

Clark University

Clark Digital Commons

Geography

Faculty Works by Department and/or School

5-1-2023

Pandemic Produce: Impacts of COVID-19 on Florida's Fruit and Vegetable Industries

Christa D. Court
University of Florida

David Outerbridge
University of Florida

Lauri Baker
University of Florida

Laura Birou
The University Of Michigan

Catherine Campbell
University of Florida

See next page for additional authors

Follow this and additional works at: https://commons.clarku.edu/faculty_geography



Part of the [Geography Commons](#)

Repository Citation

Court, Christa D.; Outerbridge, David; Baker, Lauri; Birou, Laura; Campbell, Catherine; Digiacomio, Gigi; Galindo, Sebastian; Lai, John; Magnier, Alexandre; Miller, Michelle; Oliveira, Gustavo De L.T.; Orlando, Eyrika; Peterson, Hikaru Hanawa; Qiao, Xiaohui; Roka, Fritz; Ropicki, Andrew; Saha, Bijeta Bijen; Stevens, Andrew W.; and Zhang, Li, "Pandemic Produce: Impacts of COVID-19 on Florida's Fruit and Vegetable Industries" (2023). *Geography*. 940.

https://commons.clarku.edu/faculty_geography/940

This Article is brought to you for free and open access by the Faculty Works by Department and/or School at Clark Digital Commons. It has been accepted for inclusion in Geography by an authorized administrator of Clark Digital Commons. For more information, please contact larobinson@clarku.edu, cstebbins@clarku.edu.

Authors

Christa D. Court, David Outerbridge, Lauri Baker, Laura Birou, Catherine Campbell, Gigi Digiacomio, Sebastian Galindo, John Lai, Alexandre Magnier, Michelle Miller, Gustavo De L.T. Oliveira, Eyrika Orlando, Hikaru Hanawa Peterson, Xiaohui Qiao, Fritz Roka, Andrew Ropicki, Bijeta Bijen Saha, Andrew W. Stevens, and Li Zhang

Christa D. Court*, David Outerbridge, Lauri Baker, Laura Birou, Catherine Campbell, Gigi DiGiacomo, Sebastian Galindo, John Lai, Alexandre Magnier, Michelle Miller, Gustavo de L. T. Oliveira, Eyrika Orlando, Hikaru Hanawa Peterson, Xiaohui Qiao, Fritz Roka, Andrew Ropicki, Bijeta Bijen Saha, Andrew W. Stevens and Li Zhang

Pandemic Produce: Impacts of COVID-19 on Florida's Fruit and Vegetable Industries

<https://doi.org/10.1515/jafio-2022-0025>

Received July 2, 2022; accepted November 21, 2022

Abstract: Florida has one of the most diverse agricultural economies in the United States, producing several dozen types of fruits and vegetables that are consumed within the state, across the country, and around the world. The COVID-19 pandemic and resulting policy responses occurred during the peak of spring harvest season for many crops in

Florida, abruptly removing market demand from the food service industry and shifting consumer purchasing habits, which enabled insights into several aspects of the fruit and vegetable supply chain. This article examines how the COVID-19 pandemic impacted fruit and vegetable industries in Florida, how these industries responded to COVID-19 impacts, and how Florida's experience compared to that of other states. Data are derived from several sources including a statewide survey that measured agricultural production losses in Florida resulting from COVID-19 in early 2020, interviews with Florida operations that provided insights into how the pandemic induced change across the food supply chain, and a survey of food supply chain operations in three regions of the United States conducted in 2021.

Keywords: COVID-19, economic impacts, fruits and vegetables

***Corresponding author: Christa D. Court**, Food and Resource Economics Department, University of Florida, Gainesville, FL, USA,

E-mail: ccourt@ufl.edu. <https://orcid.org/0000-0002-2690-9015>

David Outerbridge, Lee County Extension, University of Florida, Ft. Myers, FL, USA, E-mail: douterbridge@ufl.edu

Lauri Baker and Sebastian Galindo, Department of Agricultural Education and Communication, University of Florida, Gainesville, FL, USA, E-mail: lauri.m.baker@ufl.edu (L. Baker), sgalindo@ufl.edu (S. Galindo)

Laura Birou, Department of Management Studies, College of Business, University of Michigan Dearborn, Dearborn, MI, USA, E-mail: lbirou@umich.edu

Catherine Campbell, Department of Family, Youth and Community Sciences, University of Florida, Gainesville, FL, USA, E-mail: cgcampbell@ufl.edu

Gigi DiGiacomo and Hikaru Hanawa Peterson, Department of Applied Economics, University of Minnesota, St. Paul, MN, USA, E-mail: gigid@umn.edu (G. DiGiacomo), hhp@umn.edu (H.H. Peterson)

John Lai, Eyrika Orlando, Xiaohui Qiao, Andrew Ropicki and Bijeta Bijen Saha, Food and Resource Economics Department, University of Florida, Gainesville, FL, USA, E-mail: johnlai@ufl.edu (J. Lai), e.orlando@ufl.edu (E. Orlando), xiaohui.qiao@ufl.edu (X. Qiao), aropicki@ufl.edu (A. Ropicki), bijetabijen@ufl.edu (B.B. Saha)

Alexandre Magnier, Center for Agribusiness, Florida Gulf Coast University, Ft. Myers, FL, USA, E-mail: amagnier@fgcu.edu

Michelle Miller, Center for Integrated Agricultural Systems, University of Wisconsin–Madison, Madison, WI, USA, E-mail: mmmille6@wisc.edu

Gustavo de L. T. Oliveira, Graduate School of Geography, Clark University, Worcester, MA, USA, E-mail: GuOliveira@clarku.edu

Fritz Roka, Department of Economics and Finance, Florida Gulf Coast University, Ft. Myers, FL, USA, E-mail: froka@fgcu.edu

Andrew W. Stevens, Department of Agricultural and Applied Economics, University of Wisconsin–Madison, Madison, WI, USA, E-mail: awstevens@wisc.edu. <https://orcid.org/0000-0003-0960-5535>

Li Zhang, Department of Anthropology and Sociology and Department of Environmental Studies, Amherst College, Amherst, MA, USA, E-mail: lzhang@amherst.edu

1 Introduction

Florida has approximately 47,500 farms operating on 9.7 million acres across the state (USDA National Agricultural Statistics Services 2022). The state has a sub-tropical climate that varies significantly (USDA hardiness zones 8a–11a) from North to South, which enables production of an immense variety of food, fiber, and ornamental commodities worth an estimated \$10.16 billion in 2018 (UF/IFAS 2021). Unrefined commodities are harvested and packed for fresh markets or converted into finished products by food processing and manufacturing industries. Finished goods then move through the wholesale and retail distribution chains to final consumers or to other industries as intermediate goods for further value-added processing. These industries are also linked to a broad array of allied suppliers that provide production inputs and related supporting services. Altogether, the industries involved in the supply of goods and services to agricultural operations and those involved in the production, harvesting, packing, processing, and distribution of agricultural products comprise the agricultural supply chain (Weersink et al.

2021). Excluding those agricultural products that are not for human consumption, the food supply chain can be defined as the actors, activities, relationships, and resources involved in supplying, producing, harvesting, packing, processing, and distributing a food product to a consumer (Weersink et al. 2021).

In March 2020, the World Health Organization declared a pandemic associated with the novel coronavirus disease (COVID-19), caused by the novel coronavirus, SARS-CoV-2. In response to concerns about the infection rate and severity of COVID-19, many local- and national-level government agencies around the world enacted restrictive public health measures, and in some cases altered the regulatory context within which businesses operated to limit human interaction while ensuring continued provision of essential goods and services, such as food, healthcare, and education (Aiyar and Pingali 2020). Where possible, many industries rapidly converted to or increased use of digital environments both for business operations as well as marketing and sales to limit potential losses (Kniffin et al. 2021; Spicer 2020). Supply chains adapted to both the threat of the virus and the changes in supply and demand that resulted from public health measures intended to respond to this threat. In many industries, especially those deemed non-essential, forced and voluntary business closures affected the supply of goods and services. Within segments of the economy that were deemed essential, which included the food supply chain, owners and/or supervisors had to adapt workplace environments and practices to mitigate risk of viral transmission among workers and between workers and customers. Employee absences due to illness or quarantine and the implementation of physical distancing measures within the workplace also altered production capacity and timing within firms that remained operational.

Over time, local behavioral changes had global economic consequences and the COVID-19 pandemic provided a unique opportunity to analyze global supply chains (Court et al. 2021; Ferreira et al. 2021). The economic impacts to agricultural production, resulting from both supply- and demand-side shocks brought about by the COVID-19 pandemic, have been widely studied (ERA Economics, LLC 2020; Maria del Rio-Chanona et al. 2020; Workie et al. 2020). Unfortunately, much of the information and insights gleaned from these studies cannot be generalized outside of the commodity group(s) investigated or the geographic and temporal scale of the analysis due to the different contexts within which agricultural producers operate across these domains. Factors such as seasonal production cycles, COVID-19 case rates, local, state, and federal policy responses to COVID-19 case rates, regulatory frameworks within which producers operate, consumer behavior and preferences, and

many others vary across time, space, and commodity. As such, additional research is necessary across geographies and time to inform a complete understanding of COVID-19's impact on various agricultural and food systems around the world. Florida's diverse fruit and vegetable production capacity as well as the unique seasonal, supply chain, and market contexts within which it operates enabled insights into several aspects of COVID-19 impacts on the fruit and vegetable supply chain.

This article describes how the COVID-19 pandemic impacted industries involved in the fruit and vegetable supply chain in Florida, how these industries responded, and how the experience of Florida's fruit and vegetable industries compared to that of some other states. Data to support this article are derived from several sources: a statewide survey that measured the agricultural production losses in Florida resulting from COVID-19 in early 2020, qualitative interviews with producers in Florida throughout 2020 that provided insights into how the pandemic induced changes, and a survey of food supply chain operations in three regions of the United States conducted in 2021. Section 2 provides the necessary context for this study, Section 3 describes the methodologies used for data collection, and Section 4 delineates the quantitative and qualitative results of the research team's investigation into the impacts of COVID-19 on Florida's fruit and vegetable industries. Section 5 provides insights from comparing and contrasting Florida's experience with that of other regions in the United States and Section 6 concludes and offers insights on the future of overall food system resilience.

2 Background

COVID-19 infections and policies affected global agricultural supply chains around the world, often highlighting disparities, rigidities, vulnerabilities, and inequalities in food security, agricultural labor supply, input supply, food transportation and storage, and cross-border trade of goods and services (Ahmed, Akter, and Majumder 2021; Alam and Khatun 2021; FAO 2020; Global Alliance for Improved Nutrition (GAIN) 2020; Yegbemey et al. 2021). As governments and non-governmental organizations (NGOs) rushed to measure the magnitude of impacts and determine the various forms of relief needed along the supply chain, they also had to consider pre-existing strains on or events affecting the systems (i.e. account for the impacts of compound or cascading disasters (Cutter 2018)) such as labor shortages in India or droughts in Pakistan and Chad, which can have a multiplying effect on supply chain impacts (Ahmed, Akter, and Majumder 2021; Ali et al. 2020; Deaton

and Deaton 2020; FAO 2020; Global Alliance for Improved Nutrition (GAIN) 2020; Harris et al. 2020). This section provides the necessary contextual information to examine the impacts of COVID-19 on Florida's fruit and vegetable supply chain.

