

Economic Impacts of the COVID-19 Pandemic on California Agriculture

Prepared for

California Farm Bureau Federation
UnitedAg
Ag Association Management Services, Inc.
California Fresh Fruit Association
California Strawberry Commission
California Tomato Growers Association
Western Plant Health Association

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1. Executive Summary

The impact of the COVID-19 pandemic on California agricultural businesses was severe, unprecedented, and will continue to affect the industry for the coming months and years. This report summarizes an evaluation of its impact on California agricultural industries. The study focuses on producers, but also describes and quantifies impacts to other businesses in the integrated agricultural supply chain. Direct economic impacts are reported both for current year-to-date (YTD) changes and for expected annual 2020 changes under two alternative industry recovery scenarios.

This study should be viewed as an initial assessment based on the data available at the time the study was conducted (late April and May 2020). The pandemic and the resulting associated global slowdown in economic activity continue to change daily. Therefore, these impacts will change and should be updated as additional industry information becomes available. For example, timely access to crop protection products during the upcoming season was noted as a point of concern for the industry. If interruptions in this input supply chain prevent applications during the summer growing season, additional crop damage and losses would occur that are not considered in this analysis. Interruptions in available labor supply due to another wave of the pandemic or localized outbreaks within specific industries (or regions or operations) would also substantially increase estimated impacts.

The analysis uses a combination of industry production, export, and price data available through early May 2020, extensive industry interviews, and surveys sent to key businesses. Around 15 interviews were conducted (plus additional follow up calls and informal conversations with various entities) and survey information was gathered from over two dozen agricultural businesses. These data were used to calculate the direct economic impact of the COVID-19 pandemic on 14 commodities/market segments representing the majority of the agricultural value in the state.

Direct economic impacts represent the year-over-year (YOY) change in conditions using the most relevant base period (either 2019, pre-pandemic 2020, or a historical average, as appropriate). It is important to note that other factors, such as tariffs, are affecting industry conditions at the same time as the COVID-19 pandemic. These factors are described for each crop, but there are insufficient data at this time to complete an appropriate analysis that would decompose changes into the various components. Direct economic impacts are presented for total YTD and projected annual impacts under two scenarios to give the reader a sense of the range of potential impacts.

Secondary impacts (so-called “multiplier” or “indirect and induced” effects) are evaluated using a version of the Impacts for Planning and Analysis (IMPLAN) model developed by MIG, Inc. The IMPLAN model is designed to assess the secondary effects of relatively small changes in economic conditions, so its results from such a major shock as the COVID-19 pandemic should be viewed cautiously. Therefore, the assumptions used for that analysis and the resulting secondary impacts are reported separately from the direct impacts.

The analysis benefited greatly from growers and other industry experts that participated in the series of interview, calls, and surveys. These data were critical for quantifying the changing, dynamic nature of

the pandemic and its effects on the industry. This also provided context for the specific impacts of the pandemic to individual businesses and industries that are obscured in aggregate industry statistics.

The conclusions of the economic impact analysis are as follows:

- The COVID-19 pandemic was an abrupt disruption to the agricultural supply chain in California and around the world. The most significant impacts of this pandemic were caused by changes in agricultural product demand as a result of: (i) disruptions in the export markets, (ii) distribution, packing, and supply chain logistics, (iii) shut-down of the entire food service industry, and (iv) shift in consumer purchases to more shelf-stable items from retail establishments.
- The direct economic impact of the COVID-19 pandemic on California agriculture is estimated between \$5.9 and \$8.6 billion this year. This includes estimated YTD impacts of over \$2 billion.
- Including secondary impacts, and under a mid-point scenario of direct impacts, the total impact is approximately \$13 billion in output value, or between \$4.1 billion and \$6.5 billion in economic value-added for the California economy this year.
- The economic impacts fall disproportionately on impoverished, rural counties in the state. Impacts to farm jobs, processing, and income tend to fall on workers that reside in economically disadvantaged communities in these rural counties.
- Job losses depend upon how quickly the economy recovers following the shutdown of the food service sectors. Preliminary Economic Development Department (EDD) data show that April employment was down 13.4 percent, or 2.4 million jobs for farm, processing, and manufacturing sectors statewide. Impacts in the rural counties were greater, with Kern, Tulare, Imperial, and Monterey showing agriculture-related job losses of 27 percent to 81 percent, emphasizing the impacts of the pandemic in rural counties. EDD data show job losses of over 94,000 in crop farming sectors comparing April 2019 to April 2020. Including food service and retail sectors, total April jobs were down by more than 800,000 across the state.
 - Initial numbers from the Bureau of Labor Statistics (BLS) for May 2020 suggest an employment rebound, however the effect on California agriculture and related industries is not clear. These impacts should be monitored and updated as more information is released from EDD and BLS.
- In addition to changes in consumer demand that affect revenues to agricultural producers, the COVID-19 pandemic has caused direct costs to agricultural businesses. Examples of additional costs include:
 - Social distancing on pack/sorting lines that reduces productivity
 - Administrative costs associated with additional record-keeping and workforce monitoring (e.g., reporting, contact tracing, educations, other disruptions)
 - Additional cleaning of buildings, wiping down of machinery after each use, and general sanitation
 - Providing additional personal protective equipment (masks, gloves, etc.)

