for cucumbers are never zero. East Coast terminal markets included are Atlanta, Baltimore, Boston, Columbia, Miami, New York, and Philadelphia. Midwest terminal markets are Chicago, Dallas, Detroit, and St. Louis. West Coast terminal markets are Los Angeles and San Francisco.

[629] Government official, interview by USITC staff, September 3, 2021.

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Chapter 7
Effects of Imports on the U.S. Cucumber Industry

This chapter estimates the economic effects of increased cucumber imports on the U.S. domestic market, with special emphasis placed on seasonal effects. In this section, we develop and apply a partial equilibrium model of the U.S. seasonal market for fresh market cucumbers.[630] Markets producing in each period, June–October and November–May, experienced increases in the growth rates of imports during specific years within 2008–20 (also referred to in this chapter as the "high-growth years"). A counterfactual scenario is simulated using the partial equilibrium model, in which the increase in growth rates in those years did not occur, and imports are lower from 2008 onward. The period (2000–2020) is used to estimate the model, but the model results focus on the growing seasons in the most recent six years (2015–20).[631]

Economic effects of the high-growth years are modeled to reflect seasonal implications: the months from June through October encompass the harvesting periods for most U.S. states that produce fresh market cucumbers; and the months from November through May, the harvesting periods in parts of Florida, Georgia, and California. We modeled the industry based on these periods as we were requested to analyze the effect of imports on the domestic seasonal markets. Seasonality is an important feature in this analysis due to the prominence of imports from Mexico during November–May and differences in regional harvesting times. A large volume of U.S. imports during November–May compete with domestic production primarily from a few states in the U.S. Southeast. From June through October, the lower volume of U.S. imports competes with cucumbers from a majority of producing states.

The hypothetical removal of above-average increases in imports from 2008 to 2020 would have had positive effects on U.S. production, revenue, and operating income in 2015–20. In such a scenario, lower cucumber import volumes would have led to higher import prices and a shift towards consumption of domestic varieties. This counterfactual would have led to higher prices of domestically produced cucumbers and more output, as U.S. farmers would have increased production due to higher prices. Increases in output and prices would have led to increases in domestic revenue, operating income, and employment.

Model results show that the hypothetical removal of the above-average increases in imports (the counterfactual) during November–May would have increased U.S. producers' November–May domestic production by an average of 37.2 percent, domestic revenue by an average of $31.4 million per period, and operating income by an average of $6.6 million per period during the previous five growing periods.

[630] Fresh market cucumbers exclude cucumbers for pickling. This analysis uses modified import data from the Harmonized Tariff Schedule of the United States (HTS) under the 6-digit heading 0707.00.
[631] The Commission developed a customized partial equilibrium model for this investigation that uses estimates of fresh market cucumber production and imports by harvesting periods, a departure from other investigations with models that use an annual time frame. Technical details of the model, detailed calculations used to construct data inputs, and sensitivity analyses with different parameter combinations are included in appendix E of this report.

For June–October effects, domestic production during this period would have increased 27.1 percent on average in the counterfactual, domestic revenue would have been $35.6 million higher on average, and operating income $7.5 million higher. In the earlier years modeled, the economic effects of the higher import growth on domestic producers are larger during the months from November through May. These effects include the impact in some of Florida, Georgia, and California production, as those are the states that harvest during November–May. However, in the more recent years modeled, the trend reverses and the effects on domestic revenues and operating incomes are larger for states that produce during June–October.

Description of the Model

The model developed for this report is a partial equilibrium model of the U.S. cucumber market, excluding cucumbers for pickling. Consumers purchase both domestically produced and imported fresh market cucumber varieties that are differentiated by source and are imperfectly substitutable, with consumer preferences represented by constant elasticity of substitution demands. Many producers compete in a perfectly competitive domestic industry.[632] The model has three parameters that are held constant across all years: a constant elasticity of substitution between foreign and domestic sources, a supply elasticity for domestic producers, and a price elasticity of total industry demand. All other model parameters are year-specific and calibrated to industry data.

The model estimates economic effects during two major harvesting periods in the United States, June–October and November–May. Monthly U.S. production data are not generally available, so information about state-level harvesting months, along with state-level data, were used to estimate U.S. production data inputs by month. A majority of the cucumber-producing states produce during the June–October season; only Florida, Georgia, and California have some fresh market cucumber production during the model-defined off-season.

The model is calibrated with an estimate of actual fresh market cucumber domestic production and import volumes for both seasons during 2015–20. The model then considers a counterfactual where the above-average import growth did not occur. This involves first identifying the observed above-average growth rates in imports and reducing the growth rates in the identified higher growth years to calculate a counterfactual level of imports for the model. New equilibrium prices and quantities are estimated absent the above-average growth to quantify the economic effects on producers and consumers. This approach implicitly assumes that the historical increases in imports were driven by supply conditions in the exporting countries, not by changes in the U.S. market. This approach also assumes that the volume of imports has an impact on prices and domestic production, but the volume of imports does not in turn react to conditions in the domestic market. Economic effects presented in the following sections of this chapter are calculated as the percent change between actual data and the counterfactual scenario where there is no above-average growth in imports.

[632] Perfect competition is a reasonable assumption for this market because there are a large number of fresh market cucumber producers. As discussed in chapter 2, USDA NASS estimated that there were over 15,000 fresh market cucumber producers in 2017.

Model Limitations

There are a few limitations to the modeling approach. First, the counterfactual in the model, which was chosen to illustrate the effects of increased imports on U.S. producers, is one of several potentially relevant scenarios that could be analyzed within this modeling framework. The counterfactual was chosen as relevant based on hearing testimony and separate discussions with industry participants. The approach does not identify any specific events in this chapter that caused the above-average growth in imports during the higher growth years; it simply identifies above-average growth rates in imports and adjusts the import volumes to construct the counterfactual. Discussion on factors affecting import growth can be found in chapter 2 on the U.S. cucumber industry, and chapters 3–4 on the cucumber industries in Mexico and Canada.

Second, due to limitations in data on investment, the model is static, i.e., it estimates the economic effects for each year separately. Therefore, the model does not account for any increased investment that may have occurred due to higher prices that led to increased domestic production in later years.

Third, the months included in each period are not perfect measures of the U.S. harvest seasons and may shift slightly from year to year depending on weather and other factors. Seasonal production data were not available and were estimated using available state production data and information about state harvesting periods.[633] The state seasonal production may also change over time or be affected by annual weather fluctuations, with some states that typically produce in November–May shifting some harvest to June–October, and vice versa. Assumptions that states harvest consistently in the same months from year to year were necessary to arrive at estimates of seasonal production, given the lack of publicly available data.

Finally, domestic production data did not include cucumbers grown under protection (e.g., in greenhouses), so the data were inflated by an estimate of controlled environment production for all six years analyzed in order to estimate total production. Also, employment data were not available, so the number of full-time equivalent workers (FTEs) were estimated using per-acre labor hour estimates and total cucumber acreage in the United States from U.S. Department of Agriculture (USDA) National Agricultural Statistics Service (NASS).[634] This employment estimate is not reflective of actual labor in the industry, which can be seasonal or short-term in nature.

Data and Trends

Several sources of data were used in the economic model. U.S. domestic cucumber production data for the years modeled (2015–20) were obtained from USDA NASS. Production data by end use were used to narrow down production volumes of cucumbers sent to the fresh market. The effects on the domestic market of imports of cucumbers for pickling are not modeled in this analysis, because the focus of the modeling is on products most important for the U.S. Southeast.

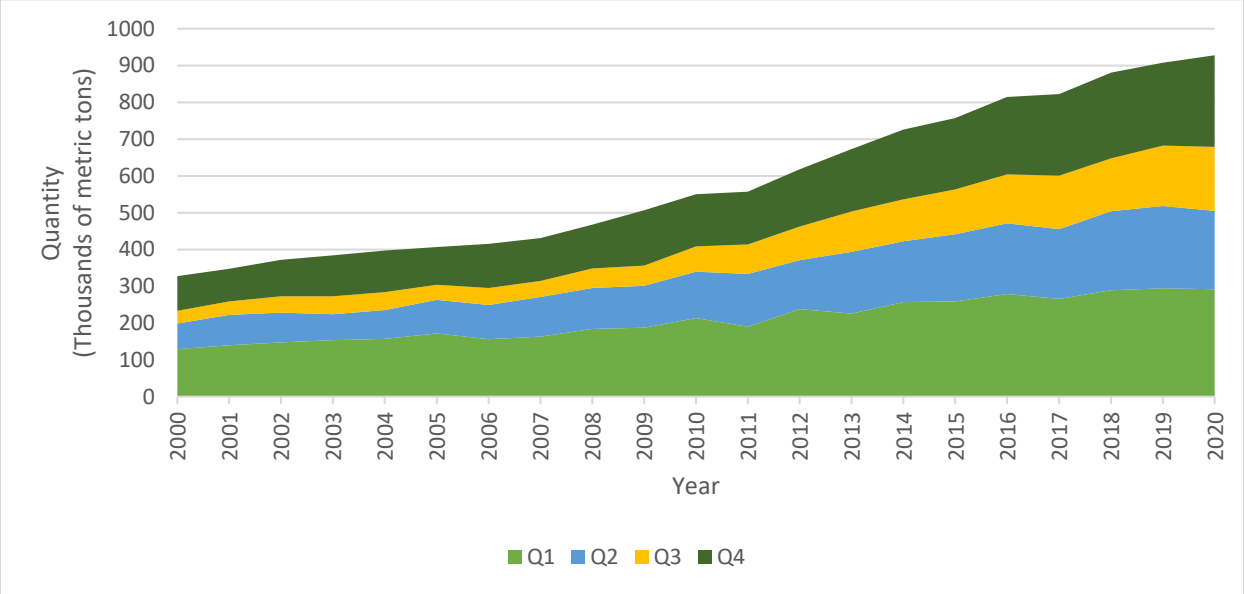
[633] Harvest seasons by major growing state and trading partner can be found in figure 1.1 in chapter 1.
[634] More information about the FTEs calculation and underlying assumptions can be found in the technical modeling appendix.

Monthly domestic production data, a key data requirement for a seasonal model, are generally not available and must be estimated. The portion of the annual domestic production data attributable to June through October and November through May are estimated using available state production data and information about state-level harvesting months. Also, USDA NASS domestic production data include only open field production, so an estimate of production under protected agriculture was added to each period's domestic production estimate to account for this additional source of supply.[635] Export data from 2015 to 2020 were subtracted from domestic production to isolate fresh market cucumbers produced and consumed in the United States.

Import data for 2015–20 were used in the model as the alternative variety to domestic production. The cucumber import HTS heading includes imports sent to both the U.S. fresh market and to U.S. processing, so imports were adjusted down by country-level estimates of fresh consumption products. To illustrate trends in imports over time, estimated quarterly import data are shown below in figure 7.1. Imports during the first, second, and fourth quarters had the greatest increases in volume, with the fourth and first quarters mostly aligning with the November–May period and the second and third quarters with the June through October period.

Figure 7.1 Cucumbers: U.S. imports, by volume and by quarter, 2000–2020

In thousands of metric tons. Underlying data for this figure can be found in appendix F, table F.16.



Source: USITC DataWeb/Census, HTS 6-digit heading 0707.00, accessed June 2021, and USITC estimates to isolate fresh market cucumber imports based on U.S. import data, importing countries' production data, and information on importing countries' production seasons for cucumbers for processing.