2.1 Impacts of COVID-19 on Fruit and Vegetable Industries

Fruits and vegetables are labor-intensive specialty crops, requiring much more labor than field crops such as wheat, soybean, and corn, which generally rely on mechanization for harvest (UF/IFAS 2021). According to Huff et al. (2015), a reduction in the available agricultural labor force of more than 25% could make even the most developed countries food insecure. Amidst the pandemic, labor supply for agricultural harvest was not affected equally around the world, with variations largely influenced by differences in COVID-19-induced policies related to international travel. Countries such as Canada and the United States recognized that the seasonal harvests of specialty crops could be affected by restrictions on international travel due to their reliance on seasonal foreign guest workers and relaxed restrictions for entry of these individuals (Department of Homeland Security 2020; Lee 2020). In some cases where entry would have been allowed, policies related to departure or transit created a situation whereby laborers were still not able to make the trip, which still resulted in labor shortages (Deaton and Deaton 2020; Faus and Hunt 2021; IHS Markit 2020; Szelewa and Polakowski 2022). In other cases, such as India's, strict regulations on domestic population movements made it difficult or impossible for migratory laborers to travel between regions of the country, which significantly affected the production and harvest of many fruit and vegetable crops (Ahmed, Akter, and Majumder 2021).

Many fruits and vegetables are highly perishable in their raw commodity form, with short windows of opportunity to harvest, pack, and distribute for processing or fresh consumption. The need for timely harvesting, packing (either on-farm or at a packinghouse), and distribution made fruit and vegetable industries particularly vulnerable to delays induced by absenteeism related to illness or risk preferences, slowdowns in packing and distribution related to the implementation of physical distancing measures for employees, labor shortages beyond the farmgate, and changes in demand, especially for products to be consumed away from home. In some cases, such delays resulted in significant on-farm losses as well as spoiled products along the supply chain, which were documented at the national level for the United States (Johnson 2020), for the State of

California (ERA Economics, LLC 2020; Goodrich, Kiesel, and Bruno 2021), in China (Gu and Wang 2020), in Canada (Richards et al. 2020), and in other Organization for Economic Co-operation and Development (OECD) countries (OECD 2020). Conversely, there is also evidence that consumer demand and purchasing patterns for shelf-stable products were more volatile than for perishable goods in the initial phase of the pandemic, largely due to panic buying or hoarding of canned goods and processed food products (Hobbs 2020; Ker and Cardwell 2020; Yuen et al. 2020), allowing food retailers to maintain relatively stable stocks of most fresh fruit and vegetable products to satisfy relatively stable demand (Johnson 2020; OECD 2020; Richards et al. 2020). Moreover, some fresh fruit and vegetable products are relatively fungible at the farm level in terms of marketing for consumer retail versus restaurants/catering/food service, and between sales for fresh markets and sales for processors (e.g., frozen or canned vegetables, food industry, etc.). The degree to which such shifts could compensate for changes in national or global market demand was highly dependent on size of demand and availability of processing capacity at a local and regional level.

Smallholder farms in developing countries operated in a different context, largely avoiding mass labor shortages during sowing and harvest seasons by hiring family members (Alam and Khatun 2021). However, delays related to lack of transportation, facility closures, and lack of available cold storage meant that farmers still had to make adjustments to sell their perishable fruit and vegetable products quickly, often resorting to short-selling their crops rather than waiting for a fair market value (Alam and Khatun 2021; Harris et al. 2020). Lower income from sales, combined with a limited access to or ability to secure loans, impacted decisions related to purchasing input supplies – some of which were also experiencing shortages – for the next season. These hindrances put many farmers in particularly dire situations, especially in lower-income countries such as Kenya, Nigeria, Ethiopia, and Bangladesh, and negatively affected food security (Ahmed, Akter, and Majumder 2021; Deaton and Deaton 2020; FAO 2020; Global Alliance for Improved Nutrition (GAIN) 2020; Harris et al. 2020; Yegbeme et al. 2021). Alam and Khatun (2021) and Ali et al. (2020) mention that many farmers resorted to decreasing their daily meal count as well as reducing more expensive, protein-rich food sources from their diets to conserve their cash for farm inputs.

With food supply chains around the world facing uncertainty, national-level governments, international organizations, and NGOs launched programs to safeguard farmers and others involved in food supply chains and to address rising numbers of individuals experiencing food insecurity. The International Monetary Fund and World

Bank launched funded support programs for governments and food system reforms (Ali et al. 2020). With the World Food Program's assistance, the Ministry of Agriculture, Livestock, Fisheries, and Cooperatives in Kenya implemented a monitoring program for food prices to combat market fluctuations (Global Alliance for Improved Nutrition (GAIN) 2020). Likewise, the Nutritional North Program has implemented price suppression mechanisms in rural Canada, where market deliveries are flown in (Deaton and Deaton 2020). The United States Department of Agriculture (USDA) set up the Coronavirus Food Assistance Program (CFAP) through the Farm Service Agency, which aimed to assist farmers with an average adjusted gross income of less than \$900,000 (United States Department of Agriculture – Farm Service Agency 2020).

While the contexts within which fruit and vegetable industries operate vary around the world, the growing literature on the impacts of COVID-19 on fruit and vegetable industries suggests that factors such as the evolution of COVID-19 infections and policy responses, seasonal production cycles, and regulatory frameworks played a significant role in determining the size, scope, and direction of these effects.

2.2 Evolution of COVID-19 and Related Policy Responses in Florida

Beginning in March of 2020, in response to rising cumulative case numbers, many states, including Florida, began implementing policies to mitigate the spread of COVID-19, which varied in restrictiveness, implementation period, and plans for reopening. These policies included, but were not limited to, closure of K-12 schools, prohibition of mass gatherings, limiting seating capacity in restaurants and bars, the closure of non-essential businesses, and stay-at-home orders, etc. In addition, some states announced state-level loan programs and relief packages to support local and small businesses that were negatively impacted by the ongoing pandemic.

Despite the implementation of the policies, by the end of the first quarter of 2020, a rise in the number of total cases was observed in Florida, which continued through the end of the second quarter of 2020 (Figure 1). As a part of Florida's step-by-step plan for recovery, the second quarter of 2020 brought about an extension on some of the restrictive policies that were set in motion in the previous quarter, such as stay-at-home orders and the suspension of vacation rentals in the state, as well as planning and execution of phase-wise reopening (Johns Hopkins University and Medicine Coronavirus Resource Center 2022). Financial support such as workers' compensation for first responders who were exposed to COVID-19 on the job was also introduced. During the third quarter of 2020, an executive order to reopen

almost all businesses in Florida was in place but later, on December 29, 2020, a state of emergency was declared as the number of cases continued to rise. Cases began to decline going into 2021 and business operations largely returned to pre-pandemic operating conditions. On April 29, 2021, Florida's State Surgeon General issued a Public Health Advisory that rescinded all previously issued public health advisories related to COVID-19, expanded vaccine eligibility, and encouraged in-person government operations and services statewide. On May 3, 2021, Governor DeSantis announced Executive Order #2021-102, suspending all remaining local government mandates and restrictions based on the COVID-19 State of Emergency. Florida experienced additional spikes in case rates in the summer of 2021 and near the end of 2021, with no new policies enacted to combat these surges (Johns Hopkins University and Medicine Coronavirus Resource Center 2022).

2.3 Fruit and Vegetable Industries in Florida

Prior to the pandemic, Florida ranked third overall in the United States for cash receipts in both fruit and nut crop sales and vegetable, melon, and potato sales. Operations involved in fruit and tree nut farming in Florida include, but are not limited to, those growing citrus fruits, grapes, berries, tropical fruit, and pecans. These operations harvested 407,000 acres in 2019, directly supporting more than 12,000 fulltime and part-time jobs, with sales revenues of \$1.05 billion (UF/IFAS 2021). These types of crops are generally not grown from seeds, have a perennial life cycle, and tend to be labor intensive, especially when it comes to harvesting. Within this commodity group, Florida ranked number one in the production of oranges and grapefruit and number two in the production of avocados, strawberries, and tangerines (UF/IFAS 2021). Operations involved in vegetable, melon, and potato farming include, but are certainly not limited to, those growing tomatoes, squash, cabbage, watermelon, cantaloupe, and potatoes. These operations harvested 200,000 acres in 2019, directly supporting more than 9,000 fulltime and part-time jobs, with sales revenues of \$1.13 billion (UF/IFAS 2021). These crops tend to have an annual or biannual growth cycle, are often grown in open fields, and also tend to be labor intensive. Within this commodity group, Florida ranked number one in the production of snap beans, fresh market cucumbers, bell peppers, and watermelons, number two in the production of cabbage, sweet corn, and tomatoes, and number three in squash (UF/IFAS 2021).

The marketing of Florida's fruit and vegetable crops varies greatly depending on the type of crop, size of operation, whether the products grown are for the fresh market or destined to be processed, and the marketing goals of the

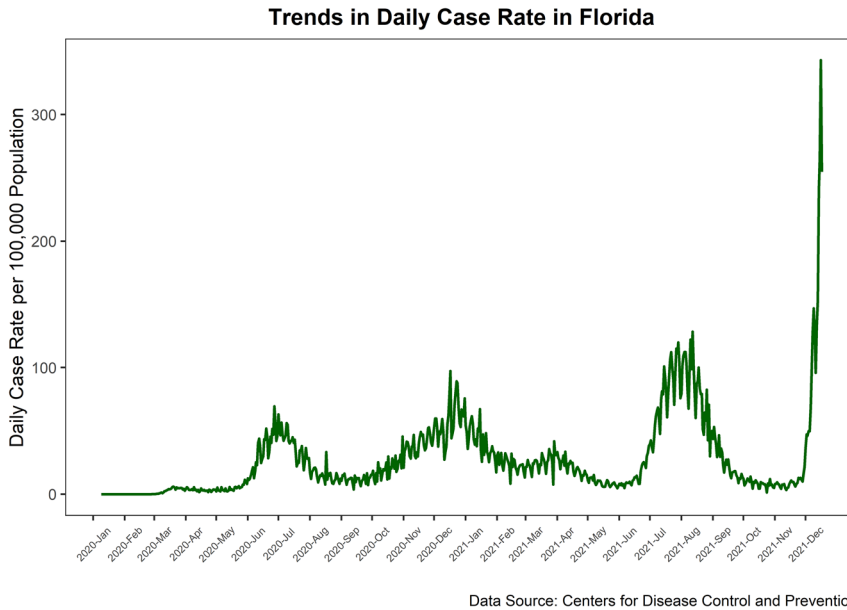


Figure 1: Daily case rate per 100,000 population between January 2020 and December 2021.

individual company. Florida is primarily a specialty crop state, defined as fruit and vegetable products grown without the support of United States Department of Agriculture crop subsidies. A sizable portion of Florida specialty crops are exported out of state without significant processing. More than 1.1 billion pounds of fresh tomatoes are shipped to other states within the United States as well as to Canada and abroad (The Florida Tomato Committee 2013). Much of the packing of fresh vegetable products is handled by sizable vertically-integrated operations that seek to be national, year-round suppliers of specific produce products. For example, Lipman Family Farms operates four east coast farms located between south Florida and the Eastern Shore of Maryland and one farm in California to handle west coast markets. In addition, they have enlisted partnerships with 18 local farmers spread throughout the eastern and mid-western states, as well as with 10 local partners in Mexico and El Salvador (Lipman Family Farms 2022). For smaller growers, most of their fresh produce is sold through community supported agriculture (CSA), roadside stands, and farmers markets (Florida Department of Agriculture and Consumer Services 2022a). Ninety-five percent of Florida's orange crop and more than 40% of Florida's grapefruit crop are processed into juice (Florida Department of Agriculture and Consumer Services 2022b). Cooperatives tend to be more prevalent among citrus growers and produce farmers. Citrus World, Inc., home to Florida's Natural juice brands, has been a grower cooperative since 1933 (Citrus World Inc. 2022). Dundee Citrus Growers Association started even earlier, in 1924. Dundee Citrus Growers Association members focus on marketing cartons of fresh citrus, and in the past few years have expanded into blueberry and peach fresh fruits

sales (Dundee Citrus Growers Association 2022). Tropicana and Minute Maid process citrus into various juice blends, but wholly rely on independent growers to supply them with their fruit.