- Employee training to keep a healthy workspace and prevent spread of disease in the home environment
 - Daily temperature checks and health screening
 - Spacing labor crews for planting or harvest, staggering shifts to reduce the number of employees in a single location, and additional break rooms and spacing
 - Absenteeism for working parents with childcare responsibilities due to the closure of childcare facilities and schools
 - Additional sick time and workers compensation cost¹
- Most of the direct crop losses were to fresh fruit and vegetables that were in season when the COVID-19 pandemic hit. Other crops have seen export market impacts. It is also important to note that some commodities have seen an uptick in demand under the pandemic. This includes shelf-stable items such as rice and processed tomato products.
 - The impact of the COVID-19 pandemic should be viewed in the context of other pressures on the agricultural industry in the state. Groundwater Sustainability Plan implementation started earlier this year for Critically Overdrafted groundwater sub-basins across the state and 2020 water supply deliveries for agriculture are reduced, resulting in higher water costs. AB 1066 and SB 3 are being implemented and workforce scarcity continues, resulting in increasing labor costs for many producers. Other water and air quality programs impose additional reporting and compliance costs on the industry.

Table 1 summarizes the direct economic impacts of COVID-19 pandemic on California agricultural industries for each crop sector included in the analysis, projected for calendar year 2020.

¹ Early reports indicate the Workers Comp claims due to COVID-19 are rising rapidly. See for example Cal Matters: <https://calmatters.org/labor/2020/06/covid-workers-comp-compensation-claims-california-lockdown/>

Table 1. Direct Economic Impact Summary, in millions of dollars

Commodity/Industry Group	Annual Direct Economic Impact Range		Notes
	Direct Impact Range		
Food Service, Retail, Export	-	-	U.S. total losses and California-specific impacts are described in the report
Processing/Manufacturing	-	-	Impacts included in respective crop categories
Leafy Greens	\$141	\$480	
Processing Tomatoes	\$88	\$211	
Berries	\$144	\$280	
Dairy	\$1,370	\$2,320	
Rice	-	-	Additional milling costs and disruptions to logistics; otherwise expect normal year
Beef and Poultry	\$610	\$878	
Cotton	\$166	\$166	
Table Grapes	\$140	\$140	
Wineries and Wine Grapes	\$1,400	\$1,610	
Citrus	\$164	\$311	
Nuts	\$486	\$728	
Hay and Feed Crops	\$65	\$130	
Cherries & Tree Fruit	\$49	\$125	
Flowers and Nurseries	\$660	\$740	
Olives and Olive Oil	\$18	\$18	
Other Vegetables	\$450	\$450	
Other Support Businesses	-	-	Impacts included in respective crop categories
Total	\$5,951	\$8,587	

Note: Impact range represents annual direct impacts based on YOY change.

The timing of impacts varies by commodity and region. Areas like the Imperial Valley and Central Coast that were in the middle of harvest and planting decisions incurred proportionally higher impacts than areas that were not making planting decisions when the shutdown occurred. Other crops that were not yet planted, such as processing tomatoes, saw impacts as contracts were canceled or revised down. Yet other industries, such as export nuts realized impacts as shipments were delayed, transportation costs increased, and some ports were shut down (e.g., India). The hope is that some of these disruptions are temporary. Finally, other industry impacts are uncertain. For example, if applicators have limited personal protective equipment, this may affect crop protection activities later this year, a second shut down could impact harvest, and lingering changes in consumer purchasing patterns (for example, the shift from food service to retail purchasing) could have long run effects on planting decisions. These planting decisions affect seed and nursery production many months prior to planting, harvest, or ultimately being consumed. Therefore, it is likely that additional impacts will be realized later this year as the pandemic unfolds.

Many impacts are currently unknown because it is still early in the planting season. For crops that were in season, including berries and leafy greens, direct losses occurred at the field and various points in the

supply chain. As food service demand evaporated, product that could not be diverted to the retail sector spoiled or was destroyed.

Federal support programs under the Families First Coronavirus Response Act (FFCRA) and Coronavirus Aid, Relief, and Economic Security Act (Cares Act) are welcome relief but provide insufficient funding to offset economic losses. Payment caps, including AGI limitations on the programs, preventing specialty crop growers from recovering the substantial costs when a crop is lost, or its market no longer exists.

Some industries have benefited from the changes in consumer purchases of shelf-stable items. For example, representatives from the dry beans industry reported that YOY sales were up as much as 20 percent during April and early May. Rice, canned fruit, and processed tomato products have also reported an increase in retail sales that offset some of the losses in the food service market. In addition, some of the impacts of the pandemic in other countries may indirectly benefit California producers by reducing the supply of competing products and/or increasing demand for California products.