The counterfactual level of imports was calculated by reducing the actual import volumes for harvest periods with above-average growth rates. First, growth rates were calculated for each harvest period from 2000–2020. Then, seasonal growth rates for each year were compared to the average seasonal growth rate for the 20-year period. For harvest periods identified as having above-average growth, the level of imports was reduced to lower the growth rate by the difference between the average growth

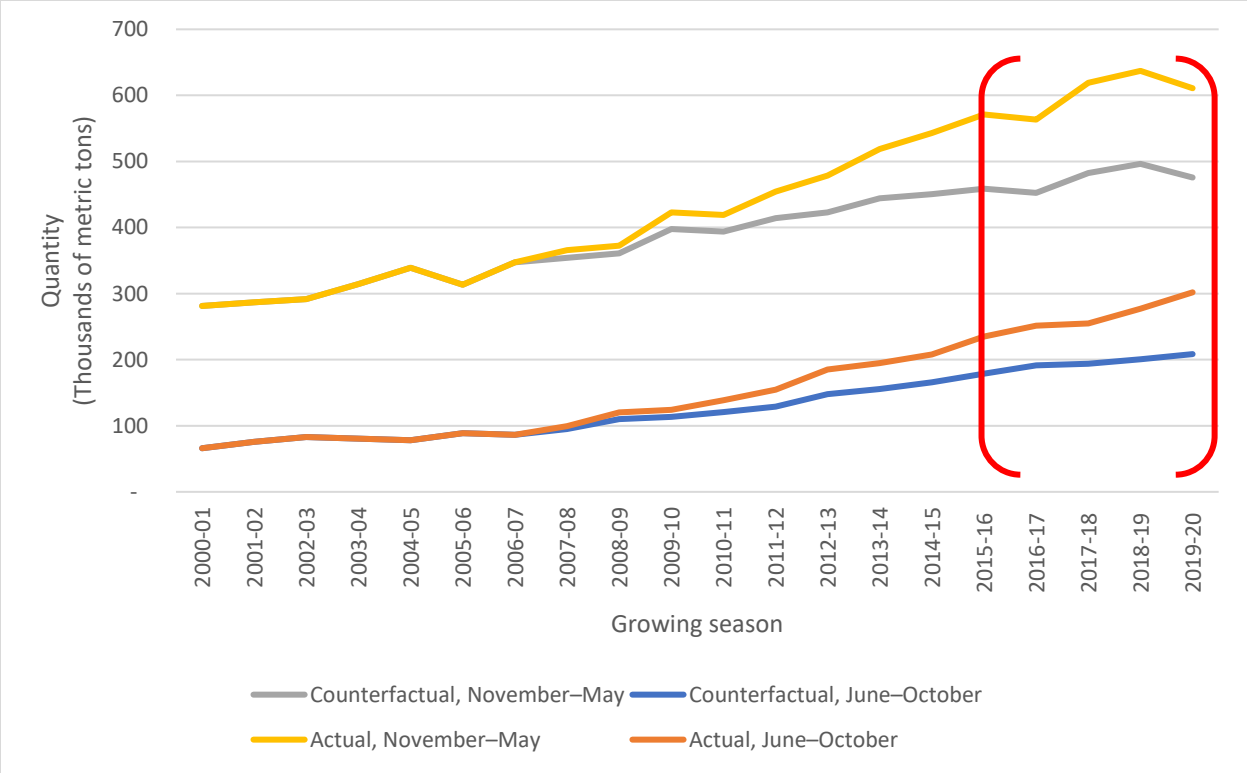
[635] Estimates of production under protected agriculture were based on ratios of production under protection and total production in 2019 data from the USDA NASS Census of Agriculture.

rate from 2000–2020 and the average growth rate between the high-growth years.[636] These counterfactual growth rates were then used to generate a counterfactual level of imports (figure 7.2) absent the above-average growth years.[637]

The historical higher growth in imports of fresh market cucumbers is larger in June–October. Average import growth for June–October from 2000–2020 was 8.6 percent, whereas average import growth during November–May was 4.3 percent over the same 20-year period. The higher growth years during June–October were between 2008 and 2020, with an average growth rate of 13.7 percent. In November–May, the higher growth years were between 2008 and 2017, with an average growth rate of 7.6 percent. Because the focus of the study is for the period 2015–20, only the counterfactual level of imports for this period were modeled.

Figure 7.2 Cucumbers: actual and counterfactual U.S. import volumes from 2000–2020 for both the June–October and November–May periods

In thousands of metric tons. Underlying data for this figure can be found in appendix F, table F.17.



Source: USITC DataWeb/Census, HTS 6-digit heading 0707.00, accessed June 2021, and USITC estimates.
Note: The years modeled are bracketed.

[636] See figure E.1 in the technical appendix for a visual representation of this process.
[637] Growth rates that were below the average were not adjusted. This means that the counterfactual level of imports grew at the same rate as actual imports during the growing season with below-average growth rates.

Estimated Economic Effects of Imports on U.S. Fresh Market Cucumber Producers

In the scenario where higher import growth is removed in the November–May period domestic output would have been about 37.2 percent higher on average, compared to a 27.1 percent increase in June–October domestic output (table 7.1 and 7.2). Effects are larger on average during November–May because of the larger import penetration rate. Because imports supply a larger share of the U.S. market, a reduction in imports will shift more demand to domestic producers.[638] In the counterfactual, domestic revenue and operating income would be $31.4 million and $6.6 million higher, respectively, in the November–May period on average, compared to $35.6 million and $7.5 million higher for the same categories, respectively, in the June–October period. The percent increase in domestic prices is higher on average during the November–May period (5.4 percent compared to 4.0 percent in the June–October period). Since producers in the U.S. Southeast are directly competing with imports during November–May, the price effects would have principally affected them.

The magnitude of the economic effects depends on several key factors. First, the bigger the import reduction, the more demand that will shift to domestically produced varieties, which will have larger impacts on U.S. producers' revenue, operating income, and employment. Second, in this model with constant elasticity of substitution demand, initial market shares have a large effect on price and quantity responses. If imports are the dominant source of supply (high import market share), then a change in imports will have a large effect on the U.S. aggregate price, and potentially a large effect on how U.S. firms respond. If imports are a minor source of supply (low import market share), then the same change in the value of imports would have a smaller effect on prices and result in a more muted response by U.S. producers.

The third factor that impacts the magnitude of effects is the consumer willingness to shift product sourcing after a relative price change. Higher willingness to shift sourcing after a relative increase in import prices leads to larger domestic price and output changes. If sources of supply are estimated to be less substitutable, then an increase in the price of imports will lead to a smaller shift in demand to the domestic variety. Finally, the ability of the U.S. industry to scale up production of fresh market cucumbers after prices increase is key for understanding how domestic supply will change. If U.S. suppliers can easily shift acreage from other products to fresh market cucumber production, and harvest the same acreage multiple times per growing period, then the domestic supply response will be greater than if production schedules are relatively rigid.

It is important to also analyze these effects over time. Removing the above-average increases in imports since 2008 has varying effects on both the June–October and November–May periods for each growing period modeled. Price and output changes are larger for the November–May period for the majority of the years modeled. For the first four growing periods modeled the percent increase in domestic production in this scenario (absent the high import growth) is larger during the November–May period, when Florida, Georgia and California are harvesting fresh market cucumbers. During 2019–20, this pattern reverses, and the model estimates a larger domestic production increase in percent terms in the

[638] Percent changes are also larger because they are starting from a smaller base, so it may also be helpful to view the changes in output in metric tons for magnitude.

months from June through October. While domestic revenue outcomes are initially larger in this scenario during the 2015–16 growing period, it reverses during the 2016–17 growing period where the June–October estimates experience larger changes in domestic revenue. June–October continues to have larger changes in domestic revenue and operating income for the remainder of the periods modeled.

There are two drivers of this trend reversal: the magnitude of the change in the level of imports, and the widening import penetration rate. First, the percent change in the quantity of imports grows larger over time, starting at a reduction of 24.0 percent during June–October and 19.7 percent during November–May and growing to about a 31.0 percent reduction in June–October and 22.1 percent reduction during November–May in the last period modeled. The June–October counterfactual level of imports deviates further from the actual imported volumes than the November–May level because the above average growth rates are higher. Second, in the 2015–16 growing period, imports made up 52.8 percent of the domestic fresh market during June–October and 79.2 percent during November–May. In 2020, import penetration rates are much larger, at 77.1 percent and 90.4 percent for June–October and November–May, respectively. The November–May import penetration rate is larger to begin with, so the reduction in imports in the counterfactual scenario has a more pronounced impact on the market in November through May. But as the June–October counterfactual level of imports deviates further from the actual level, this effect outweighs the higher import penetration rates in November–May. This leads to larger effects on domestic production, revenue, and operating income in June–October for the later years modeled.

Table 7.1 Cucumbers: estimated economic effects in June–October of a hypothetical reduction in U.S. imports, 2016–20

In percentages, thousands of metric tons, millions of dollars, and number of FTEs; mt = metric tons; FTEs = full-time equivalent workers.

Period	Import price (%)	Import quantity (%)	Domestic price (%)	Domestic output (%)	Domestic output (1,000 mt)	Domestic revenue (million $)	Domestic operating income (million $)	Domestic employment (no. of FTEs)
Jun–Oct 2016	12.24	−23.95		16.62	40.70	31.12	6.52	231
Jun–Oct 2017	13.85	−23.95	3.25	21.16	33.48	31.26	6.55	282
Jun–Oct 2018	13.69	−23.95	3.18	20.68	39.20	34.73	7.27	281
Jun–Oct 2019	18.00	−27.54	4.41	29.56	42.19	38.44	8.05	334
Jun–Oct 2020	25.24	−30.96	6.70	47.57	43.96	42.21	8.84	467
Average	16.60	−26.07	4.03	27.12	39.91	35.55	7.45	319

Source: USITC estimates.

Note: These numbers were simulated using a customized partial equilibrium model of the U.S. market for fresh market cucumbers. They can be interpreted as the percent change and dollar-value change of model outcomes after removing the above-average increases in imports.

Table 7.2 Cucumbers: estimated economic effects in November–May of a hypothetical reduction in U.S. imports, 2015–20

In percentages, thousands of metric tons, millions of dollars, and number of FTEs; mt = metric tons; FTEs = full-time equivalent workers.

Period	Import price (%)	Import quantity (%)	Domestic price (%)	Domestic output (%)	Domestic output (1,000 mt)	Domestic revenue (million $)	Domestic operating income (million $)	Domestic employment (no. of FTEs)
Nov 2015–May 2016	15.70	−19.68	4.45	29.89	36.53	33.30	6.97	208
Nov 2016–May 2017	16.14	−19.68	4.63	31.20	29.71	27.36	5.73	250
Nov 2017–May 2018	19.26	−22.09	5.54	38.17	35.28	33.31	6.97	253
Nov 2018–May 2019	19.86	−22.09	5.78	40.08	35.56	34.50	7.23	282
Nov 2019–May 2020	21.92	−22.09	6.56	46.44	30.61	28.43	5.95	325
Average	18.58	−21.13	5.39	37.16	33.54	31.38	6.57	263

Source: USITC estimates.

Note: These numbers were simulated using a customized partial equilibrium model of the U.S. market for fresh market cucumbers. They can be interpreted as the percent change and dollar-value change of model outcomes after removing the above-average increases in imports.

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Appendix A
Request Letter

DOCKET NUMBER
3512
OFFICE OF THE SECRETARY
INT'L TRADE COMMISSION

RECEIVED
December 7, 2020
OFFICE OF THE
SECRETARY
U.S. INT'L TRADE
COMMISSION

THE UNITED STATES TRADE REPRESENTATIVE
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON

December 4, 2020

The Honorable Jason Kearns
Chair
United States International Trade Commission
500 E Street, SW
Washington, DC 20436

Dear Chair Kearns:

On September 1, 2020, the Office of the United States Trade Representative ("USTR") and the Departments of Agriculture ("USDA") and Commerce ("Commerce") announced a comprehensive plan to support American producers of seasonal and perishable fruits and vegetables. The plan resulted from hearings conducted by USTR, USDA, and Commerce on trade practices that might be contributing to unfair pricing of seasonal and perishable agricultural products in the United States. We received more than 300 written submissions, and more than 60 witnesses testified at two days of hearings. A transcript of the hearings and copies of written submissions are available at www.regulations.gov under Docket ID: USTR-2020-0010.