Agricultural production of food products in Florida, especially fruits and vegetables, is largely export driven, providing much of the fresh produce consumed along the east coast of the United States, especially throughout the winter months, and sustenance to the many domestic and international visitors who come to the state for tourism purposes, staying in the many hotels, motels, amusement parks, and vacation properties in-state or embarking on cruises that depart from Florida ports (Campbell and McAvoy 2020; UF/IFAS 2021; USDA National Agricultural Statistics Services 2022). Unlike fruit and vegetable production in most areas of the United States, the onset of the COVID-19 pandemic coincided with the peak harvesting and sales phases of these industries in Florida. In addition, the shutdown of institutional markets, such as cruise lines, hotels, and restaurants, caused an abrupt disruption in large-scale sales for many commercial fresh fruit and vegetable producers in Florida. Hundreds of acres of highly perishable crops such as tomatoes, green beans, and sweet corn were destroyed as crop maintenance and harvest costs loomed with little to no market remaining for sales (Campbell and McAvoy 2020; Campbell, Rihn, and Campbell 2021).

3 Methodology

Results in this article were derived from two separate data collection tools: the 2020 Florida Agriculture and Aquaculture

COVID-19 Assessment, a survey of Florida agricultural producers distributed in early 2020 to gather information on losses resulting from COVID-19 and qualitative interviews with Florida-based food supply chain operations throughout 2020, which provided insights into how the pandemic induced change in businesses operations.

3.1 2020 Florida Agriculture and Aquaculture COVID-19 Assessment

Early in the pandemic, a team of researchers from the University of Florida Institute of Food and Agricultural Science (UF/IFAS) adapted an established survey tool developed for assessing the agricultural impacts of natural disasters (Court, Hodges, and Lollar 2020) to analyze the impacts of COVID-19 on Florida agricultural producers, here referred to as the 2020 Florida Agriculture and Aquaculture COVID-19 Assessment. Survey design and distribution followed all guidelines and rules imposed on human subjects research by the University of Florida Institutional Review Board (IRB202000642). The survey instrument was pre-tested with Florida Cooperative Extension faculty and agents to help ensure questions were well aligned with respondents and once approved, trainings were provided to individuals within the Florida Cooperative Extension System (CES) on the administration of the survey so that fielding of the survey could progress smoothly and they could assist with the collection of responses from Florida's agricultural producers. The survey was fielded from April 16, 2020 to May 15, 2020, collecting responses from agricultural operations, inclusive of aquaculture, throughout the State of Florida using the online platform Qualtrics.

The survey instrument guided respondents through a series of questions beginning with informed consent, introductory baseline questions, operation status, production, impacts, and closing questions. Respondents to the survey were recruited through a two-layer approach. The first layer consisted of two announcements broadcasted widely in the media with links to the online survey instrument. The first announcement was on April 16, followed by a second announcement on May 4 (e.g. Romaguera 2020a, 2020b). The second approach utilized referrals via the established networks of state extension specialists, county extension agents, and agricultural communities throughout Florida.

Data collected from respondents of the 2020 Florida Agriculture and Aquaculture COVID-19 Assessment were

summarized across Florida's major commodity groups. This information provided a snapshot of the status for each commodity with respect to businesses impacts. Multiple key areas were emphasized, and respondents were asked to consider year over year changes in their agribusiness as it related to: operations that were open or closed for businesses, impacts to demand for labor, prevalence of financial constraints, COVID-19-related alterations to normal business operations, revenue and operating impacts generated by COVID-19, changes due to COVID-19 in the processing and transportation- or logistics-related challenges that arose. These measures demonstrate the magnitude of impacts on Florida's agricultural operations, help identify areas where the greatest challenges were being faced, and commodity areas with the greatest needs stemming from the turbulent business environment resulting from COVID-19 disruptions.

3.2 Interviews with Florida Fruit and Vegetable Supply Chain Operations

Following the 2020 Florida Agriculture and Aquaculture COVID-19 Assessment, and in the interest of following an explanatory sequential design (Creswell and Clark 2017), faculty members at UF/IFAS and Florida Gulf Coast University (FGCU) devised a research framework (Outerbridge et al. 2022) to conduct semi-structured interviews to gain a deeper understanding of the shifts, adaptations, and innovations occurring within Florida's food system. The research team developed a standardized interview guide (i.e. set of question banks) to guide conversations between research team members, engaged representatives of Florida's CES, and food system stakeholders with a distinct set of questions for 15 different sectors within Florida's food system (Outerbridge et al. 2022). Selected food system sectors were based on consultations between researchers in the fields of economics, agronomics, business, supply chain, and sustainable food systems, and educators within the Florida CES that specialize in family and consumer sciences, agriculture, livestock, dairy, small farms, and horticulture. To provide contextualization and insights on the experiences of fruit and vegetable industries in Florida during the COVID-19 pandemic, this article summarizes the insights gained from interviews with 36 companies directly or indirectly involved in the fruit and vegetable supply chain representing Production Agriculture, including small farms (14 participants), Processing and Packing (five participants), Retail Distribution (three participants) and Food-

related NGOs (14 participants). Interview guides for these categories are provided in Appendix A: Relevant Interview Guides. Questions were focused on specific areas of interest to the research team that applied to all participants, including risk management, impacts, labor, new partnerships, regulation, and observed market changes. Optional follow-up questions and prompts were provided, tailored to gain more detailed information, while cohering with the standardized interview guide.

Interview subjects were recruited through referrals via established stakeholder networks of UF/IFAS Extension and FGCU and a snowball sampling technique, which is desirable to identify hard-to-reach populations with specific knowledge or expertise (Goodman 2011). The interview effort was also mentioned in news media (e.g. Romaguera 2020b) and webinars presenting quantitative results from the 2020 Florida Agriculture and Aquaculture COVID-19 Assessment. Interviews were conducted from July 2020 through September 2021. The long data collection period allowed examination of the initial experiences and responses to the pandemic, as well as the evolving experiences of the producers, processors, and distributors interviewed. Both institutions followed all guidelines and rules imposed on human subjects research by their respective Institutional Review Boards (IRB202001435, Protocol ID #2020-49). Participants were owners, high-level managers, or directors who could speak knowledgeably of their respective company or organization's experiences during the COVID-19 pandemic and were not monetarily compensated for their participation.

The technological framework of digital meetings, transcription, analysis, and storage enabled this broad data gathering effort across the state. On average, the interviews were conducted by individual project team members via Zoom web conferencing technology and lasted an average of 35 min. Following the data collection, the individual interviewers edited the Zoom transcription files and submitted them to the core research group. This core group of 5–6 developed a coding structure (Saldanña and Omasta 2022) based on the specific research interests and codified the interviews in batches according to the food system sector. The coding structure used for qualitative data analysis is provided in Appendix B: Coding Structure for the Qualitative Analysis of Interviews. Thematic analysis methods and NVivo qualitative data analysis software (QSR International Pty Ltd., NVivo 12 Plus) were used to analyze the semi-structured interview transcripts (Nowell et al. 2017). Deductive coding was used based on expectations informed by the academic literature as well as inductive coding to identify emergent, unanticipated topics and ideas.

4 COVID-19 Experiences of Fruit and Vegetable Industries in Florida

4.1 Quantitative Survey: Production Losses Due to COVID-19

A total of 729 responses were collected, of which 424 were complete. While partial responses were also kept as part of the sample, outliers were identified and removed to help ensure accurate reporting. Among all respondents, 65% of responses were involved in production agriculture (farming, ranching, forestry, aquaculture, etc.), 8% were involved in post-harvest processing of agricultural products (packing, drying, ginning, milling, etc.), 9% were involved in the transportation of agricultural products, and 18% indicated involvement in other sectors. Responses were received from nearly all counties in Florida and were concentrated in areas with relatively higher levels of agricultural activities. The sample collected through this survey consisted of about 39% small agricultural operations (as defined by the USDA¹), with the remainder classified as midsize or large operations.

Results for production agriculture operations suggest that the impacts of the COVID-19 pandemic varied by commodity. The estimated statewide losses in Florida agricultural sales revenues experienced in the March to mid-May 2020 period by commodity group using information on annual sales revenues (five-year average), estimates of the proportion (%) of annual revenue that is typically collected in the March – mid-May period, and survey results on percentage losses due to COVID-19 are summarized in Table 1. On average, all commodity groups reported losses due to the COVID-19 pandemic for the March to mid-May 2020 period analyzed. The nursery and greenhouse group experienced the largest economic losses (\$445 million), followed by fruit and tree nuts (\$189 million), and vegetables, melons, and potatoes (\$129 million). Responses² for operations producing fruits and tree nuts and/or vegetables, melons, and potatoes suggest that the onset of the pandemic caused both commodity groups to experience losses, an average of 32.9% and

¹ The USDA defines a small operation as one whose revenues are \$250,000 and less (Hoppe, Macdonald, and Korb 2010).

² The number of responses varied across commodity groups and the questions targeted toward assessing the impacts of the pandemic. For example, for the vegetables, melons, and potatoes industry, and the fruits and nuts industry, there were 78 and 59 responses that reported planted acreage, whereas there were only 29 and 17 responses that reported losses in terms of planted acreage, respectively.

Table 1: Estimated losses in Florida agricultural sales revenues experienced in March to mid-May 2020, by commodity group.

	Total annual sales revenues (five year average, \$millions)	% annual revenue March to mid-May	Output at risk (\$millions)	% loss from survey (average with 90% confidence interval)	Estimated losses (\$ millions)
Field crops	\$720.36	10%	\$72.04	-22% [-30%, -15%]	\$15.85 [\$10.81, \$21.61]
Horticultural crops	\$1,935.52	44%	\$846.79	-46% [-54%, -39%]	\$389.52 [\$330.25, \$457.27]
Vegetable, melon, potatoes	\$1,421.97	40%	\$568.79	-24% [-38%, -12%]	\$136.51 [\$68.25, \$216.14]
Fruits and nuts	\$1,593.90	40%	\$637.56	-32% [-39%, -24%]	\$204.02 [\$153.01, \$248.65]
Livestock and aquaculture	\$1,455.65	21%	\$303.26	-40% [-46%, -34%]	\$121.30 [\$103.11, \$139.50]
Animal products (milk, honey, eggs)	\$653.69	21%	\$136.19	-20% [-32%, -8%]	\$27.24 [\$10.89, \$43.58]
Sum total	\$7,781.09		\$2,564.62		\$894.44 [\$676.33, \$1,126.75]

Results reported in 2020 dollars. Estimates are for losses experienced in March – mid-May period of 2020. Data on Total Annual Sales Revenues are from USDA-NASS QuickStats and estimates of % Annual Revenue information were informed by conversations with producers, industry representatives, and specialized Cooperative Extension agents.

48.41% losses, respectively, as a percentage of total planted acres.^{3,4}

The impacts of COVID-19 on production agriculture also varied geographically. Geographic variation in economic losses experienced across counties within the state from March to mid-May of 2020 by agricultural commodity group are shown in Figure 2. In this figure, the size of the pie chart represents the total losses in dollars with each section of the pie chart representing the losses by agricultural commodity group. County-level losses were estimated assuming that the county-level breakdown of revenue by quarter/month matches that of a particular commodity group at the state level, as displayed in Table 1. Considering all commodity groups, Miami-Dade County suffered the highest total agricultural losses (\$133 million), followed by Palm Beach County (\$81 million) and Hillsborough County (\$66 million). The geographic variation in economic losses specific to fruit and tree nut production and vegetable, melon, and potato

production experienced from March to mid-May of 2020 across Florida counties are displayed in Figure 3. Overall, losses for the fruit and vegetable industries were concentrated in southern Florida, particularly in Hendry, Hillsborough, Polk, and Palm Beach Counties, which were actively harvesting their spring crops during the period assessed.

Respondents from both commodity groups reported altered customer bases, the implementation of social-distancing measures for customers, and the implementation of social-distancing amongst employees as the major changes experienced since the COVID-19 pandemic began to impact their business. They also reported experiencing disruptions in selling or shipping goods or services, the inbound supply chain, and both short- and long-term cash flow.

4.2 Qualitative Interviews: Experiences Within and Beyond the Farm Gate

The qualitative interview effort was designed to provide additional context and insights on how the COVID-19 pandemic affected food supply chain businesses. Thirty-six interviews with individuals representing fruit and vegetable supply chain operations were selected for analysis: production (n = 14 interviews), processing (n = 5 interviews), distribution (n = 3 interviews), and NGOs (n = 14 interviews) (e.g. food banks, community gardens and public-school food programs). These interviews were qualitatively analyzed using the coding structure presented in Appendix B. Across

³ The average was calculated as a weighted average of responses associated with tomato, pepper, herbs, lettuce, cucumber, greens, squash, and watermelon for the Vegetables, Melons, and Potatoes industry and of avocado, orange, citrus (other), and blueberries for the Fruits and Tree Nuts industry.

⁴ The average planted acreage and the average losses as a percentage of planted acreage was much lower when the responses that reported zero acres being planted and/or zero loss experienced – were considered. For example, for the vegetable, melons, and potato industry, the average planted acreage is 52.72 and the average loss is 14.03%, whereas for the fruits and nuts industry the average planted acreage is 602.98 and the average loss is 18.71%.

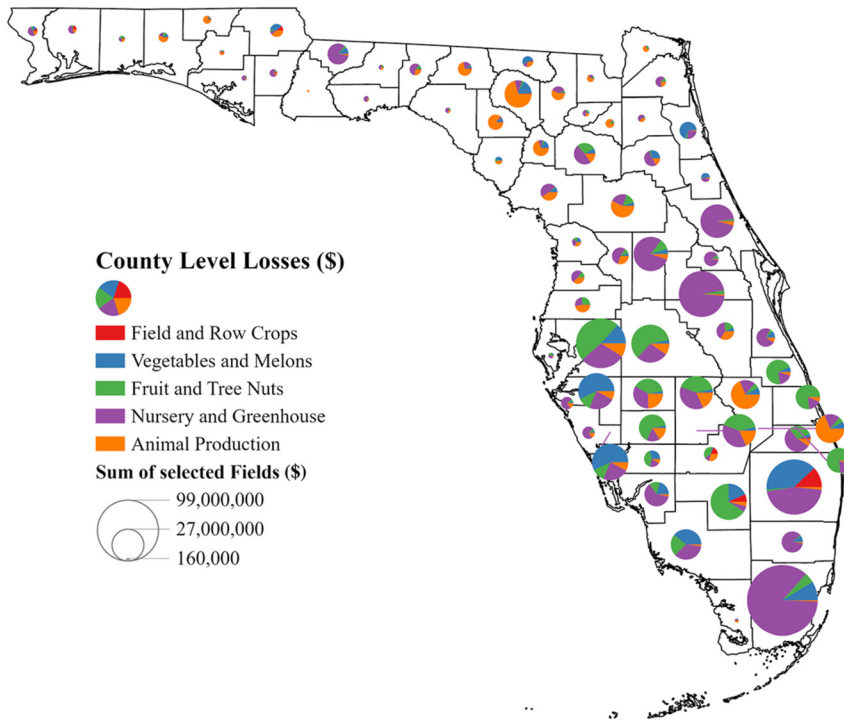


Figure 2: Geographic variation in agricultural economic losses caused by COVID-19 during the period of March – mid-May 2020.

the fruit and vegetable supply chain in Florida, two major themes emerged as relevant to an operation’s ability to adapt to and overcome pandemic conditions: prioritization of personnel and community engagement. Each theme is explored below including relevant excerpts from individual fruit and vegetable supply chain operations.

4.2.1 Prioritization of Personnel

Agribusinesses across the supply chain were deemed “essential,” and therefore did not shut down as a result of the pandemic. Nearly all employers interviewed across the fruit and vegetable supply chain noted heightened stress among their workers, particularly among employees with children, who now had to be home-schooled because of school closures. One participant stated:

Back to the spring, when this first started falling off a large population of our workforce. We had about 23% of them leave within a day of a lot of media about the virus. They just went home. For a long time, that was their reaction. And so, they created an enormous hardship on us. We typically try to work a 10-hour day (now) our workforce (was) working 12 and 14 hours a day to compensate.

- Processing and Packing operation, Southwest Florida.

Companies addressed these concerns by prioritizing their personnel. They accomplished this, in part, by providing informational materials related to COVID-19, by being more flexible with work hours, and by including “hazard pay” that

increased hourly wages by at least a dollar per hour. Select participant comments in this respect include:

We made sure that everyone at our company knew the first week of March, that no one was going to lose their job over this and we were going to protect all of our employees. Both safety-wise, and also their livelihood. And we were all in this together.

- Production Agriculture (including small farms) operation, Southwest Florida.

... We would put out an email almost every day for a while, or every other day, and there would be some updates on farm worker safety.

- Production Agriculture (including small farms) operation, Southwest Florida.

In addition, operations quickly altered their policies and procedures to prevent the spread of COVID-19 within the workplace. Crop advisors and fertilizer and chemical representatives were barred from entering onto farm properties. Farm supervisors and managers stopped attending off-farm meetings. External and internal communications moved to phone and video conferencing technologies. Social distancing guidelines were implemented and administrative staff were sent home to work remotely. In the case of non-profits, which heavily rely on volunteer labor, many of whom are retirees, there was a particular concern about their volunteer population being at a higher risk of developing severe cases of COVID-19. Some examples that participants provided included:

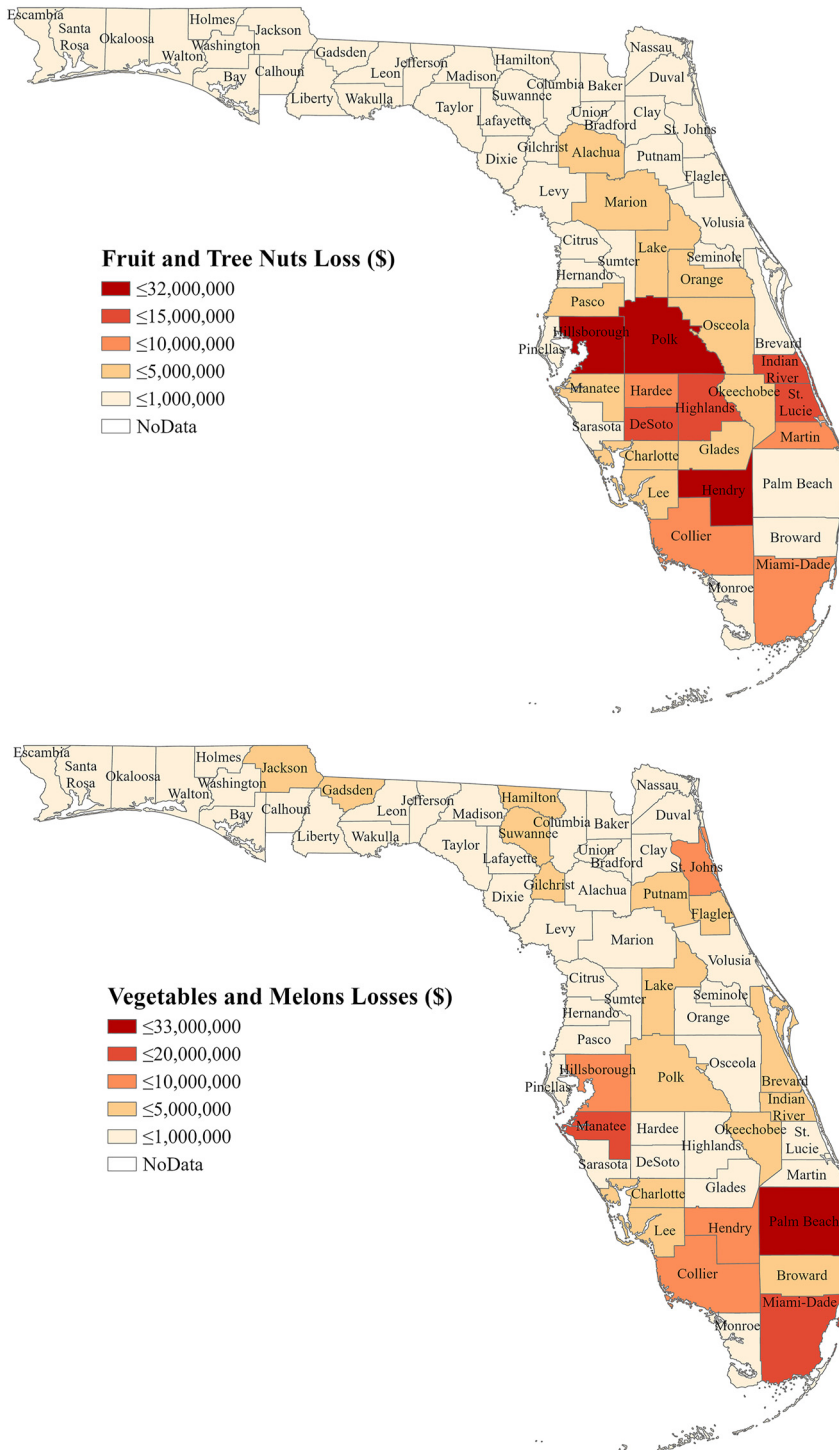


Figure 3: Economic losses of the fruits and tree nuts commodity group as well as the vegetables, melons, and potatoes commodity group due to COVID-19 during the period of March – mid-May 2020.