Among the Administration actions identified in the plan were the requests by USTR for the Commission to commence investigations into blueberries, strawberries, and bell peppers, that were the subjects of my September 29 and November 3 letters to you. The plan also noted that USTR, USDA, and Commerce would continue to monitor the seasonal and perishable fruit and vegetable industries and to consider potential future investigations.

To that end, under authority delegated by the President to the United States Trade Representative, and pursuant to section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)), I request that the Commission conduct additional investigations into cucumbers and squash, and to prepare reports for cucumbers and squash as requested below. Specifically, the products in question consist of all imports that fall within the product descriptions under the following statistical reporting categories in the Harmonized Tariff Schedule of the United States:

- for cucumbers: 0707.00 (cucumbers and gherkins, fresh or chilled); and
- for squash: 0709.93.20 (squash, fresh or chilled).

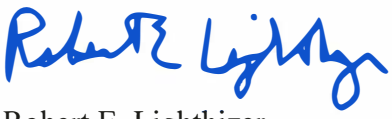
I respectfully request that the investigations and reports focus on the effect of imports on the domestic seasonal markets of the products in question, with particular focus on production and competitiveness of cucumbers and squash grown in the Southeastern United States. I would like

the reports to also include information on recent trends in trade in these products between the United States and its trading partners, including information on seasonal patterns of trade. Furthermore, I also request that the reports include descriptions of monthly price trends for these products in the United States, including an analysis and comparison of the prices of domestically produced products and imported products in the U.S. market, and I would like the reports to focus primarily on the 2015-2020 time period.

I request that the Commission transmit its reports no later than 12 months following receipt of this request. It is my desire that the Commission's reports will be made available to the public in their entirety, and therefore the reports should not include any business confidential information.

I appreciate the Commission's assistance and cooperation in this matter.

Sincerely yours,



Robert E. Lighthizer

Appendix B
Federal Register Notice

of contents when the document addresses multiple issues.

Confidential Business Information: Any submissions that contain confidential business information must also conform to the requirements of section 201.6 of the Commission's Rules of Practice and Procedure (19 CFR 201.6). Section 201.6 of the rules requires that the cover of the document and the individual pages be clearly marked as to whether they are the ''confidential'' or ''non-confidential'' version, and that the confidential business information is clearly identified by means of brackets. All written submissions, except for confidential business information, will be made available for inspection by interested parties.

As requested by the USTR, the Commission will not include any confidential business information in its report. However, all information, including confidential business information, submitted in this investigation may be disclosed to and used: (i) By the Commission, its employees and Offices, and contract personnel (a) for developing or maintaining the records of this or a related proceeding, or (b) in internal investigations, audits, reviews, and evaluations relating to the programs, personnel, and operations of the Commission including under 5 U.S.C. Appendix 3; or (ii) by U.S. government employees and contract personnel for cybersecurity purposes. The Commission will not otherwise disclose any confidential business information in a way that would reveal the operations of the firm supplying the information.

Summaries of Written Submissions: Persons wishing to have a summary of their position included in the report that the Commission sends to the USTR should include a summary with their written submission and should mark the summary as having been provided for that purpose. The summary should be clearly marked as ''summary for inclusion in the report'' at the top of the page. The summary may not exceed 500 words, should be in MS Word format or a format that can be easily converted to MS Word, and should not include any confidential business information. The summary will be published as provided if it meets these requirements and is germane to the subject matter of the investigation. The Commission will list the name of the organization furnishing the summary and will include a link to the Commission's Electronic Document Information System (EDIS) where the full written submission can be found.

By order of the Commission.

Issued: January 8, 2021.

Lisa Barton,

Secretary to the Commission.

[FR Doc. 2021–00565 Filed 1–12–21; 8:45 am]

BILLING CODE 7020–02–P

INTERNATIONAL TRADE COMMISSION

[Investigation Nos. 332–583]

Cucumbers: Effect of Imports on U.S. Seasonal Markets, With A Focus on the U.S. Southeast

ACTION: Notice of investigation and scheduling of a public hearing.

SUMMARY: Following receipt on December 7, 2020, of a request from the U.S. Trade Representative (USTR), under section 332(g) of the Tariff Act of 1930, the U.S. International Trade Commission (Commission) instituted Investigation No. 332–583, *Cucumbers: Effect of Imports on U.S. Seasonal Markets, with a Focus on the U.S. Southeast.* The USTR asked that the investigation cover all imports that fall within the product description of U.S. Harmonized Tariff Schedule subheading 0707.00 (cucumbers, including gherkins, fresh or chilled).

DATES:

March 25, 2021: Deadline for filing requests to appear at the public hearing.

March 29, 2021: Deadline for filing prehearing briefs and statements.

April 1, 2021: Deadline for filing electronic copies of oral hearing statements.

April 8, 2021: Public hearing.

April 15, 2021: Deadline for filing post-hearing briefs and statements.

April 27, 2021: Deadline for filing all other written submissions.

December 7, 2021: Transmittal of Commission report to the USTR.

ADDRESSES: All Commission offices, including the Commission's hearing rooms, are located in the U.S. International Trade Commission Building, 500 E Street SW, Washington, DC. All written submissions should be addressed to the Secretary, U.S. International Trade Commission, 500 E Street SW, Washington, DC 20436. The public record for this investigation may be viewed on the Commission's electronic docket (EDIS) at *https://edis.usitc.gov.*

FOR FURTHER INFORMATION CONTACT: Project Leader Lesley Ahmed (*lesley.ahmed@usitc.gov* or 202–205–3459), or Deputy Project Leader Kelsi Van Veen (202–708–3086 or *kelsi.vanveen@usitc.gov*) for information specific to these investigations. For information on the legal aspects of this investigation, contact William Gearhart of the Commission's Office of the General Counsel (202–205–3091 or *william.gearhart@usitc.gov*). The media should contact Margaret O'Laughlin, Office of External Relations (202–205–1819 or *margaret.olaughlin@usitc.gov*). Hearing-impaired individuals may obtain information on this matter by contacting the Commission's TDD terminal at 202–205–1810. General information concerning the Commission may also be obtained by accessing its website (*https://www.usitc.gov*). Persons with mobility impairments who will need special assistance in gaining access to the Commission should contact the Office of the Secretary at 202–205–2000.

Background: As requested by the USTR, the Commission in its report will focus on the effect of imports on the domestic seasonal markets of cucumbers, including gherkins, with a particular focus on production and competitiveness of such products grown in the Southeastern United States. In particular, the USTR asked that the report:

(1) Include information on recent trends in trade in these products between the United States and its trading partners, including information on seasonal patterns of trade;

(2) include descriptions of monthly price trends for these products in the United States, including an analysis and comparison of the prices of domestically produced and imported products in the U.S. market; and

(3) focus primarily on the 2015–2020 time period.

The USTR requested that the Commission transmit its report no later than 12 months following receipt of this request. In his request letter, the USTR stated that his office intends to make the Commission's report available to the public in its entirety and asked that the Commission not include any confidential business information.

Public Hearing: A public hearing in connection with this investigation will be held beginning at 9:30 a.m. on April 8, 2021, using a videoconference platform. More detailed information about the hearing, including how to participate, will be posted on the Commission's website at (*https://usitc.gov/research_and_analysis/what_we_are_working_on.htm*). Once on that web page, scroll down to Investigation No. 332–583, *Cucumbers: Effect of Imports on U.S. Seasonal Markets, with a Focus on the U.S. Southeast,* and click on the link to ''Hearing Information.'' Interested parties should check the Commission's website periodically for updates.

Requests to appear at the public hearing should be filed with the Secretary no later than 5:15 p.m., March 25, 2021, in accordance with the requirements in the ''Written Submissions'' section below. All prehearing briefs and statements should be filed not later than 5:15 p.m., March 29, 2021. To facilitate the hearing, including the preparation of an accurate written transcript of the hearing, oral testimony to be presented at the hearing must be submitted to the Commission electronically no later than noon, April 1, 2021. All post-hearing briefs and statements should be filed no later than 5:15 p.m., April 15, 2021. Post-hearing briefs and statements should address matters raised at the hearing. For a description of the different types of written briefs and statements, see the ''Definitions'' section below.

In the event that, as of the close of business on March 25, 2021, no witnesses are scheduled to appear at the hearing, the hearing will be canceled. Any person interested in attending the hearing as an observer or nonparticipant should check the Commission website in the preceding paragraph for information concerning whether the hearing will be held.

Written Submissions: In lieu of or in addition to participating in the hearing, interested parties are invited to file written submissions concerning this investigation. All written submissions should be addressed to the Secretary, and should be received not later than the dates provided for in this notice. All written submissions must conform to the provisions of section 201.8 of the Commission's Rules of Practice and Procedure (19 CFR 201.8), as temporarily amended by 85 FR 15798 (March 19, 2020). Under that rule waiver, the Office of the Secretary will accept only electronic filings at this time. Filings must be made through the Commission's Electronic Document Information System (EDIS, *https://edis.usitc.gov*). No in-person paper-based filings or paper copies of any electronic filings will be accepted until further notice. Persons with questions regarding electronic filing should contact the Office of the Secretary, Docket Services Division (202–205–1802), or consult the Commission's Handbook on Filing Procedures.

Definitions of Types of Documents That May be Filed; Requirements: In addition to requests to appear at the hearing, this notice provides for the possible filing of four types of documents: prehearing briefs, oral hearing statements, post-hearing briefs, and other written submissions.

(1) *Prehearing briefs* refers to written materials relevant to the investigation and submitted in advance of the hearing, and includes written views on matters that are the subject of the investigation, supporting materials, and any other written materials that you consider will help the Commission in understanding your views. You should file a prehearing brief particularly if you plan to testify at the hearing on behalf of an industry group, company, or other organization, and wish to provide detailed views or information that will support or supplement your testimony.

(2) *Oral hearing statements (testimony)* refers to the actual oral statement that you intend to present at the public hearing. *Do not* include any confidential business information in that statement. If you plan to testify, you must file a copy of your oral statement by the date specified in this notice. This statement will allow Commissioners to understand your position in advance of the hearing and will also assist the court reporter in preparing an accurate transcript of the hearing (*e.g.,* names spelled correctly).

(3) *Post-hearing briefs* refers to submissions filed after the hearing by persons who appeared at the hearing. Such briefs: (a) Should be limited to matters that arose during the hearing, (b) should respond to any Commissioner and staff questions addressed to you at the hearing, (c) should clarify, amplify, or correct any statements you made at the hearing, and (d) may, at your option, address or rebut statements made by other participants in the hearing.

(4) *Other written submissions* refer to any other written submissions that interested persons wish to make, regardless of whether they appeared at the hearing, and may include new information or updates of information previously provided.

There is no standard format that briefs or other written submissions must follow. However, each such document must identify on its cover (1) the type of document filed (*i.e.,* prehearing brief, oral statement of (name), post-hearing brief, or written submission), (2) the name of the person or organization filing it, and (3) whether it contains confidential business information (CBI). If it contains CBI, it must comply with the marking and other requirements set out below in this notice relating to CBI. Submitters of written documents (other than oral hearing statements) are encouraged to include a short summary of their position or interest at the beginning of the document, and a table of contents when the document addresses multiple issues.

Confidential Business Information: Any submissions that contain confidential business information must also conform to the requirements of section 201.6 of the Commission's Rules of Practice and Procedure (19 CFR 201.6). Section 201.6 of the rules requires that the cover of the document and the individual pages be clearly marked as to whether they are the ''confidential'' or ''non-confidential'' version, and that the confidential business information is clearly identified by means of brackets. All written submissions, except for confidential business information, will be made available for inspection by interested parties.

As requested by the USTR, the Commission will not include any confidential business information in its report. However, all information, including confidential business information, submitted in this investigation may be disclosed to and used: (i) By the Commission, its employees and Offices, and contract personnel (a) for developing or maintaining the records of this or a related proceeding, or (b) in internal investigations, audits, reviews, and evaluations relating to the programs, personnel, and operations of the Commission including under 5 U.S.C. Appendix 3; or (ii) by U.S. government employees and contract personnel for cybersecurity purposes. The Commission will not otherwise disclose any confidential business information in a way that would reveal the operations of the firm supplying the information.