And so we took some measures, with sanitizing shared equipment and stuff like that. I mean, it cost us some money, but it helps keep people safe ... We did not have to purchase masks for anyone. We tried and couldn't get a hold of any back then. And then they became a little more available when that became more of the

protocol. The timing just kind of worked, but most people have their own, they will just use face coverings, you know, makeshift type of stuff.

- Production Agriculture (including small farms) operation, Southwest Florida.

We're very actively making changes within our operations and within the packing house. We're putting physical barriers ... clear plastic in between graders, in between the packers. You know, working on one way traffic, alternating break times, social distancing. Just education, education ...

- Processing and Packing operation, Southwest Florida.

4.2.2 Community Engagement

When asked to describe the implications of the COVID-19 pandemic on business operations and relationships, many operations noted an increase in community engagement; in some cases this engagement was actively solicited through outreach and marketing, but in other cases, it happened more naturally, highlighting a shift in consumer behavior driven by an increased awareness of and interaction with local producers. Consumer behavior survey research related to the purchasing of fresh fruits and vegetables during COVID-19 revealed slight increases in dollar amount spent on fresh fruits and vegetables throughout the first 18-months of the pandemic in a nationwide survey (Baker, Peterson, and Boyer 2022). As one participant stated:

So originally, we had maybe 5 or 10 people come in on a day. Now we have hundreds and hundreds a day coming in. This past season was our best season ever, with the peaches, and that was partly due to COVID. So unlike a lot of people, we had a positive impact and that was due to the fact that the schools had gone into spring break, and then they did not reopen ... So we had a lot of mothers coming out with their kids on these weekdays, in particular, and then of course the weekend. So we were just a free-for-all. I mean people literally came out of the woodwork because it was something they could do outside. They had distance and we did put in some safety measures ... And once the work of that passed around Facebook, that's our main media, people started commenting and it was very, very positive and the crowds picked up.

- Production Agriculture (including small farms) operation, Central Florida.

Many producers, regardless of size, also reflected the sentiment of a responsibility to supply food to their communities during uncertain times. Some of the related comments made by participants include:

I'm willing to make sure I can sustain on very little, and I can still produce. I can provide the community with ethical and more products. Including fish, other vegetables and so forth ...

- Production Agriculture (including small farms) operation, Southwest Florida.

We had a line of cars around the block and were putting together boxes all day. But even with the community engagement, the

amount we were able to shift was only about a container of produce.

- Production Agriculture (including small farms) operation, Southwest Florida.

Both NGOs and school food service programs saw substantial increases in need of food and support from their communities. They emphasized the importance of new or existing social connections and partnerships in facilitating their response to the pandemic, which enabled them to leverage their resources and infrastructure to respond to community needs, even beyond merely providing food. Many NGO interviewees also reported increased financial donations and produce from local fruit and vegetable producers. For example, one participant stated:

... So very proud of my staff. Very proud of our community who stepped up being volunteers. We also had a teacher who came across a farmer that had a lot of fresh corn and said, "I'd like to give it away". Then we worked with [him/her] to arrange that. They ultimately delivered corn to four sites.

- Food-related NGO operation, Southwest Florida.

5 How was Florida's Experience Different from Other Regions?

In the latter half of 2020, the 2020 Florida Agriculture and Aquaculture COVID-19 Assessment was adapted to survey five agri-food supply chain segments: agricultural production, food processing/manufacturing, grocery wholesaling, food and beverage retailing, and restaurants.⁵ This survey, hereafter the 2021 Multi-Regional Food Supply Chain Survey, was fielded in three regions of the United States (Florida, California, and the combined two-state region of Minnesota and Wisconsin) from February 1, 2021 to April 15, 2021 using the online platform Qualtrics, following all guidelines and rules imposed on human subjects research by the Institutional Review Boards of all three institutions (University of Florida, University of Minnesota, and University of California – Irvine) involved in data collection (IRB202002280, STUDY00010619, and IRBAPP#15202).

The survey questionnaire ranged in length from 21 to 154 questions depending on business status (open, closed, temporarily closed) and the supply chain segment(s) represented. Survey distribution lists were compiled from Data

⁵ This survey was part of the project titled "Lessons from COVID-19: Positioning Regional Food Supply Chains for Future Pandemics, Natural Disasters and Human Made Crises", which is supported by the Agriculture and Food Research Initiative, grant no. 2020-68006-33037, from the USDA National Institute of Food and Agriculture.

Axel/Reference Solutions and from private and non-profit membership organizations representing all segments of the agri-food supply chain. Postcards with a QR code linking to the survey were also distributed by mail to businesses representing the middle segments of the supply chain to improve the response rate from these under-studied groups.

It is clear from the literature and our analyses of within-state variation that the impacts of COVID-19 on operations within the fruit and vegetable supply chain were highly influenced by the degree to which production cycles (or seasons) coincided with market disruptions resulting from policies implemented to mitigate the spread of COVID-19 at a local and national level. The 2021 Multi-Regional Food Supply Chain Survey provided further insights on this observation through a harmonized assessment of two additional fruit and vegetable producing regions (California and Minnesota-Wisconsin) with very different evolutions of COVID-19 cases and policies as well as very different production cycles.

Figure 4 compares the trend in the number of daily cases per 100,000 population across two different states (California and Florida) and the combined region of two other states, Minnesota and Wisconsin. After implementing policies restricting interaction in response to rising case rates in the first quarter of 2020, California gradually started reopening lower-risk workplaces in the second quarter of 2020, along with updating guidance on providing safer environments for workers, resuming delayed medical care, and mandating face coverings. As the number of cumulative cases doubled within less than a month, restaurants and indoor businesses were shut down for the second time in all counties in mid-July. California experienced the sharpest surge in the number of daily cases per 100,000 from the last quarter of 2020 through the end of the first quarter of 2021 and 2020, ending with an extended regional stay-at-home order, as intensive

care unit capacity could not match the massive surge in number of cases. California fully reopened its economy during the second quarter of 2021, as the number of new cases declined. In July of 2021 there was another surge in the number of cases but no new restrictive policies were initiated (Johns Hopkins University and Medicine Coronavirus Resource Center 2022).

During the second quarter of 2020, Minnesota extended a stay-at-home order initiated in the first quarter of 2020, although elective surgeries, operating food trucks, and limited outdoor dining, along with some indoor venues, began to re-open. During late June, applications for relief grants were accepted to consider support for small business owners. In Wisconsin, during the same quarter, several state parks, forests, and recreational areas re-opened with the requirement of maintaining social distancing amongst visitors and limiting the size of the crowd. Relief packages and grant programs were introduced to support ethnically diverse micro-businesses and those who were at risk for financial hardship. In Wisconsin, an executive order requiring face coverings statewide was declared in the third quarter of 2020, and a new stay-at-home order went into effect as the number of total cases increased significantly over the previous quarter. For the combined region of Minnesota and Wisconsin, the trend in the number of total cases per 100,000 population escalated the most between the third quarter of 2020 and second quarter of 2021, enticing Minnesota to enact new restrictions on social gatherings, bars, and restaurants. Both states initiated further economic relief packages to support small businesses. Minnesota loosened restrictions for many indoor services to run with a limited capacity in early January 2021. Further measures were taken to reopen the economy but still the businesses were encouraged to run at a lower capacity than usual. All restrictive measures were relaxed by mid-March of 2021

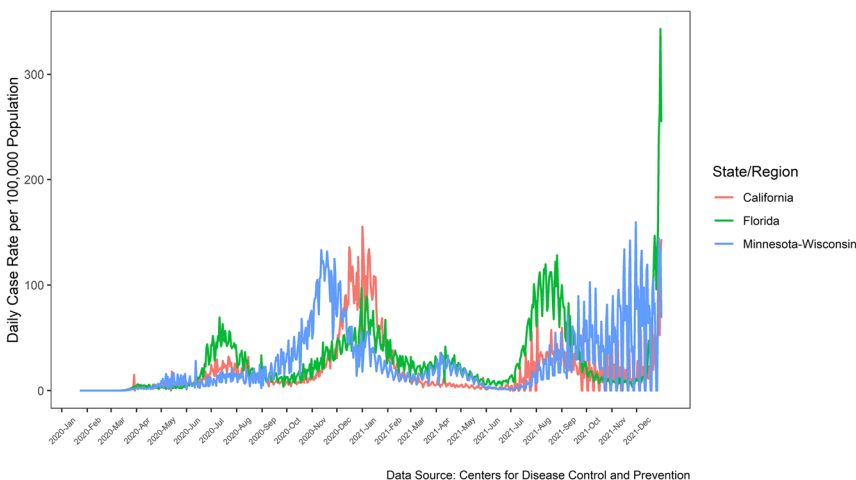


Figure 4: Trend in the daily case rate per 100,000 population across three different regions: Florida, California, and the combined region of Minnesota and Wisconsin.

(Johns Hopkins University and Medicine Coronavirus Resource Center 2022).

Ten fruit and vegetable crops grown in Florida, deemed significant crops for the state based on their total planted acreage, value per acre, Florida's ranking within national sales, and labor intensity, were selected for comparison across the regions. Figure 5 shows the planting and harvesting calendar of these 10 crops in Florida, California, and Minnesota-Wisconsin (there are no avocado or citrus crops in Minnesota-Wisconsin). Most of these crops have long growing periods in Florida and California, and short growing periods in Minnesota-Wisconsin. Moreover, the specific months for planting and harvesting vary significantly across regions due to differences in climate. Specifically, the primary growing seasons for these crops in Florida are from September to May, with only a few crops able to grow through summer (June to August) amid the

humidity, heat, and abundant rainfall. The primary growing seasons for these crops in California and Minnesota-Wisconsin are both around summer from May to October. At the time of the COVID-19 lockdown in March 2020, most of these 10 crops were ready for harvesting in Florida, while these crops in the other two states were mostly out of season. Therefore, except for avocado, the onset of the COVID-19 pandemic in the spring of 2020 coincided with the peak harvesting period of these crops in Florida. Florida producers were left with hundreds of millions of pounds of produce with no available market (Campbell and McAvoy 2020).