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By order of the Commission.

Issued: January 8, 2021.

Lisa Barton,

Secretary to the Commission.

[FR Doc. 2021–00535 Filed 1–12–21; 8:45 am]

BILLING CODE 7020–02–P

INTERNATIONAL TRADE COMMISSION

[Investigation No. 337–TA–567 (Advisory Opinion Proceeding 2)]

Certain Foam Footwear; Institution of an Advisory Opinion Proceeding

AGENCY: U.S. International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the U.S. International Trade Commission has determined to institute an advisory opinion proceeding in the above-captioned investigation.

FOR FURTHER INFORMATION CONTACT: Clint Gerdine, Office of the General Counsel, U.S. International Trade Commission, 500 E Street SW, Washington, DC 20436, telephone (202) 708–2310. Copies of non-confidential documents filed in connection with this investigation may be viewed on the Commission's electronic docket (EDIS) at *https://edis.usitc.gov.* For help accessing EDIS, please email *EDIS3Help@usitc.gov.* General information concerning the Commission may also be obtained by accessing its internet server at *https://www.usitc.gov.* Hearing-impaired persons are advised that information on this matter can be obtained by contacting the Commission's TDD terminal, telephone (202) 205–1810.

SUPPLEMENTARY INFORMATION: The Commission instituted the underlying investigation on May 11, 2006, based on a complaint, as amended, filed by Crocs, Inc. (''Crocs'') of Niwot, Colorado. 71 FR 27514–15 (May 11, 2006). The complaint alleged, *inter alia,* violations of section 337 of the Tariff Act of 1930, as amended (19 U.S.C. 1337), in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain foam footwear, by reason of infringement of claims 1–2 of U.S. Patent No. 6,993,858 (''the '858 patent'') and U.S. Patent No. D517,789 (''the '789 patent''). The notice of investigation named several respondents, including Double Diamond Distribution Ltd. (''Double Diamond'') of Saskatoon, Canada.

On July 25, 2008, the Commission issued a final determination finding no violation of section 337 based on non-infringement and failure to satisfy the technical prong of the domestic industry requirement with respect to the '789 patent, and based on invalidity of the '858 patent as obvious under 35 U.S.C. 103. 73 FR 45073–74 (Aug. 1, 2008). On July 15, 2011, after an appeal to the U.S. Court of Appeals for the Federal Circuit and subsequent remand vacating the Commission's previous finding of no violation, the Commission found a violation of section 337 based on infringement of the asserted claims of the patents and issued a general exclusion order (''GEO'') and, *inter alia,* a cease and desist order (''CDO'') directed against Double Diamond. 76 FR 43723–24 (July 21, 2011).

On March 28, 2020, the '789 patent expired, so the GEO and CDO are now only directed to articles that infringe one or more of claims 1 and 2 of the '858 patent. Subsequently, on December 8, 2020, Double Diamond petitioned for institution of an expedited advisory opinion proceeding to determine whether its Original Beach DAWGS™ shoes with plastic washers are covered by the GEO or CDO. On December 18, 2020, Crocs opposed Double Diamond's petition for an expedited advisory opinion proceeding. On December 22, 2020, Double Diamond moved for leave to file a reply to Crocs' opposition.

The Commission has determined that Double Diamond's petition complies with the requirements for institution of an advisory opinion proceeding under Commission Rule 210.79 to determine whether its Original Beach DAWGS™ shoes with plastic washers fall within the scope of the GEO or CDO. Accordingly, the Commission has determined to institute an advisory opinion proceeding and refer it to the Office of the General Counsel. The parties will furnish the Office of the General Counsel with information as requested in the accompanying order, and the Commission will issue an advisory opinion within ninety (90) days of the date of publication of this notice in the **Federal Register**. The following entities are named as parties to the proceeding: (1) Double Diamond and (2) Crocs. The Commission has determined to grant Double Diamond's motion for leave to file a reply to Crocs' opposition.

The Commission vote for this determination took place on January 7, 2021.

The authority for the Commission's determination is contained in section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. 1337, and in part 210 of the Commission's Rules of Practice and Procedure, 19 CFR part 210.

By order of the Commission.

Issued: January 7, 2021.

Lisa Barton,

Secretary to the Commission.

[FR Doc. 2021–00477 Filed 1–12–21; 8:45 am]

BILLING CODE 7020–02–P

INTERNATIONAL TRADE COMMISSION

Notice of Receipt of Complaint; Solicitation of Comments Relating to the Public Interest

AGENCY: International Trade Commission.

ACTION: Notice.

SUMMARY: Notice is hereby given that the International Trade Commission has received a complaint entitled *Certain Wireless Communications Equipment and Components Thereof, DN 3522;* the Commission is soliciting comments on any public interest issues raised by the complaint or complainant's filing pursuant to the Commission's Rules of Practice and Procedure.

FOR FURTHER INFORMATION CONTACT: Lisa R. Barton, Secretary to the Commission, U.S. International Trade Commission, 500 E Street SW, Washington, DC 20436, telephone (202) 205–2000. The public version of the complaint can be accessed on the Commission's Electronic Document Information System (EDIS) at *https://edis.usitc.gov.* For help accessing EDIS, please email *EDIS3Help@usitc.gov.*

General information concerning the Commission may also be obtained by accessing its internet server at United States International Trade Commission (USITC) at *https://www.usitc.gov.* The public record for this investigation may be viewed on the Commission's Electronic Document Information System (EDIS) at *https://edis.usitc.gov.* Hearing-impaired persons are advised that information on this matter can be obtained by contacting the Commission's TDD terminal on (202) 205–1810.

SUPPLEMENTARY INFORMATION: The Commission has received a complaint and a submission pursuant to § 210.8(b) of the Commission's Rules of Practice and Procedure filed on behalf of Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. on January 7, 2021. The complaint alleges violations of section 337 of the Tariff Act of 1930 (19 U.S.C. 1337) in the importation into the United States, the sale for importation, and the sale within the United States after importation of certain wireless communications equipment and components thereof. The

Appendix C
Calendar of Hearing Witnesses

CALENDAR OF PUBLIC HEARING

Those listed below appeared in the United States International Trade Commission's hearing via videoconference:

Subjects:	Cucumbers: Effect of Imports on U.S. Seasonal Markets with a Focus on the U.S. Southeast Squash: Effect of Imports on U.S. Seasonal Markets with a Focus on the U.S. Southeast
Inv. Nos.:	332-583 and 332-584, respectively
Date and Time:	April 8, 2021 - 9:30 a.m.

STATE GOVERNMENT APPEARANCE:

The Honorable Nicole Fried, Commissioner of Agriculture, Florida Department of Agriculture and Consumer Services

EMBASSY AND FOREIGN GOVERNMENT APPEARANCES:

Embassy of Canada
Washington, DC

Nadia Bourély, Minister Counsellor

Glen Snoek, Marketing and Economic Policy Analyst, Ontario Greenhouse Vegetable Growers

Andre Solymosi, General Manager, British Columbia Vegetable Marketing Commission

Ron VanDamme, Vice Chair, Ontario Processing Vegetable Growers

Jocelyn Gibouleau, President, Les Productions Margiric Inc.

Mathieu Boucher, Deputy Director, Horticulture Division, Agriculture and Agri-Food Canada

Embassy of Mexico
Government of Mexico
Washington, DC

Minister Gerardo Lameda, Head of the Trade Office

PANEL #1: ACADEMIA, TRADE ASSOCIATIONS, AND COUNTY GOVERNMENT

ORGANIZATION AND WITNESSES:

University of Florida IFAS
Southwest Florida Research and Education Center
Immokalee, FL

Gene McAvoy, Associate Director for Stakeholder Relations

University of Florida IFAS
Gulf Coast Research and Education Center
Wimauma, FL

Zhengfei Guan, Associate Professor

Harris Bricken McVay, LLP
Seattle, WA
on behalf of

Fresh Produce Association of the Americas ("FPAA")

Lance Jungmeyer, President, FPAA

Adams Lee) – OF COUNSEL

Georgia Fruit & Vegetable Growers Association
LaGrange, GA

Charles T. Hall, Jr., Executive Director

Florida Fruit & Vegetable Association ("FFVA")
Maitland, FL

Michael Joyner, President, FFVA

Marie Bedner, Owner, Bedner Growers, Inc.

Richard "Dick" Bowman, Director of Farming, J&J Family of Farms

Texas International Produce Association
Mission, TX

Dante L Galeazzi, Chief Executive Officer and President

Dade County Farm Bureau
Homestead, FL

James R. Pierce, Jr., Executive Director
Economic Resources Department of Miami-Dade County

Cutler Bay, FL

Charles LaPradd, Agricultural Manager

PANEL #2: GROWERS, PACKERS, AND DISTRIBUTORS FROM THE U.S. SOUTHEAST

ORGANIZATION AND WITNESSES:

Chill C Farms
Moultrie, GA

Sam Watson, Managing Partner

Minor Brothers Farm
Andersonville, GA

Dick Minor, Partner

BTR Farms
Moultrie, GA

Brian Robinson, Chief Executive Officer

Lewis Taylor Farms
Tifton, GA

William L. Brim, President and Chief Executive Officer

J. Alderman Farms, Inc.
Boynton Beach, FL

James M. Alderman, President

M. F. Burgin, Inc. d/b/a Burgin Farms
Wauchula, FL

Caleb Burgin, President

Sasha Burgin, Secretary/Treasurer

S & L Beans, Inc.
Homestead, FL

Salvatore Finocchiaro, Farmer from Miami-Dade County,
Dade County Farm Bureau

PANEL #3: GROWERS, PACKERS, AND DISTRIBUTORS OUTSIDE OF THE U.S. SOUTHEAST

ORGANIZATION AND WITNESSES:

J&D Produce Inc.
Edinburg, TX

Bret Erickson, Senior Vice President, Business Affairs

SunFed Produce
Rio Rico, AZ

Craig Slate, President and Chief Executive Officer

Frello Fresh, LLC
Rio Rico, AZ

Guillermo Martinez, Chief Executive Officer

Tricar Sales, Inc.
Rio Rico, AZ

Rod Sbragia, Director, Sales and Marketing

Chamberlain Distributing, Inc.
Nogales, AZ

Jaime Chamberlain, President

The Sykes Company
Rio Rico, AZ

Lesley Sykes, Vice President

- END -

Appendix D
Summary of Views of Interested Parties

Appendix D includes summaries of written submissions prepared by interested parties as well as the names of interested parties who filed written submissions in the investigation but did not file a written summary. The Commission has not edited the written summaries. A full copy of each written submission is available in the Commission's Electronic Document Information System (EDIS) (https://edis.usitc.gov/). A public hearing was held for the investigation on April 8, 2021, and the transcript of the hearing is available on EDIS.

Written Submissions

Fresh Produce Association of the Americas

The Fresh Produce Association of the Americas ("FPAA") strongly opposes any requests for the imposition of additional duties or other trade remedy measures on imports of cucumbers. The Commission collected information and data regarding the supply and demand conditions in the U.S. market for cucumbers that clearly demonstrates that any requests for trade relief should not be granted.

First, because cucumbers have different growing seasons in different regions, most Mexican cucumbers are imported in the winter months when most U.S. cucumbers producers are not producing cucumbers. Mexico's cucumber import volumes decrease in the summer months during the growing season of most states. Only the Southeast U.S. has a growing season that overlaps with Mexico, yet the Southeast U.S. growers do not represent the entire domestic cucumber industry and also are unable to meet total U.S. market demands during their growing season.

Second, most Mexican cucumbers are pole-grown in protected agriculture and shed-packed, and have a clear quality advantage over U.S. cucumbers that are mostly grown on unsupported bushes in open fields and field packed. This quality advantage in terms of consistency of color, size, and shape is significant for retail customers who offer price premiums not just for better Mexican product quality but also better supply logistics. Most Southeast U.S. cucumber growers have not innovated and still grow, harvest, pack and market cucumbers using decades-old techniques.