Results from the 2021 Multi-Regional Food Supply Chain Survey suggest that sales revenue losses for fruit and vegetable producers in California were highest in the second quarter of 2020, but persistent across the year as producers serving institutional markets scrambled to redirect large

Florida												
Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avocado												
Blueberry												
Cabbage												
Cucumber												
Orange												
Pepper												
Strawberry												
Sweet Corn												
Tomato												
Watermelon												
California												
Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avocado												
Blueberry												
Cabbage												
Cucumber												
Orange												
Pepper												
Strawberry												
Sweet Corn												
Tomato												
Watermelon												
Minnesota-Wisconsin												
Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Blueberry												
Cabbage												
Cucumber												
Pepper												
Strawberry												
Sweet Corn												
Tomato												
Watermelon												

Figure 5: Planting and harvesting seasons of major fruit and vegetable crops in Florida, California, and Minnesota.

volumes of products. Changes in sales revenues for fruit and vegetable producers in Minnesota-Wisconsin were almost non-existent, potentially owing to the smaller scale of production in this region and the later production season, which afforded growers time to plan and adjust to market disruptions.

Like Florida, southern California shares a large scale and diversified fruit and vegetable industry, and the onset of COVID-19 cases and public health measures were roughly simultaneous (ERA Economics, LLC 2020). Much of California's fruit and vegetable industry is also exported outside the state, including to national markets within the United States that also consume Florida produce. Given the relatively long planting and harvesting calendar for many of these crops in both California and Florida, there are both overlap and complementarities across both states. In the case of oranges, for example, both Florida and southern California harvest nearly year-round, but Florida's oranges are used primarily for processing into juice while California's oranges are largely intended for the fresh market. Florida harvests peppers starting in November and mainly from March to May, while in California peppers are harvested mainly from July to early December. Seasonal complementarity is also evidenced in refrigerated truck movements. Therefore, the initial disruptions due to the onset of the pandemic in the United States during spring 2020 affected Florida's harvesting, packing, and processing of peppers more than California's, and Florida's citrus operations might have been impacted by a dramatic increase in demand for orange juice, presumably due to its reputation as a healthy beverage containing Vitamin C and other nutrients (Heng, Zansler, and House 2020). According to (Florida Department of Citrus (FDOC) 2020), the value of sales of orange juice at grocery stores rose 50.7% in April 2020, as compared to the same period in the previous year. The extent to which increased demand will persist or yield positive impacts for the citrus industry in Florida remains unclear (Court, Ferreira, and Cruz 2021).

There is evidence that for some California fruit and vegetable crops, such as tomatoes and various nuts, there were some shifts from sales for fresh markets towards processing (Goodrich, Kiesel, and Bruno 2021), which might indicate a difference with Florida where there is far less in-state processing of fruits and vegetables. On the other hand, these shifts were the exception and not the rule, and California-focused studies seem to reflect a general national trend, where the most notable impact of the pandemic were significant losses on farm and along the supply chain due to labor shortages and shifts in marketing channels (ERA Economics, LLC 2020; Goodrich, Kiesel, and Bruno 2021; Johnson 2020).

The Minnesota-Wisconsin region, which spans USDA hardiness zones 3–5, tells a different story. The fruit and vegetable industry in this region is relatively small with growers representing only one percent of agricultural acreage (USDA National Agricultural Statistics Services 2017). This is despite the fact that many of these fruits and vegetables can be grown in the region, and in fact were grown to a greater extent in decades past. Minnesota-Wisconsin produce tends to remain in the region as growers typically direct-market locally-grown fruits and vegetables as fresh products. There are some exceptions. Vegetables grown for processing, such as sweet corn, green peas, green beans, and potatoes are typically frozen or canned for both retail and institutional markets. During the first 12 months of the pandemic, growers who relied solely on institutional sales scrambled to pivot, looking for alternative buyers. Thirty-four percent of Minnesota-Wisconsin fruit and vegetable survey respondents reported losing existing customers during the first and second half of 2020. For processors that specialized in institutional markets, there was little room to pivot. Alternatively, potato growers reported some insulation from dramatic market shifts since they were supplying fresh markets and processing markets for institutional sale and for retail sale. This allowed them to shift sales into the retail categories as institutional sales declined.

6 Conclusions

The COVID-19 pandemic was an unprecedented event for modern society and tested every facet of our modern infrastructure with wide-reaching implications and many lessons learned. The early phases of the pandemic provided an opportunity to reflect on where food comes from, where it goes, and to connect families and communities to producers. Many found solace in preparing meals at home and many fruit and vegetable producers, distributors, and retailers were able to identify deficiencies and pivot quickly to ensure that demand would be met. Many operations within the fruit and vegetable supply chain gained a deeper understanding of where their products were going, how they got there, and the complexities of the broader food supply chain.

The impacts of COVID-19 on Florida's fruit and vegetable industries were dependent on several factors, including a confluence of high COVID-19 spread, "shutdowns," and peak harvest periods as well as heavy reliance on sending products to institutional/fresh markets. Fresh fruit and vegetable growers who grow perishable crops for the food-service sector were impacted significantly during the early months of the pandemic. However, produce sales recovered strongly during the latter half of May and into the summer months as

produce demand shifted from food service industries to retail grocery stores.

Fruit and vegetable producers adapted quickly to pandemic impacts and uncertainties to continue supplying consumers with the necessary products to sustain their families and communities. One area of heightened concern for every operation within the fruit and vegetable supply chain was the potential impact of COVID-19 infections within the workplace. During the early stages of the pandemic, many operations implemented procedures to minimize the risk of COVID-19 transmission and provided educational materials to their workforce. Interviews with company representatives attributed a low number of infections to their rapid implementation of social distancing, masking, and worker isolation procedures if infection was suspected. Many operations also alluded to the adoption of an innovative mindset to weather the pandemic, in some cases implementing changes that had long been considered but not prioritized. Likewise, there was a pattern of leveraging relationships to continue operations. It became apparent that many businesses' survival and success was largely due to greater community awareness and engagement with local food production, financial support through government interventions, and assurances that food production would remain an essential service.

It is only when something disappears that we realize what we had or what we miss. COVID-19 highlighted this adage and can serve as a moment to increase the value we place on fruit and vegetable production within communities and how actors on both the supply and demand sides of this system understand the dynamics outside their limited interactions within production, packing/processing, movement, or consumption of fresh fruit and vegetable products.

Appendix A: Interview Guides

Question Bank #2: Production agriculture

Q2.1 Briefly describe your farming operation in Southwest Florida (or other specific region) *pre-COVID-19*. (geographic and open-ended)

Optional Prompts:

- *What do you grow/produce?*
- *Who are your customers, or how do you sell your products?*
- *Where are your markets or customers located?*
- *How many people do you directly employ on your operation?*

Q2.2 How has (have) your market(s) changed as a result of COVID-19? (geographic and open-ended)

Optional Prompts:

- *Did your operation expand or contract?*
- *Are you employing more or fewer people than before the pandemic?*
- *Describe how your relationships with your customers AND suppliers have changed because of the pandemic.*

Q2.3 What adjustments did you make in your farming and/or marketing in reaction to COVID-19? (open-ended)

Optional Prompt:

- *Did you adopt any new innovations or form new partnerships?*

Q2.4 Have there been any regulations or other constraints that have enabled or prevented you from making adjustments you wanted to make within your operations in response to COVID-19? (open-ended)

Q2.5 How do you think COVID-19 will change the future of your business? (open-ended)

Q2.6 Describe how you managed risk before the COVID-19 pandemic (i.e., weather, market volatility). (open-ended)

Q2.7 Were you able to prepare for risks associated with the COVID-19 pandemic? (open-ended)

Q2.8 Has the COVID-19 pandemic changed your approach to risk management? If so, how? (open-ended)

Question Bank #3: Processing/Packing

Q3.1 Briefly describe your processing or packing operations *pre-COVID-19*. (open-ended)

Optional Prompts:

- *What do process or pack?*
- *Who are your customers, or how do you sell your products?*
- *Where are your markets or customers located?*
- *How many people did you employ prior to the pandemic?*

Q3.2 How has (have) your market(s) changed as a result of COVID-19?

Optional Prompts:

- *Did your sales or revenues increase or decrease?*
- *Are you employing more or fewer people than before the pandemic?*
- *Describe how your relationships with your customers AND suppliers have changed because of the pandemic.*

Q3.3 What adjustments did you make in your operation and/or marketing strategy in reaction to COVID-19? (open-ended)

Optional Prompts:

- Did you adopt any new innovations or form new partnerships?

Q3.4 Have there been any regulations or other constraints that have enabled or prevented you from making adjustments you wanted to make within your operations in response to COVID-19? (open-ended)

Q3.5 How do you think COVID-19 will change the future of your business? (open-ended)

Q3.6 Describe how you managed risk before the COVID-19 pandemic? (open-ended)

Optional Prompts:

- Think about how you anticipated actions against hurricanes, drought, low prices from market volatility.

Q3.7 Were you able to prepare for risks associated with the COVID-19 pandemic?

(open-ended)

Q3.8 Has the COVID-19 pandemic changed your approach to risk management? If so, how?

(open-ended)

Question Bank #5: Retail Distribution – local food networks

Q5.1 Briefly describe your food retail operations in Southwest Florida (or other specific region) pre-COVID-19. (geographic and open-ended)

Optional Prompts:

- What do you sell?
- Who are your customers, or how do you sell your products?
- Where are your markets or customers located?
- How many people do you directly employ on your operation?

Q5.2 How has your market changed as a result of COVID-19? (geographic and open-ended)

Optional Prompts:

- Did your retail operations expand or contract?
- Are you employing more or fewer people than before the pandemic?
- Describe how your relationships with your customers AND suppliers have changed because of the pandemic.

Q5.3 What adjustments did you make in your marketing approach as a reaction to COVID-19? (open-ended)

Optional Prompt:

- Did you adopt any new innovations or form new partnerships?

Q5.4 Have there been any regulations or other constraints that have enabled or prevented you from making adjustments you wanted to make within your operations in response to COVID-19? (open-ended)

Q5.5 How do you think COVID-19 will change the future of your business? (open-ended)

Q5.6 Describe how you managed risk before the COVID-19 pandemic (i.e., weather, market volatility). (open-ended)

Q5.7 Were you able to prepare for risks associated with the COVID-19 pandemic? (open-ended)

Q5.8 Has the COVID-19 pandemic changed your approach to risk management? If so, how? (open-ended)

Question Bank #10: Food-Related Nongovernmental Operations (NGOs)

Q10.1 Briefly describe your non-profit pre COVID-19?

Optional Prompts:

- What communities do you serve?
- What is the structure of organization?
- How many employees?
- How many participants?