Third, over the past five years, the data does not show any significant loss of U.S. sales volume or market share or underselling by Mexican imports of cucumbers. Contrary to the anecdotal testimony of certain domestic growers, the U.S. import statistics and USDA AMS data shows stable Mexican import volumes with only slight annual increases corresponding to the growth in U.S. population and consumer demand, but with consistent seasonal trends with highest import volumes in the winter and early spring and a sharp decrease in import volumes during the summer. Cucumbers are perishable with pricing subject to variable, rapid and frequent market swings.

Fourth, Southeast U.S. growers elsewhere have highlighted the problems caused by the lack of availability or high cost of U.S. agricultural labor, damage from hurricanes or tropical storms, encroaching real estate development, or the impact of COVID-19. But before the Commission they ignore or discount their own prior statements about these problems and instead unreasonably blame only Mexican imports. Imposing duties or otherwise restricting Mexican imports will not solve any of these other problems that are more significant causes of the Southeast U.S. growers' current condition.

The growth of Mexican agriculture, including cucumbers, has been funded primarily from private investment, not from Mexican government subsidies. Any Mexican government subsidies previously provided for protected agriculture and other innovations were declared as non-distortive ("green box") and have been discontinued. Many U.S. companies, including those from the Southeast U.S., have invested directly in Mexico so that they can be in the marketplace year-round, helping increase per capita consumption.

American Farm Bureau Federation

No written summary. Please see EDIS for full submission.

Border Trade Alliance

No written summary. Please see EDIS for full submission.

Confederación de Asociaciones Agrícolas del Estado de Sinaloa, A.C., Consejo Agrícola de Baja California, A.C., Asociación Mexicana de Horticultura Protegida, A.C. and Asociación de Productores de Hortalizas del Yaqui y Mayo, and Asociación de Organismos de Agricultores del Norte de Sonora, A.C.

No written summary. Please see EDIS for full submission.

Congress of the United States

Members: Austin Scott, Darren Soto, Rick W. Allen, Jack Bergman, Sanford D. Bishop, Jr., Kat Cammack, John H. Rutherford, Mario Diaz-Balart, Daniel Webster, Brian Mast, Scott Franklin, Frederica S. Wilson, Alcee L. Hastings, Bill Huizenga, A. Drew Ferguson, Dan Kildee, W. Gregory Steube, Jody Hice, Stephanie Murphy, Carlos Gimenez, Debbie Wasserman Schultz, Lisa McClain, Fred Upton, Val Demings, Bill Posey, Neal Dunn, Earl L. "Buddy" Carter, David Scott, Ted Deutch, Al Lawson, Jr.

No written summary. Please see EDIS for full submission.

Florida Department of Agriculture and Consumer Services

No written summary. Please see EDIS for full submission.

Florida Fruit & Vegetable Association ("FFVA")

No written summary. Please see EDIS for full submission.

Georgia Fruit and Vegetable Growers Association

No written summary. Please see EDIS for full submission.

Government of Canada

No written summary. Please see EDIS for full submission.

Government of Mexico

No written summary. Please see EDIS for full submission.

Miami-Dade County

No written summary. Please see EDIS for full submission.

Michigan Farm Bureau

No written summary. Please see EDIS for full submission.

University of Florida IFAS

No written summary. Please see EDIS for full submission.

Appendix E
Modeling

This appendix provides a technical description of the economic model. The first section describes the model's structural features. The second section describes the data and parameter inputs of the model. The third section details the approach used to econometrically estimate the elasticity of substitution. The last section reports a set of additional model runs under alternative assumptions to illustrate the sensitivity of estimated economic effects to these assumptions.

Technical Description of the Model

Chapter 7 used a customized partial equilibrium model of the U.S. cucumbers market to simulate the effects of increased imports on the U.S. industry. Consumers in the market have non-nested constant elasticity of substitution (CES) demands for both imported and domestic fresh market cucumber varieties with imperfect substitution across sources. Total imports are aggregated into one variety, implying that consumers do not differentiate between fresh market cucumbers from different import sources.[639] Equations (1) through (3) represent the price index (P), demand for domestic varieties (q_d), and demand for imported varieties (q_i). The price elasticity of total industry demand is denoted as γ. The elasticity of substitution is σ, which represents consumers' willingness to shift between cucumbers from foreign and domestic varieties in response to a change in relative prices. The parameter *b* is a demand shifter and *k* is the total expenditure in the industry.

$$P = (p_d^{1-\sigma} + b\, p_i^{1-\sigma})^{1/1-\sigma} \qquad (1)$$

$$q_d = k\, P^{\gamma} (\frac{p_d}{P})^{-\sigma} \qquad (2)$$

$$q_i = k\, b\, P^{\gamma} (\frac{p_i}{P})^{-\sigma} \qquad (3)$$

The model assumes that there is a large number of producers who compete in a perfectly competitive industry. The domestic supply curve (equation 4) is upward sloping and governed by a domestic price elasticity of supply (ε_d). The parameter *a* is a supply shifter. The quantity of imports is exogenous, set to the calculated counterfactual level q_c (equation 5).

$$q_d = a\, p_d^{\varepsilon_d} \qquad (4)$$

$$q_i = q_c \qquad (5)$$

Domestic revenue is calculated as the domestic price times domestic quantity. The change in operating income is approximated by calculating the change in revenue divided by the elasticity of substitution. This relationship can be formally derived in a monopolistic competition model with CES preferences, which is a similar formulation to the perfect competition model used here.[640] The change in domestic employment—the number of full-time equivalent workers (FTEs)—is calculated as the baseline number of FTEs multiplied by the percent change in domestic quantity, thus moving in proportion to domestic output.

[639] Consumers do not differentiate between fresh market cucumbers from different countries of import; the imported varieties are aggregated. An alternative model structure could differentiate between each country of import, but this would have limited impact on the domestic results.
[640] Ahmad, "Conducting Profitability Analysis in Partial Equilibrium Models with Monopolistic Competition," July 2019.

First, actual data are used to calibrate the model in the baseline. Second, a counterfactual level of imports is exogenously imposed in the model to illustrate the economic effects of increased imports on the U.S. market. The counterfactual level of imports is calculated as the level of imports in the market had there not been above-average growth since the year 2000. The counterfactual calculation is described in the next section below.

The seasonal model was run five separate times per season, once for each period in the 2015–20 investigation window. There are no dynamic links between periods, like inventory storage, in the model. They are not likely to be important because cucumbers have a relatively short shelf-life.

Detailed Description of the Model Inputs

Domestic fresh market cucumber production for U.S. consumption was estimated as total fresh market cucumber production by season, estimated from U.S. Department of Agriculture (USDA) National Agricultural Statistics Service Information (NASS) data, plus an estimate of domestic cucumber production under protected agriculture, less domestic exports (table E.1). Monthly fresh market cucumber production data were not available, so the seasonal production data were estimated using information about each state's harvest season (table E.1). A majority (65 percent) of Florida fresh market cucumber production was allocated to November–May and 35 percent to June–October. Half of Georgia production was allocated to June–October and half to November–May, based on conversations with Georgia industry. California production was also allocated between the periods with approximately 44 percent in the November–May period and 56 percent in the June–October period. Production from the rest of the states was included in the June–October period. Some states' fresh market cucumber production data were not disclosed in the USDA NASS dataset, including data for Georgia and Florida, so those state-level production quantities were estimated by using AMS shipment data for each year.

The USDA NASS survey data include only open field production, so an estimate of production grown under protection (e.g., in greenhouses) was added to each season. Controlled environment protection was estimated to be 11 percent of fresh market cucumber production in the United States. Shares of production under protection by state were obtained from the USDA NASS census data and added to the estimates for the two periods, June–October and November–May. Finally, the domestic exports number in table E.1 includes only fresh market cucumber exports, using the fresh cucumbers production share by year to remove exports for pickling.

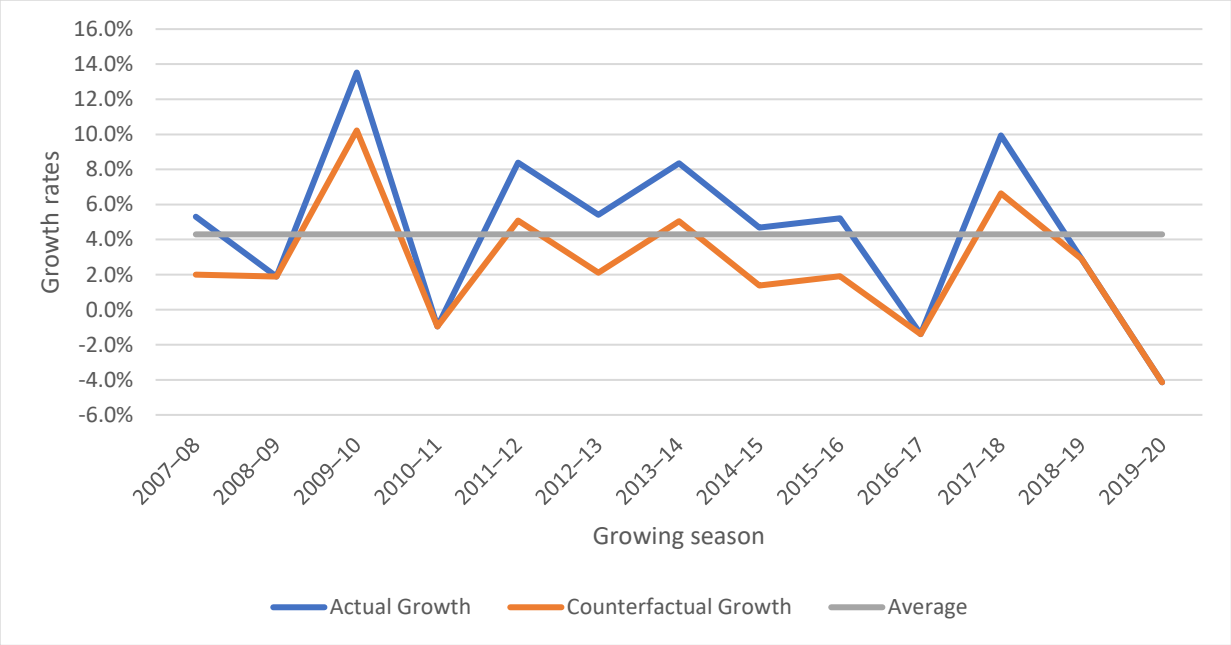
Domestic employment data are not generally available for individual agricultural products. An estimate of full-time equivalent workers (FTEs) was estimated using information about per-acre labor hours and acreage data from USDA NASS. The per-acre number of labor hours needed to produce cucumbers was multiplied by the total number of cucumber acres in the United States to calculate the total number of labor hours for all regions. Then, the number of FTEs was calculated assuming a full-time employee is working eight hours a day, five days a week, and 52 weeks per year. The FTEs were then split between the June–October and November–May periods using production shares. FTEs are used to match the time aggregation in the model but are not representative of actual employment in the industry. Actual employment figures are likely to be much higher, with seasonal and part-time workers common in this industry.

Actual imports volumes and values by month were obtained from USITC's DataWeb. The cucumber import HTS 6-digit heading 0707.00 separates imports of fresh market cucumbers and cucumbers for pickling only during certain time periods, so imports were adjusted down by country-level estimates of fresh market products based on U.S. import data, importing countries' production data, and information on importing countries' production seasons for cucumbers for processing. Imports from Mexico were estimated to be 95.5 percent for the fresh market by quantity and 96.5 percent by value; imports from Canada were estimated to be 82 percent by quantity and 95 percent by value; and all other imports were estimated to be 95 percent by quantity and value.