Q10.2 What area do you serve geographically? (locations)

Q10.3 How and how much has demand for your services changed? (percentage and discussion)

Q10.4 Where have you seen increases in demand geographically? (locations) Has this changed the way you distribute to these areas? (open-ended)

Q10.5 How has your volunteer base changed? (percentages and discussion)

Q10.6 Have you made changes to how and where you procure food? If so, what are they? (open-ended)

Q10.7 What funding impacts do you anticipate as a result of COVID-19? (percentage, open-ended)

Q10.8 Do you anticipate lasting operational changes as a result of COVID-19? If so, what are they? (open-ended)

Q10.9 Have there been any regulations or other constraints that have enabled or prevented you from making adjustments you wanted to make within your operations in response to COVID-19? (open-ended)

Q10.10 What role have partnerships played in responding to COVID-19? Have you formed new partnerships? (open-ended)

Q10.11 What risks has COVID-19 highlighted for your operation? (open-ended)

Appendix B: Codes for Qualitative Analysis of Interviews

Metadata labels for transcripts:

- Location of interview (UF/IFAS Districts/County)
- Date of Interview
- Interviewer
- Major Themes
- Question Bank
- a. Sector/Question bank – for categorizing questions asked.
 - i. Business Description
 - ii. Market Change
 - iii. Adjustments to COVID-19
 - iv. Regulation constraint
 - v. Future outlook
 - vi. Risk Perception pre, during, and post
 - vii. Other/added
 - viii. Prompt/probe
- b. Impact-Evaluative statement that represents change in business practices, approach, and effects due to direct or indirect implications of the COVID-19 pandemic.
 - i. **Positive** (the business/ individual had outcomes that were a benefit in the duration of the COVID-19 pandemic)
 - ii. **Negative** (the business/ individual had outcomes that were at a detriment in the duration of the COVID-19 pandemic)
 - iii. None
 - iv. Both positive and negative
 - v. Observed market impact
- c. Partnerships-relationships between businesses, individuals or agencies.
 - i. **New** (a partnership or relationship that was formed in reaction to the COVID-19 pandemic)
 - ii. **Improved** (an existing partnership expanded due to the COVID-19 pandemic)

- iii. **Declined** (an existing partnership was reduced due to the COVID-19 pandemic)
- iv. Loss
 - v. Change in relationship
 - vi. No change
- d. Culture (Institutional/Business) – The ethos and practices of a business, institution or individual that determines approach, attitudes and common practices.
 - i. Changed
 - ii. Remained the same
- e. Change Internal – Adjustments in reaction from within the business, individual(s) or institution. This may be change inspired, accelerated or in direct relation to the COVID-19 pandemic or awareness brought about during the COVID-19 pandemic.
 - i. Operational/process change
 - ii. Physical (structural)
 - iii. Future changes
 - iv. Systemic change
- f. Change External – Events or circumstances outside of the business, individual or institution that determined shifts in practices, behavior and operations.
 - i. Weather
 - ii. Market change output
 - iii. Market change input
- g. Technology
 - i. New technology adoption in operations
 - ii. Re-invention of already adopted technologies
 - iii. Remote meetings positive
 - iv. Remote meetings negative
 - v. No change
- h. Risk Mitigation – Consists of actions, attitudes or perceptions towards risk prior, during, and post the COVID-19 pandemic.
 - i. During
 - ii. Post
 - iii. Prior
 - iv. Approach to risk
- i. Constraints – Reduced the ability of the individual(s), institution or business to operate and were due to the COVID-19 pandemic or COVID-19-related decisions or extraneous circumstantial occurrence.
 - i. COVID-19 related
 - ii. COVID-19 decisions
 - iii. Circumstantial
- j. Ongoing Concerns
- k. Employees
 - i. COVID-19 risk
 - ii. Let go
 - iii. Hired more

- iv. Stayed same
- l. Geography
 - i. Expanded reach/market
 - ii. Recession in reach/ market
 - iii. New locations
- m. Legislation/Regulation – Regulations or restrictions introduced or highlighted as a result of the COVID-19 pandemic.
 - i. Slowed Business
 - ii. Supported Business
 - iii. Complicated
 - iv. Indecisive
 - v. Limited
 - vi. Adapted
 - vii. Loosened
 - viii. Tightened
 - ix. No change
 - x. External to the COVID-19 pandemic
- n. Future Outlook – Specific in relation to the time of the interview. Post COVID-19 outlook should be addressed with risk mitigation code.
 - i. Positive
 - ii. Negative
 - iii. Unclear
 - iv. Concerned
 - v. External to COVID-19
- o. Implied knowledge and elaboration required
- p. Business Description

Acknowledgments: Valuable assistance in the preparation of the interview guides, recruitment of participants, and implementation of interviews was provided by Lauren Butler, County Extension Director and Livestock Agent II, Okeechobee County Cooperative Extension Service, UF/IFAS; Angela Corona, Public Health Specialist, Family Nutrition Program, Osceola and Orange Counties, UF/IFAS; Dr. Vincent Encomio, Florida Sea Grant Agent, Martin and St. Lucie Counties, UF/IFAS; Liz Felter, Regional Specialized Extension Agent in central Florida, UF/IFAS; Carlita Fiestas-Nunez, Food Systems Specialist, Family Nutrition Program, UF/IFAS; Yvette Goodiel, Sustainability and Commercial Horticulture Agent, Martin County, UF/IFAS; Jennifer Hagen, Family Consumer Sciences Agent, UF/IFAS Extension Lee County; Brittany Hall-Scharf, Marine Agent, UF/IFAS Extension and the Florida Sea Grant Program; Ron Hamel, Agribusiness Consultant, Center for Agribusiness, Lutgert College of Business, FGCU; Lisa Hickey, Sustainable Agriculture and Food Systems Extension Agent, UF/IFAS Extension Manatee County; Molly Jameson, Sustainable Agriculture and Community Food Systems Agent, UF/IFAS Extension Leon

County; Elias T. Kirche, Department of Information Systems Operations Management, Florida Gulf Coast University; Colleen Larson, Regional Dairy Agent, Okeechobee, Highlands, DeSoto, and Hardee Counties, UF/IFAS; Gene McAvoy, Associate Director for Stakeholder Relations, Southwest Florida Research and Education Center, UF/IFAS; Jeannie Necessary, Food Systems Specialist, Family Nutrition Program, UF/IFAS; Chris Prevatt, State Specialized Extension Agent II – Beef Cattle and Forage Enterprise Budgeting and Marketing, Range Cattle Research and Education Center, UF/IFAS; Jessica Ryals, Agriculture and Sustainable Food Systems Agent, Collier County, UF/IFAS; Stuart Van Auken, Eminent Scholar, Marketing, Lutgert College of Business, FGCU; Andrea Moron Vasquez, Program Manager, Family Nutrition Program, Lee County, UF/IFAS; and Kelly Wilson, Food Systems Specialist, Family Nutrition Program, Lee County, UF/IFAS. Valuable assistance with the preparation of the interview data and this article was also provided by Kelsey McDaid, Research Coordinator, Food and Resource Economics Department, UF/IFAS.

Research funding: This work is in part supported by the Agriculture and Food Research Initiative, grant no. 2020-68006-33037, from the USDA National Institute of Food and Agriculture.

References

- Ahmed, J. U., S. Akter, and K. A. Majumder. 2021. "Impact of COVID-19 on Agricultural Production and Distribution in South Asia." *World Food Policy* 7 (2): 168–82.
- Aiyar, A., and P. Pingali. 2020. "Pandemics and Food Systems – Towards a Proactive Food Safety Approach to Disease Prevention Management." *Food Security* 12 (4): 749–56.
- Alam, G. M. M., and M. N. Khatun. 2021. "Impact of COVID-19 on Vegetable Supply Chain and Food Security: Empirical Evidence from Bangladesh." *PLoS One* 16 (3): e0248120.
- Ali, Z., R. Green, R. B. Zougmore, S. Mkuhlani, A. Palazzo, A. M. Prentice, A. Haines, A. D. Dangour, and P. F. D. Scheelbeek. 2020. "Long-Term Impact of West African Food System Responses to COVID-19." *Nature Food* 1 (12): 768–70.
- Baker, L. M., H. H. Peterson, and C. R. Boyer. 2022. "Changes in Consumer Purchasing Behavior of Fresh Fruits and Vegetables During the COVID-19 Pandemic." *HortScience* 57 (9): S242–3.
- Campbell, C., and G. McAvoy. 2020. "Florida Fruit and Vegetable Growers' Adaptation and Response to COVID-19." *Journal of Agriculture, Food Systems, and Community Development* 9 (4): 165–9.
- Campbell, B. L., A. L. Rihn, and J. H. Campbell. 2021. "Impact of the Coronavirus Pandemic on Plant Purchasing in Southeastern United States." *Agribusiness* 37 (1): 160–70.
- Citrus World, Inc. 2022. *Cooperative Information*. Lake Wales: Citrus World Inc. Also available at <https://citrusworldinc.com/cooperative-information/> (accessed September 12, 2022).

- Court, C. D., A. Hodges, and M. Lollar. 2020. *Harmonizing the Assessment of the Impacts of Natural Disasters to Florida Agriculture*. Gainesville: UF/IFAS. Also available at <https://edis.ifas.ufl.edu/publication/FE1075?msckid=d86b1bccd16511ecb69a7a18d7d7e56a>.
- Court, C. D., J. Ferreira, and J. Cruz. 2021. *Economic Contributions of the Florida Citrus Industry, 2019–2020*. Gainesville: UF/IFAS Economic Impact Analysis Program. Also available at <https://fred.ifas.ufl.edu/PDF/economic-impact-analysis/FRE-EconomicContributionsFLCitrusReport2019-20FINAL.pdf>.
- Court, C. D., J. P. Ferreira, G. J. D. Hewings, and M. L. Lahr. 2021. "Accounting for Global Value Chains: Rising Global Inequality in the Wake of COVID-19?" *International Review of Applied Economics* 35 (6): 813–31.
- Creswell, J. W., and V. L. P. Clark. 2017. *Designing & Conducting Mixed Methods Research*, Vol. 1. Los Angeles: Sage Publishing.
- Cutter, S. L. 2018. "Compound, Cascading, or Complex Disasters: What's in a Name?" *Environment: Science and Policy for Sustainable Development* 60 (6): 16–25.
- Deaton, B. J., and B. J. Deaton. 2020. "Food Security and Canada's Agricultural System Challenged by COVID-19." *Canadian Journal of Agricultural Economics* 68 (2): 143–9.
- Department of Homeland Security. 2020. *Temporary Changes to Requirements Affecting H-2A Nonimmigrants Due to the COVID-19 National Emergency: Partial Extension of Certain Flexibilities*. Washington: Homeland Security Department. Also available at <https://www.federalregister.gov/documents/2020/08/20/2020-18283/temporary-changes-to-requirements-affecting-h-2a-nonimmigrants-due-to-the-covid-19-national>.
- Dittmar, P., J. Freeman, M. Paret, and H. Smith. 2021. *2021–2022 Vegetable Production Handbook*. Gainesville: UF/IFAS. Also available at <https://journals.flvc.org/edis/issue/view/5959>.
- Dundee Citrus Growers Association. 2022. *Our Story*. Dundee: Dundee Citrus Growers Association. <http://dun-d.com/about-dundee/> (accessed September 12, 2022).
- ERA Economics, LLC. 2020. *Economic Impacts of the COVID-19 Pandemic on California Agriculture*. Also available at https://www.cfbf.com/wp-content/uploads/2020/06/COVID19_AgImpacts.pdf.
- FAO. 2020. *Impact of COVID-19 on Agriculture, Food Systems and Rural Livelihoods in Eastern Africa*.
- Faus, J., and N. Hunt. 2021. *Coronavirus Costs Climb as Europe's Farmers Seek Seasonal Workers*. New York: Reuters. Also available at <https://www.reuters.com/article/us-health-coronavirus-produce/coronavirus-costs-climb-as-europes-farmers-seek-seasonal-workers-idUSKBN2BN2AR>.
- Ferreira, J. P., P. Ramos, E. Barata, C. D. Court, and L. Cruz. 2021. "The Impact of COVID-19 on Global Value Chains: Disruption in Nonessential Goods Production." *Regional Science Policy & Practice* 13 (S1): 32–54.
- Florida Department of Agriculture and Consumer Services. 2022a. *State Farmers Markets*. Tallahassee. <https://www.fdacs.gov/Agriculture-Industry/State-Farmers-Markets> (accessed September 10, 2022).
- Florida Department of Agriculture and Consumer Services. 2022b. *Florida Citrus Statistics 2020–2021*. Tallahassee. https://www.nass.usda.gov/Statistics_by_State/Florida/Publications/Citrus/Citrus_Statistics/2020-21/fcs2021b.pdf (accessed September 10, 2022).
- Florida Department of Citrus (FDOC). 2020. *Nielson Retail Sales. Annual Topline Report on Retail Sales for Florida Citrus Juice, 2019–20 Season, Dec. 2020*. Bartow. Also available at <https://www.floridacitrus.org/grower/florida-department-of-citrus/economic-market-resources/market-reports/>.
- Global Alliance for Improved Nutrition (GAIN). 2020. *Impact of COVID-19 on Kenya's Food Systems: A Situational Report*. Also available at <https://docs.wfp.org/api/documents/WFP-0000119380/download/>.
- Goodman, L. A. 2011. "Comment: On Respondent-Driven Sampling and Snowball Sampling in Hard-to-Reach Populations and Snowball Sampling Not in Hard-to-Reach Populations." *Sociological Methodology* 41 (1): 347–53.
- Goodrich, B., K. Kiesel, and E. Bruno. 2021. "Differential Impacts of the COVID-19 Pandemic on California's Produce and Nut Industries." *Western Economics Forum* 19 (1): 58–74.
- Gu, H., and C. Wang. 2020. "Impacts of the COVID-19 Pandemic on Vegetable Production and Countermeasures from an Agricultural Insurance Perspective." *Journal of Integrative Agriculture* 19 (12): 2866–76.
- Harris, J., L. Depenbusch, A. A. Pal, R. M. Nair, and S. Ramasamy. 2020. "Food System Disruption: Initial Livelihood and Dietary Effects of COVID-19 on Vegetable Producers in India." *Food Security* 12 (4): 841–51.
- Heng, Y., M. Zansler, and L. House. 2020. *Orange Juice Consumers' Response to the COVID-19 Pandemic*. EDIS Document FE1082. Gainesville: UF/IFAS, Food Resource Economics. Also available at <https://edis.ifas.ufl.edu/publication/FE1082>.
- Hobbs, J. E. 2020. "Food Supply Chains During the COVID-19 Pandemic." *Canadian Journal of Agricultural Economics/Revue Canadienne d'agroéconomie* 68 (2): 171–6.
- Hoppe, R. A., J. M. Macdonald, and P. Korb. 2010. *Small Farms in the United States Persistence Under Pressure, EIB-63*. Washington: United States Dept. of Agriculture Economic Research Service, Economic Information Bulletin. 63: i–32. Also available at <https://www.ers.usda.gov/publications/pub-details/?pubid=44463>.
- Huff, A. G., E. B. Walter, S. K. Nicholas, and A. M. Joseph. 2015. "How Resilient is the United States' Food System to Pandemics?" *Journal of Environmental Studies and Sciences* 5 (3): 337.
- IHS Markit. 2020. *Coronavirus Triggers Acute Farm Labour Shortages in Europe*. London: S&P Global. Also available at <https://ihsmarkit.com/research-analysis/article-coronavirus-triggers-acute-farm-labour-shortages-europe.html>.
- Johns Hopkins University and Medicine Coronavirus Resource Center. 2022. *Impact of Opening and Closing Decisions by State: A Look at How Social Distancing Measures May Have Influenced Trends in COVID-19 Cases and Deaths*. Baltimore: JHU Coronavirus Resource Center. Also available at <https://coronavirus.jhu.edu/data/state-timeline/new-confirmed-cases/florida/27> (accessed July 1, 2022).
- Johnson, R. 2020. *COVID-19: Supply Chain Disruptions in the US Fruit and Vegetable Industry: In Brief*. Washington: Homeland Security Digital Library. Also available at <https://www.hsdl.org/?abstract&did=838233>.
- Ker, A. P., and R. Cardwell. 2020. "Introduction to the Special Issue on COVID-19 and the Canadian Agriculture and Food Sectors: Thoughts from the Pandemic Onset." *Canadian Journal of Agricultural Economics/Revue Canadienne d'agroéconomie* 68 (2): 139–42.
- Kniffin, K. M., J. Narayanan, F. Anseel, J. Antonakis, S. P. Ashford, A. B. Bakker, and P. Bamberger. 2021. "COVID-19 and the Workplace: Implications, Issues, and Insights for Future Research and Action." *The American Psychologist* 76 (1): 63–77.
- Lee, D. 2020. *COVID-19 Pandemic: Update on Canadian Immigration*. Vancouver: (blog) Alexander Holburn Beaudin + Lang LLP. Also available at <https://www.ahbl.ca/blog-covid-19-pandemic-update-on-canadian-immigration-2/>.
- Lipman Family Farms. 2022. *We're Local Everywhere*. Immokalee: Lipman Family Farms. <https://www.lipmanfamilyfarms.com/find-us/> (accessed September 12, 2022).
- Maria del Rio-Chanona, R., P. Mealy, A. Pichler, F. Lafond, and J. D. Farmer. 2020. "Supply and Demand Shocks in the COVID-19 Pandemic: An

- Industry and Occupation Perspective.” *Oxford Review of Economic Policy* 36: 594–137.
- Nowell, L. S., J. M. Norris, D. E. White, and N. J. Moules. 2017. “Thematic Analysis: Striving to Meet the Trustworthiness Criteria.” *International Journal of Qualitative Methods* 16 (1). <https://doi.org/10.1177/1609406917733847>.
- OECD. 2020. *Preliminary Report: Evaluation of the Impact of the Coronavirus (COVID-19) on Fruit and Vegetables Trade*. 1–14. Also available at <https://www.oecd.org/agriculture/fruit-vegetables/oecd-covid-19-impact-on-fruit-and-vegetables-trade.pdf>.
- Outerbridge, D., C. D. Court, L. Birou, C. Campbell, L. Felter, S. Galindo, J. Hagen, B. Hall-Scharf, L. Hickey, M. Jameson, E. Kirche, A. Magnier, and F. Roka. 2022. “Change and Innovation Within Florida’s Food System in Response to COVID-19.” In *Economies, Institutions, and Territories: Dissecting Nexuses in A Changing World*, edited by L. Storti, G. Urso, and N. Reid. Milton Park: Taylor and Francis Ltd.
- Richards, T. J., B. Rickard, C. J. T. Richards, and W. P. Carey. 2020. “COVID-19 Impact on Fruit and Vegetable Markets.” *Canadian Journal of Agricultural Economics/Revue Canadienne d’agroeconomie* 68 (2): 189–94.
- Romaguera, K. 2020a. *UF Surveys to Identify Impact of Pandemic on Florida’s Agriculture and Marine Industries*. Gainesville: UF/IFAS Blog. Also available at <https://blogs.ifas.ufl.edu/news/2020/04/16/ag-marine-impact-covid-19/>.
- Romaguera, K. 2020b. *Preliminary Reports in COVID-19 Impact Survey Show Effects Vary by Industry*. Gainesville: UF/IFAS Blog. Also available at <https://blogs.ifas.ufl.edu/news/2020/05/04/preliminary-reports-in-covid-19-impact-survey-show-effects-vary-by-industry/>.
- Saldanña, J., and M. Omasta. 2022. *Qualitative Research: Analyzing Life*, 2nd ed. Los Angeles: Sage Publishing.
- Spicer, A. 2020. “Organizational Culture and COVID-19.” *Journal of Management Studies* 57 (8): 1737–40.
- Szelewa, D., and M. Polakowski. 2022. “European Solidarity and ‘Free Movement of Labour’ During the Pandemic: Exposing the Contradictions Amid East–West Migration.” *Comparative European Politics* 20 (2): 238–56.
- The Florida Tomato Committee. 2013. *Tomato 101*. Maitland: Florida Tomato Committee. https://www.floridatomatoes.org/wp-content/uploads/2013/01/Tomato_1011.pdf (accessed September 10, 2022).
- UF/IFAS. 2021. *Florida’s Agriculture and Food System Fast Facts 2021*. Gainesville: UF/IFAS. Also available at <https://blogs.ifas.ufl.edu/ifascomm/2021/04/06/floridas-agriculture-and-food-system-fast-facts-booklet/>.
- United States Department of Agriculture – Farm Service Agency. 2020. *USDA Announces Details of Direct Assistance to Farmers Through the Coronavirus Food Assistance Program*. Washington: United States Department of Agriculture – Farm Service Agency. Also available at <https://www.usda.gov/media/press-releases/2020/05/19/usda-announces-details-direct-assistance-farmers-through>.
- USDA National Agricultural Statistics Services. 2017. *2017 Census of Agriculture*. Washington: USDA National Agricultural Statistics Service. Also available at <https://www.nass.usda.gov/Publications/AgCensus/2017/index.php>.
- USDA National Agricultural Statistics Services. 2022. *2021 State Agriculture Overview for Florida*. Washington: USDA National Agricultural Statistics Service. Also available at https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=FLORIDA.
- Weersink, A., M. von Massow, N. Bannon, J. Ifft, J. Maples, K. McEwan, M. G. S. McKendree, C. Nicholson, A. Novakovic, A. Rangarajan, T. Richards, B. Rickard, J. Rude, M. Schipanski, G. Schnitkey, L. Schulz, D. Schuurman, K. Schwartzkopf-Genswein, M. Stephenson, J. Thompson, and K. Wood. 2021. “COVID-19 and the Agri-Food System in the United States and Canada.” *Agricultural Systems* 188: 103039.
- Workie, E., J. Mackolil, J. Nyika, and S. Ramadas. 2020. “Deciphering the Impact of COVID-19 Pandemic on Food Security, Agriculture, and Livelihoods: A Review of the Evidence from Developing Countries.” *Current Research in Environmental Sustainability* 2: 100014.
- Yegbemey, R. N., C. M. K. Ahihou, I. Olorunnipa, M. Benali, V. Afari-Sefa, and P. Schreinemachers. 2021. “COVID-19 Effects and Resilience of Vegetable Farmers in North-Western Nigeria.” *Agronomy* 11 (9): 1808.
- Yuen, K. F., X. Wang, F. Ma, and K. X. Li. 2020. “The Psychological Causes of Panic Buying Following a Health Crisis.” *International Journal of Environmental Research and Public Health* 17 (10): 3513.