The counterfactual level of imports was calculated by reducing the actual imports volumes for harvest periods with above-average growth rates. First, growth rates were calculated for each harvest period from 2000–2020. Next, periods were identified as being above the average growth rate for the 20-year period. For periods identified as having above-average growth, the growth rate was lowered by the difference between the average growth rate from 2000–2020 and the average growth rate between the high-growth years (figure E.1). This brings the average growth rate of the high-growth period down to the average growth rate of other years while still allowing variation between years. The simulation then creates a counterfactual level of imports for each harvest period from the beginning of the high-growth years to 2020 based on the import volume of the prior year and the new counterfactual growth rate in the high-growth years. Imports continue to grow in the counterfactual, but the above-average increases are removed.

Figure E.1 Example of actual and counterfactual import growth rates during the high growth period for November-May

Underlying data for this figure can be found in appendix F, table F.18.



Source: USITC DataWeb/Census (6-digit HTS heading 0707.00), accessed June 2021, and USITC estimates.

The high-growth periods for June–October were during the years 2008, 2009, 2011, 2012, 2013, 2016, 2019 and 2020. The high-growth periods for November–May were during 2007–08, 2009–20, 2011–12, 2012–13, 2013–14, 2014–15, 2015–16, and 2017–18.

The counterfactual scenario does not correspond to any analysis of specific policy alternatives. Instead, the counterfactual was chosen based on aggregate import trends. More information on country-specific factors that impacted overall U.S. import trends can be found in chapters 2-4.

Table E.1 Seasonal data inputs used in the cucumber model, 2015–20

In millions of dollars, metric tons, and number of FTEs; mt = metric tons; FTEs = full-time equivalent workers.

Seasonal data input	2015–16	2016–17	2017–18	2018–19	2019–20
June–October domestic production (million $)	158.4	124.6	141.7	109.0	73.5
June–October domestic production (mt)	244,846	158,235	189,578	142,700	92,407
June–October imports, fresh market (million $)	212.2	232.9	256.3	264.6	311.2
June–October imports, fresh market (mt)	234,876	251,467	254,865	277,164	301,934
June–October counterfactual imports (mt)	178,624	191,242	193,826	200,826	208,455
June–October exports (mt)	2,366	1,081	1,547	1,853	1,550
June–October employment (# of FTEs)	1,395	1,334	1,359	1,133	983
November–May domestic production (million $)	93.3	73.4	72.7	71.6	50.7
November–May domestic production (mt)	122,233	95,212	92,436	88,728	65,915
November–May imports, fresh market (million $)	469.5	406.2	468.0	519.3	564.9
November–May imports, fresh market (mt)	571,277	563,283	619,233	637,137	610,745
November–May counterfactual imports (mt)	458,877	452,456	482,453	496,403	475,841
November–May exports (mt)	3,967	3,069	3,507	3,053	2,371
November–May employment (# of FTEs)	696	802	663	704	701

Source: USITC estimates, as described above.

The model has three parameters that are held constant across all years: the constant elasticity of substitution between foreign and domestic sources, the seasonal domestic supply elasticity, and the industry price elasticity of demand (table E.2). The elasticity of substitution is estimated using the trade cost method and further described in the next section.

The model assumes a moderate value for the domestic supply elasticity, six, for several reasons. First, cucumbers have a relatively short (45-day) growing season and producers can easily adjust production by changing the number of times a crop is harvested. There are relatively few costs in soil preparation to produce cucumbers, and farmers do not require specialized farm equipment. There are also several states with different growing conditions that are suitable for producing cucumbers. The industry price elasticity of demand is set to −1, which implies that the overall expenditure (price times quantity) in a year does not change with price. This assumption is common in similar models and has been found to hold for many types of products.

Table E.2 Parameter inputs used in the model

Parameter	Value	Source
Seasonal elasticity of substitution	4.78	USITC estimate, using econometric model described in next section
Seasonal domestic supply elasticity	6	USITC estimate, based on length of growing season, costs, and technology requirements
Industry price elasticity of demand	−1	USITC estimate

Source: USITC estimates.

Econometric Approach to Estimate the Elasticity of Substitution

The elasticity of substitution is a model parameter that describes how consumers shift sourcing after a relative price change. A higher value means that the products are more substitutable, or less differentiated, leading to larger estimated effects of imports on the domestic market. It is an important parameter in trade policy models with CES demands, because the magnitude can significantly impact model predictions.[641]

The cucumber substitution elasticity was estimated using the trade cost method described in Riker (2020).[642] The econometric method assumes a non-nested CES structure, with one parameter describing substitutability across all sources of supply.[643] The method uses variation in international trade costs, such as freight costs and tariffs, to identify the elasticity of substitution across sources of imports. Monthly panel import data from 2016–20 were obtained from the U.S. International Trade Commission's DataWeb and are disaggregated by product, source country, customs district of import entry, month, and year. The measure for international trade costs is the ratio between the landed duty-paid value of imports and the customs value, and includes international freight costs, tariffs, and other import charges. The estimation uses country-time and district-time fixed effects to control for variation in prices and other demand factors, including the price index, producer prices, and total expenditures. Monthly data were aggregated into the two harvest periods for the model, so the time element in the fixed effects is referring to the June–October and November–May periods. Table E.3 reports the substitution elasticity point estimate and standard error.

Table E.3 Estimated elasticity of substitution for cucumbers, fresh or chilled

Product and HTS 6-digit heading	Point estimate	Standard error
Cucumbers, fresh or chilled (0707.00)	4.7756	0.8842

Source: USITC estimates.

[641] For example, McDaniel and Balistreri (2003) show that the value of the elasticity of substitution can have a significant effect on welfare gains or losses in trade policy simulations.
McDaniel and Balistreri, *A Review of Armington Trade Substitution Elasticities*, 2003.
[642] Riker, *A Trade Cost Approach to Estimating the Elasticity of Substitution*, July 2020.
[643] In theory, a nested CES structure could be used, with a separate elasticity of substitution between domestic and imported aggregates. There was no reason to believe that the domestic varieties are substantially different than the imported varieties, so a non-nested CES model was used in this analysis.

Sensitivity Analyses

This section reports additional sensitivity analyses under alternative assumptions about model parameters. First, data are aggregated to an annual time frame and economic effects are estimated without seasonality. A new counterfactual level of imports is calculated, following the same procedure described above but by analyzing annual growth rates instead of growth rates by season. Economic effects are not an aggregate of the main chapter results, because the counterfactual level of imports on an annual basis is different than when calculated by growing period. Results are also different because the estimated elasticity of substitution is different with an annual time frame.[644]

Table E.4 Sensitivity analysis using an annual time frame
In percentages, millions of dollars, and number of FTEs. FTEs = full-time equivalent workers.

Year	Import price (%)	Import quantities (%)	Domestic price (%)	Domestic output (%)	Domestic revenues (mil $)	Operating income (mil $)	Employment (no. of FTEs)
2015	10.9	−15.8	2.2	14.1	39.2	10.5	295
2016	13.0	−18.3	2.7	17.0	50.6	13.5	355
2017	14.0	−18.3	3.0	19.3	45.2	12.0	411
2018	16.2	−20.6	3.4	22.5	57.2	15.2	454
2019	17.3	−20.6	3.8	25.2	54.2	14.4	463
2020	19.5	−20.6	4.5	30.4	45.1	12.0	511
Average	15.1	−19.0	3.3	21.4	48.6	12.9	415

Source: USITC estimates.
Note: These numbers were simulated using a customized partial equilibrium model of the U.S. market for fresh market cucumbers. They can be interpreted as the percent change and dollar-value change of model outcomes after removing the above average increases in imports.

Next, the domestic supply elasticity is altered to show the sensitivity in the seasonal model to this parameter value. A value of five is used in the "low supply elasticity" case, a value of six is used in the "Chapter 7 result" case, and a value of seven is used in the "high supply elasticity case". Economic effects are reported in table E.5, showing that the higher the supply elasticity, the more able U.S. producers are to scale up production after a shift in demand. Results vary by elasticity assumption but are not substantially different for each of the three scenarios.[645]

[644] Even if the annual model used the same parameter values and an aggregated counterfactual that matched the seasonal model, results would still differ because the model is non-linear.
[645] The change in import quantities in table E.5 is the same for all three simulations. This is because imports are treated as exogenous in the model; changing the supply elasticity does not affect the counterfactual level of imports that was calculated outside the model.

Table E.5 Sensitivity analysis under different domestic supply elasticity assumptions, November–May results for illustration

In percentages, millions of dollars, and number of FTEs. FTEs = full-time equivalent workers.

Result	Change in import price (%)	Change in import quantities (%)	Change in domestic price (%)	Change in domestic output (%)	Change in domestic revenues (mil $)	Change in operating income (mil $)	Change in employment (no. of FTEs)
Low supply elasticity (5)	18.89	−21.13	6.11	34.58	30.17	6.32	245
Chapter 7 result (6)	18.58	−21.13	5.39	37.16	31.38	6.57	263
High supply elasticity (7)	18.32	−21.13	4.83	39.24	32.35	6.63	278

Source: USITC estimates.

Note: These numbers were simulated using a customized partial equilibrium model of the U.S. seasonal market for fresh market cucumbers. They can be interpreted as the percent change and dollar-value change of model outcomes after removing the above average increases in imports.

Finally, the sensitivity of the shares used to split California fresh market cucumber production into two periods,
June–October, and November–May, is tested.[646] In the main chapter, 44 percent of California production is included in November–May season and 56 percent in June–October. This sensitivity analysis first shifts all California production into November–May, and then shifts all California production into June–October, to test the two extreme cases. If all of California production were harvested in November–May, domestic output would be about 34.7 percent higher in the counterfactual scenario, compared to 37.2 percent in the main chapter results. If all of California production were harvested in June–October, domestic output for November–May would be about 39.4 percent higher in the counterfactual scenario. Thus, the percent change in domestic output in November–May is likely to fall between 34.7 percent and 39.4 percent. The other economic outcomes have similar ranges and are omitted for brevity.

[646] This sensitivity analysis focuses on California because California shares have the least amount of supporting evidence of all state splits.

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Appendix F
Data Tables for Figures and Supplemental Data Tables

Data Tables for Figures

Table F.1 Harvest seasons for fresh market cucumbers

This table corresponds to figure 1.1.

State/country	Harvest season
Florida	Second half of September through June
Georgia	May through June and October through November
North Carolina	June through first half of October
Michigan	Second half of June through first half of October
California	Second half of March through November
United States	January through December
Mexico	January through December
Canada	Second half of February through first half of November

Sources: Florida Department of Agriculture and Consumer Services, "Florida Agriculture by the Numbers," 2019, 85; Josh H. Freeman, Eugene J. McAvoy, Nathan S. Boyd, Mathews Paret, Qingren Wang, Christian F. Miller, Johan Desaeger, Jawwad Qureshi, Xavier Martini, and Phillip B. Williams, "Chapter 7. Cucurbit Production," in *Vegetable Production Handbook of Florida, 2020–2021 Edition*, 2020; Kemble, *Southeastern U.S. 2020 Vegetable Crop Handbook*, 2020, 52; Produce Blue Book, "Cucumbers," accessed July 14, 2021. Gerald J. Holmes, David W. Monks, Jonathan R. Schultheis, Kenneth A. Sorensen, Allan C. Thornton, and Stephen J. Toth, Jr. (ed.), "Crop Profile for Cucumbers in North Carolina," June 2005, 3; James Manning, Daniel Brainard, and Gary Heilig, "How to Grow Cucumbers," *Michigan State University Extension* (blog), May 19, 2016; Wayne L. Schraeder, Jose L. Aguiar, and Keith S. Mayberry, "Cucumber Production in California" (University of California, Agriculture and Natural Resources, 2002), 1; Canadian government representative, email to Commission staff, July 6, 2021; Industry representatives, interview by USITC staff, March 9, 2021, (Bridges Produce).

Notes: These seasons represent typical commercial practices, though seasons may be shortened due to extenuating weather events or extended if the grower chooses to employ certain production technologies. It should also be noted that demand may affect individual grower decisions to shorten or extend the harvest seasons. Florida harvest season reflects practices in northern, southern, and central Florida, where most production is located. Georgia harvest seasons reflect practices in southern Georgia where most production is located. North Carolina harvest season reflects practices in eastern North Carolina where most production is located. Michigan harvest season reflects practices in the central, eastern, and southwestern lower peninsula of Michigan where most is located. California harvest season reflects production practices in northern, southern, and central California. Canada harvest season reflects production in high-technology greenhouses, which is where nearly all of Canada's fresh market cucumbers are grown. Mexico's harvest season reflects both open field produced cucumbers as well as cucumbers grown under protected agriculture (PA) in northwestern and central Mexico, where the majority of fresh market cucumbers are being grown. Note that while growers have the ability to harvest year-round under certain types of PA in Mexico, some industry representatives claim that the actual growing season is much shorter (November–March) and based on demand.

Table F.2 Cucumber production in the United States, by state, 2020

In metric tons. This table corresponds to figure 2.1.

State	2020
California	42,184
Florida	154,924
Georgia	82,554
Michigan	204,616
North Carolina	60,146
Texas	21,459

Source: USDA, NASS, *Cucumber Production in cwt,* accessed March 3, 2021.

Note: Production includes cucumbers for fresh market and for processing. Volumes account for only cucumbers grown in open field conditions and do not include greenhouse production. The latest available data for Georgia are from 2019.

Table F.3 Cucumber production in Mexico, by state, 2020

In metric tons. This table corresponds to figure 3.1.

State	2020
Sinaloa	342,150
Sonora	262,871
Morelos	81,156
Michoacán	64,997
Guanajuato	61,712
Yucatán	51,346
Zacatecas	42,340
San Luis Potosí	41,332
Jalisco	37,388
Colima	30,094
Baja California	23,709
Baja California Sur	20,632
Veracruz	15,211
Coahuila	14,048
Puebla	10,737
México	10,573
Querétaro	8,482
Aguascalientes	7,508
Quintana Roo	7,076
Nayarit	6,869
Tamaulipas	6,697
Hidalgo	3,329
Guerrero	3,299
Chihuahua	885
Chiapas	837
Oaxaca	828
Campeche	615
Tabasco	243
Nuevo León	211
Durango	23

Source: Government of Mexico, SIAP, Anuario estadístico: Pepino, accessed May 3, 2021.

Table F.4 Cucumbers: Production shares by growing environment, 2015–20

In percentage shares of production in metric tons. This table corresponds to figure 3.2. PA = protected agriculture (e.g., greenhouses).

Area	2015	2016	2017	2018	2019	2020
Open field	48	46	46	39	39	38
PA: Shade house	23	35	36	38	31	34
PA: Greenhouse	29	18	17	23	30	27
PA: Macro Tunnel	0	1	1	1	0	0

Source: Government of Mexico, Anuario estadístico: Pepino, accessed May 4 and 7, 2021.

Table F.5 Minimum wage rates in Mexico, 2015–21

In pesos per day. n.a. = not applicable. This table corresponds to figure 3.3.

	2015	2016	2017	2018	2019	2020	2021
General	70	73	80	88	103	123	142
Northern border zone	n.a.	n.a.	n.a.	n.a.	178	184	213
Agricultural day laborer	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	160

Source: Government of Mexico, CONASAMI, Tabla de Salarios Mínimos: 2015–21 (Minimum Wage Table).

Table F.6 Cucumber production in Canada, by province, 2020

In metric tons. This table corresponds to figure 4.1.

Province	2020
Ontario	229,872
Quebec	28,104
British Columbia	26,005
Alberta	20,649
Nova Scotia	1,580
Prince Edward Island	289
Manitoba	202
New Brunswick	177
Saskatchewan	136
Newfoundland and Labrador	10

Source: Government of Canada, Statistics Canada, Table 32-10-0365-01 Area, production, and farm gate value of marketed vegetables, accessed February 10, 2021; Government of Canada, Statistics Canada, Table 32-10-0456-01 Production and value of greenhouse fruits and vegetables, accessed May 6, 2021.
Note: Data include both open field and greenhouse production.

Table F.7 Types and production methods for fresh market cucumbers supplied to the U.S. market by country or region

This table corresponds to figure 5.1. "Yes" in a column under a particular product means that this country's or region's product is supplied to the U.S. market. "No" indicates that it is not supplied, or only supplied in small quantities. This table corresponds to figure 5.1.

Country or region	American slicer	Burpless	Local grown	Protected agriculture	Vertical production
United States	Yes	Yes	Yes	No	No
Southeast	Yes	No	Yes	No	No
Canada	Yes	Yes	No	Yes	Yes
Mexico	Yes	Yes	No	Yes	Yes

Source: Compiled by USITC.
Note: There is some limited production of burpless cucumbers and cucumbers grown under protected agriculture and/or with vertical production practices in the United States, including in the U.S. Southeast, but the majority of production is open field, and grown on plastic beds on the ground. There is also a minimal amount of organic production in the United States and the U.S. Southeast, this is estimated to be less than 10 percent of total U.S. production.

Table F.8 Monthly U.S. cucumber imports from Mexico, by quantity, 2015–20

In metric tons. This table corresponds with figures ES.1 and 6.1.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	84,427	80,675	69,355	66,912	61,455	31,992	28,273	22,537	23,333	39,412	64,967	78,972
2016	83,416	81,349	86,689	68,387	59,390	37,504	26,523	21,739	25,532	47,042	68,858	81,856
2017	86,924	77,645	77,029	66,424	57,878	38,303	32,101	25,615	27,401	50,720	84,272	78,331
2018	96,355	79,198	86,532	77,907	70,302	38,251	32,002	25,338	29,672	54,159	77,267	91,177
2019	90,920	87,353	90,847	83,919	69,932	41,161	37,373	29,930	32,866	51,579	73,035	85,862
2020	98,026	82,646	78,229	72,387	61,485	46,657	39,338	36,309	41,115	61,558	81,756	89,806

Source: USITC DataWeb/Census, imports for consumption, first unit of quantity, HTS statistical reporting numbers 0707.00.2000, 0707.00.4000, 0707.00.5010, 0707.00.5090, 0707.00.6010, 0707.00.6030, 0707.00.6050, accessed June 16, 2021.

Table F.9 Monthly U.S. cucumber imports from Canada, by quantity, 2015–20

In metric tons. This table corresponds with figures ES.1 and 6.1.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	1,729	2,989	9,313	9,918	11,283	11,622	20,123	26,281	12,464	7,888	4,385	1,594
2016	1,968	4,242	7,884	9,989	13,274	13,872	31,442	26,882	12,161	8,578	5,344	2,173
2017	2,116	3,674	7,703	9,899	13,873	13,976	26,559	33,003	14,702	9,092	4,246	2,392
2018	2,352	4,280	9,729	11,589	15,108	15,529	27,796	29,513	12,280	9,453	4,799	2,630
2019	2,044	3,858	10,031	11,809	15,225	16,130	27,344	37,860	13,836	10,572	6,042	2,591
2020	2,905	4,978	11,257	14,283	16,313	16,805	28,216	29,339	13,962	11,003	8,494	4,993

Source: USITC DataWeb/Census, imports for consumption, first unit of quantity, HTS statistical reporting numbers 0707.00.2000, 0707.00.4000, 0707.00.5010, 0707.00.5090, 0707.00.6010, 0707.00.6030, 0707.00.6050, accessed June 16, 2021.

Table F.10 Monthly U.S. cucumber imports from all other sources, by quantity, 2015–20

In metric tons. This table corresponds with figures ES.1 and 6.1.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	10,381	8,401	5,649	1,360	793	967	1,200	702	546	1,485	1,538	4,961
2016	12,961	9,290	6,392	1,982	890	1,012	1,517	1,156	2,368	1,794	1,296	6,162
2017	10,207	9,492	5,749	869	1,168	1,152	1,006	1,029	1,015	1,431	1,668	3,084
2018	7,971	10,594	8,232	895	899	882	788	810	2,116	1,943	1,294	4,349
2019	12,794	8,703	4,698	765	552	845	711	750	2,713	1,552	1,047	5,624
2020	12,588	10,404	7,256	771	388	731	1,349	1,357	1,194	1,331	1,371	4,305

Source: USITC DataWeb/Census, imports for consumption, first unit of quantity, HTS statistical reporting numbers 0707.00.2000, 0707.00.4000, 0707.00.5010, 0707.00.5090, 0707.00.6010, 0707.00.6030, 0707.00.6050, accessed June 16, 2021.

Table F.11 Monthly U.S. cucumbers imports from Mexico, by quantity, 1990–95 and 2015–20

In metric tons. This table corresponds to figure. 6.2.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	39,323	29,230	26,149	10,897	6,379	2,571	2,189	899	576	2,919	16,828	28,298
1991	33,325	34,165	21,537	9,960	5,125	5,028	2,629	1,839	829	2,981	16,169	26,374
1992	27,484	22,794	19,525	16,398	7,070	4,762	4,049	1,710	1,585	4,131	20,547	41,314
1993	40,916	41,630	33,909	12,611	7,157	5,259	3,017	2,338	675	2,466	17,078	37,363
1994	45,620	45,072	36,301	18,767	10,187	6,187	4,980	4,683	2,265	2,660	20,903	30,603
1995	38,998	39,527	36,561	17,236	11,521	6,107	6,745	3,592	1,934	5,933	31,858	38,974
2015	84,427	80,675	69,355	66,912	61,455	31,992	28,273	22,537	23,333	39,412	64,967	78,972
2016	83,416	81,349	86,689	68,387	59,390	37,504	26,523	21,739	25,532	47,042	68,858	81,856
2017	86,924	77,645	77,029	66,424	57,878	38,303	32,101	25,615	27,401	50,720	84,272	78,331
2018	96,278	79,125	86,454	77,848	70,264	38,207	31,901	25,327	29,659	54,089	77,175	91,101
2019	90,827	87,214	90,741	83,919	69,932	41,161	37,373	29,930	32,866	51,579	73,030	85,860
2020	98,002	82,557	78,224	72,381	61,486	46,643	39,338	36,309	41,115	61,558	81,756	89,806

Source: USITC DataWeb/Census, imports for consumption, first unit of quantity, HTS statistical reporting numbers 0707.00.2000, 0707.00.4000, 0707.00.5010, 0707.00.5090, 0707.00.6010, 0707.00.6030, 0707.00.6050, accessed June 16, 2021.

Table F.12 Average monthly price difference between foreign and domestic medium-sized conventional slicing cucumbers, AMS shipping point, 2015–20

In U.S. dollars per 1⅑ bushel crate or carton; n.a. = not available. This table corresponds to figure 6.3.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	−4.06	n.a.	−10.80	−2.77	−2.90	−3.68	−2.18	−2.33	4.73	1.87	1.36	−4.00
2016	−4.74	n.a.	−3.39	−4.16	−5.41	−3.12	1.00	2.70	7.80	−0.52	0.36	0.84
2017	−0.30	n.a.	−3.68	−0.63	0.30	−3.06	−2.31	1.93	4.75	−0.15	−3.21	−5.13
2018	−5.39	n.a.	2.68	−3.52	−1.53	−0.09	−0.44	6.66	8.32	0.39	−3.85	−4.56
2019	0.08	n.a.	0.68	0.04	−1.98	−1.69	2.99	3.51	5.44	4.60	0.15	−0.42
2020	n.a.	n.a.	−1.73	−2.90	−6.66	−7.18	0.32	−1.23	−0.53	2.41	−2.71	−5.78

Source: USDA, AMS, *Market News,* custom report, shipping point report, sorted for cucumbers, conventional, medium, slicers, and origin accessed March 16, 2021.

Note: Domestic includes cucumbers shipped from Florida, Georgia, Michigan, New York, and North Carolina; while, foreign includes product shipped from Central America and Mexico.

Table F.13 Average monthly price difference between U.S. Southeast and Mexican medium-sized conventional slicing cucumbers, AMS shipping point, 2015–20

In U.S. dollars per 1⅑ bushel crate or carton; n.a. = not available. This table corresponds to figure 6.4.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	−4.00	n.a.	−10.80	−2.77	−2.90	−3.68	−3.04	−3.08	4.17	1.87	1.36	−4.00
2016	−4.32	n.a.	−3.90	−4.16	−5.41	−3.12	−0.12	2.05	8.38	−0.52	0.36	0.84
2017	−0.96	n.a.	−4.20	−0.63	0.30	−3.06	−6.45	n.a.	3.85	−0.15	−3.21	−5.13
2018	−5.65	n.a.	1.70	−3.52	−1.53	0.06	−0.23	4.51	6.51	0.39	−3.85	−4.56
2019	−0.43	n.a.	0.39	0.04	−1.98	−1.69	4.15	n.a.	6.85	4.43	0.15	−0.42
2020	n.a.	n.a.	−2.03	−2.90	−6.66	−7.18	0.54	−1.52	−1.06	2.41	−2.71	−5.78

Source: USDA, AMS, Shipping point data for cucumbers, conventional, slicers, medium, accessed March16, 2021.

Note: U.S. Southeast includes cucumbers shipped from Florida, Georgia, and North Carolina.

Table F.14 Average monthly price difference between U.S. Southeast and Mexican medium-sized conventional slicing cucumbers, AMS East Coast terminal markets, 2015–20

In U.S. dollars per 1⅑ bushel crate or carton; n.a. = not available. This table corresponds to figure 6.5.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	2.75	2.80	1.48	2.56	2.38	4.41	4.84	−0.82	2.99	3.49	5.89	5.25
2016	5.83	n.a.	2.41	4.28	0.57	1.13	0.65	3.06	4.78	3.30	3.87	3.31
2017	1.92	1.71	1.72	3.30	3.47	5.45	1.55	0.40	3.29	3.14	1.62	1.48
2018	−1.57	−1.01	3.52	2.26	2.92	3.58	3.87	4.14	8.85	5.54	2.90	4.96
2019	4.12	−0.03	3.67	2.29	1.55	1.49	1.25	0.14	2.70	1.12	4.20	3.75
2020	8.34	8.99	2.13	4.06	−0.87	−3.24	2.73	3.33	0.64	3.10	2.34	−1.69

Source: USDA, AMS, Market News, custom report, terminal market (non-organic) report, sorted for cucumbers, conventional, slicers, medium, and source. Accessed March 16, 2021.

Note: Southeast includes Florida, Georgia, and North Carolina. East Coast terminal markets include Atlanta, Baltimore, Boston, Columbia, Miami, New York, and Philadelphia.

Table F.15 Average prices of Mexican medium-sized conventional slicing cucumbers in U.S. terminal markets, by region, 2015–20

In U.S. dollars per 1⅑ bushel carton or crate. This table corresponds to figure 6.6.

Year	East Coast	Midwest	West Coast
2015	22.84	21.13	21.10
2016	22.40	21.06	21.20
2017	22.05	20.74	20.02
2018	23.71	23.03	22.84
2019	22.43	20.91	21.26
2020	24.75	24.45	23.18

Source: USDA, AMS, Market News, custom report, terminal market (non-organic) report. Accessed March 16, 2021.
Note: East Coast terminal markets included are Atlanta, Baltimore, Boston, Columbia, Miami, New York, and Philadelphia. Midwest terminal markets are Chicago, Dallas, Detroit, and St. Louis. West Coast terminal markets are Los Angeles and San Francisco.

Table F.16 Cucumbers: U.S. imports, by volume and by quarter, 2000–20

In thousands of metric tons. Q = quarter. This table corresponds to figure 7.1.

Year	Q1	Q2	Q3	Q4
2000	129	70	35	94
2001	139	83	36	89
2002	148	81	44	99
2003	153	71	49	111
2004	157	78	48	113
2005	172	91	41	102
2006	156	93	47	120
2007	163	108	44	117
2008	184	111	54	119
2009	187	114	55	150
2010	214	126	68	142
2011	190	144	80	144
2012	238	133	92	155
2013	226	168	110	170
2014	257	165	114	189
2015	259	183	121	194
2016	279	192	133	211
2017	266	189	145	222
2018	289	215	144	233
2019	295	224	164	225
2020	292	213	174	249

Source: USITC DataWeb/Census (HTS 6-digit heading 0707.00), accessed June 2021, and USITC estimates to isolate fresh market cucumber imports based on U.S. import data, importing countries' production data, and information on importing countries' production seasons for cucumbers for processing.

Table F.17 Cucumbers: actual and counterfactual U.S. import volumes from 2000–2020 for both the June–October and November–May periods

In metric tons. This table corresponds to figure 7.2.

Year	Counterfactual, November–May	Counterfactual, June–October	Actual, November–May	Actual, June–October
2000–01	281,348	65,995	281,348	65,995
2001–02	286,611	75,863	286,611	75,863
2002–03	291,679	82,875	291,679	82,875
2003–04	314,497	80,591	314,497	80,591
2004–05	339,019	77,893	339,019	77,893
2005–06	313,483	88,641	313,483	88,641
2006–07	347,387	86,536	347,387	86,536
2007–08	354,331	95,008	365,805	99,454
2008–09	361,015	109,951	372,705	120,206
2009–10	397,916	113,502	423,111	124,088
2010–11	394,117	120,967	419,072	138,625
2011–12	414,145	128,847	454,209	154,778
2012–13	422,900	147,657	478,813	185,325
2013–14	444,204	155,379	518,747	195,018
2014–15	450,305	165,662	543,005	207,924
2015–16	458,877	178,624	571,277	234,876
2016–17	452,456	191,242	563,283	251,467
2017–18	482,453	193,826	619,233	254,865
2018–19	496,403	200,826	637,137	277,164
2019–20	475,841	208,455	610,745	301,934

Source: USITC DataWeb/Census (HTS 6-digit heading 0707.00), accessed June 2021, and USITC estimates.
Note: The years modeled are 2015–16 to 2019–20.

Table F.18 Example of actual and counterfactual import growth rates during the high-growth period for November-May

In percentages. Average actual growth during the period was 4.3 percent. This table corresponds with figure E.1.

Growing season	Actual growth	Counterfactual growth
2007–08	5.3	2.0
2008–09	1.9	1.9
2009–10	13.5	10.2
2010–11	−1.0	−1.0
2011–12	8.4	5.1
2012–13	5.4	2.1
2013–14	8.3	5.0
2014–15	4.7	1.4
2015–16	5.2	1.9
2016–17	−1.4	−1.4
2017–18	9.9	6.6
2018–19	2.9	2.9
2019–20	−4.1	−4.1

Source: USITC DataWeb/Census (HTS 6-digit heading 0707.00), accessed June 2021, and USITC estimates.

Supplemental Data Tables

Table F.19 Average monthly prices, domestic medium-sized conventional slicing cucumbers, AMS shipping point, 2015–20

In U.S. dollars per 1⅑ bushel crate or carton; n.a. = not available.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	16.25	n.a.	24.50	13.10	13.75	17.57	21.07	17.47	19.48	15.78	15.94	29.33
2016	26.35	n.a.	26.35	14.87	15.47	18.39	14.08	15.27	18.90	15.20	12.33	9.51
2017	12.35	n.a.	20.65	17.73	17.44	18.34	20.46	12.89	17.20	12.85	16.35	14.89
2018	19.35	n.a.	16.48	16.40	14.14	14.27	18.34	14.35	20.93	21.10	17.35	17.81
2019	16.85	n.a.	14.85	11.60	10.60	14.63	16.46	13.99	12.02	12.68	16.76	23.23
2020	n.a.	n.a.	29.35	13.10	16.06	19.90	15.81	19.98	21.83	11.88	17.88	17.35
Average	17.42	n.a.	20.87	14.67	14.75	16.91	17.79	16.26	18.43	14.68	16.09	18.05

Source: USDA, AMS, Market News, custom report, shipping point report, sorted for cucumbers, conventional, medium, slicers, and origin accessed March 16, 2021.

Note: Domestic includes cucumbers shipped from Florida, Georgia, Michigan, New York, and North Carolina.

Table F.20 Average monthly prices, foreign medium-sized conventional slicing cucumbers, AMS shipping point, 2015–20

In U.S. dollars per 1⅑ bushel crate or carton.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	12.19	14.60	13.70	10.33	10.85	13.89	18.89	15.13	24.20	17.65	17.31	25.33
2016	21.61	10.80	22.96	10.71	10.05	15.27	15.08	17.98	26.70	14.68	12.69	10.36
2017	12.05	11.88	16.97	17.10	17.74	15.29	18.15	14.82	21.95	12.70	13.14	9.76
2018	13.96	9.51	19.16	12.88	12.62	14.18	17.90	21.01	29.25	21.49	13.50	13.25
2019	16.94	13.88	15.53	11.64	8.62	12.94	19.45	17.50	17.45	17.28	16.90	22.81
2020	22.63	23.56	27.62	10.20	9.40	12.72	16.14	18.75	21.31	14.29	15.18	11.58
Average	16.58	14.41	19.47	12.17	11.67	13.98	17.59	17.56	23.27	16.55	14.88	15.02

Source: USDA, AMS, *Market News,* custom report, shipping point report, sorted for cucumbers, conventional, medium, slicers, and origin accessed March 16, 2021.

Note: Foreign includes product shipped from Central America and Mexico.

Table F.21 Average monthly prices, medium-sized conventional slicing cucumbers from the U.S. Southeast, AMS East Coast terminal markets, 2015–20

In U.S. dollars per 1⅑ bushel crate or carton; n.a. = not available.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	16.25	n.a.	24.50	13.10	13.75	17.57	21.93	18.22	20.03	15.78	15.94	29.33
2016	26.35	n.a.	26.35	14.87	15.47	18.39	15.20	15.93	18.32	15.20	12.33	9.51
2017	12.35	n.a.	20.65	17.73	17.44	18.34	24.60	n.a.	18.10	12.85	16.35	14.89
2018	19.35	n.a.	16.48	16.40	14.14	14.13	18.13	16.50	22.75	21.10	17.35	17.81
2019	16.85	n.a.	14.85	11.60	10.60	14.63	15.30	n.a.	10.60	12.85	16.76	23.23
2020	n.a.	n.a.	29.35	13.10	16.06	19.90	15.59	20.27	22.37	11.88	17.88	17.35
Average	17.42	n.a.	20.87	14.67	14.75	16.95	18.68	18.07	19.89	14.75	16.09	18.05

Source: USDA, AMS, Market News, custom report, terminal market report, sorted for cucumbers, conventional, medium, slicers, and origin accessed March 16, 2021.

Note: Southeast includes Florida, Georgia, and North Carolina. East Coast terminal markets include Atlanta, Baltimore, Boston, Columbia, Miami, New York, and Philadelphia.

Table F.22 Average monthly prices, medium-sized conventional slicing cucumbers from Mexico, AMS East Coast terminal markets, 2015–20

In U.S. dollars per 1⅑ bushel crate or carton.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	12.26	13.95	13.70	10.33	10.85	13.89	18.89	15.13	24.20	17.65	17.31	25.33
2016	22.03	10.45	22.45	10.71	10.05	15.27	15.08	17.98	26.70	14.68	12.69	10.36
2017	11.39	11.33	16.45	17.10	17.74	15.29	18.15	14.82	21.95	12.70	13.14	9.76
2018	13.70	9.15	18.18	12.88	12.62	14.18	17.90	21.01	29.25	21.49	13.50	13.25
2019	16.42	13.94	15.24	11.64	8.62	12.94	19.45	17.50	17.45	17.28	16.90	22.81
2020	23.37	22.90	27.33	10.20	9.40	12.72	16.14	18.75	21.31	14.29	15.18	11.58
Average	17.04	13.99	19.16	12.17	11.67	13.98	17.59	17.56	23.27	16.55	14.88	15.02

Source: USDA, AMS, Market News, custom report, terminal market report, sorted for cucumbers, conventional, medium, slicers, and origin accessed March 16, 2021.

Note: East Coast terminal markets include Atlanta, Baltimore, Boston, Columbia, Miami, New York, and Philadelphia.