The outlook for the industry depends on whether another wave of COVID-19 circulates through communities in the summer and fall, whether an effective vaccine is developed, and how the global economy rebounds from the unprecedented disruption in business activity. A prolonged recession would reduce consumer purchases of some California specialty crops. At this time, it seems likely that additional economic impacts are likely to result from changes in consumer income as the U.S. and other countries enter a recessionary period.

2. Introduction

Early reports of a new respiratory illness (COVID-19) spreading in China started circulating in late 2019. By January 26, 2020 there was a confirmed case in California in a traveler returning from Wuhan, China. On February 26 the first reported community transmission of unknown origin was reported, and state and federal efforts to understand the extent and spread of the disease were increasing. China, the U.S., and other countries around the globe implemented increasingly restrictive travel bans and shelter-in-place orders for citizens. On March 19, a shelter-in-place order was issued in California, following similar local county and city ordinances. That order remained in effect through mid-May 2020. As of late-May, counties around the state were slowly lifting shelter-in-place orders for a phased re-opening of businesses.

The increasingly restrictive travel bans, social distancing requirements, and stay-at-home orders shut down significant portions of the California economy. All non-essential businesses, including retail, restaurants, sports, and entertainment, were closed indefinitely. The food service sector, including institutions (e.g., schools, stadiums, other events) and restaurants, was shut down overnight. Fresh fruit, vegetables, dairy, and meat purchases stopped, leaving food to spoil in restaurant refrigerators and farmer fields. At the same time, retail demand for shelf-stable foods increased, which disrupted supply logistics for fresh produce and other commodities. This disruption in business activity continues to affect all sectors of the economy.

The impact of the COVID-19 pandemic on California agricultural businesses was severe, unprecedented, and will continue to affect the industry for the coming months and years. Impacts are being felt across four main sectors: consumer demand (retail, export, and food service), agricultural supply chain (transportation, packing, storage), producers (crops, dairy, nursery, and meat), and input suppliers (workers, crop protection, materials).

At the consumer level, an initial run on grocery stores for consumer staples was followed by increasing purchases of nonperishable goods, as the food service industry shut down and consumers shifted to cooking and eating at home. Restaurants, schools, sports, entertainment, and retail outlets were closed. The export market for fresh and processed produce was impacted by lack of freight movement, port closures, and shelter-in-place orders issued in countries around the world. The net effect was an increase in retail sales for nonperishable items, evaporation of food service demand, and a drop in exports.

The agricultural supply chain is a tightly integrated system that allows food products, floriculture products, and animal products to flow through a series of intermediaries that transport, store, process, and distribute to domestic retail outlets, domestic food service providers, and international markets. It is a highly competitive and efficient system designed to move food products cost-effectively from the field to consumer plates anywhere in the world. Businesses in the supply chain depend on other entities to enable a continuous flow of products, and on information about changes in domestic retail, food service, and international demand. Changes at any point in the system pass back through the supply chain to producers who (eventually) adjust their choice of crops, floriculture, and animal products to

supply. This includes decisions about inputs (e.g., labor) and in land, labor, water, capital, agronomic materials, animals, plant and animal protective materials, plant and animal nutrition and growth materials.

The highly efficient and specialized supply chain is not able to quickly adjust to abrupt changes in consumer demand (e.g., closing of schools and restaurants). It is difficult and costly to shift processing, packaging, and distribution from food service products to retail outlets. For example, fluid milk production lines devoted to school lunches are not easily shifted to producing retail consumer packaging. In addition, demand for food service packages of butter, ice cream, and other dairy products stopped abruptly. As a result, the industry was forced to dump fluid milk, incurring substantial losses.

Crop production, processing, manufacturing, and food service and retail sectors provide jobs and income for workers across the state. Many of these jobs are held by workers in rural counties. Table 2 summarizes California Employment Development Department (EDD) data, current through Q2 2019. Data for relevant food and agricultural business sectors were classified into the aggregate industry sectors such as crop farming, food service and food retail. The selected food and agriculture sectors account for more than 2.1 million jobs, on an average monthly basis. Crop farming jobs more than triple during planting and harvest seasons. Section 5 of this report summarizes YOY changes in food and agriculture jobs.

Table 2. Average Monthly Food and Agriculture Sector Industry Employment

Industry Category	2017	2018	2019
Animal and Dairy Production	31,235	30,740	30,180
Crop Farming	174,560	166,675	154,520
Food Service	1,224,360	1,249,730	1,260,680
Processing and Manufacturing	78,540	76,455	67,410
Nursery	14,635	14,750	14,960
Retail	379,320	383,760	375,790
Support	203,010	209,300	201,615
Wholesale	86,365	90,400	87,690

Source: California Employment Development Department; ERA Economics' category definitions

The California agricultural supply chain is resilient. It has been tested by drought, floods, trade disputes, availability of production inputs, and government interventions. Despite economic losses during these events, the industry has continued to provide a reliable supply for domestic and international food, floriculture, and animal demands.

The COVID-19 pandemic is a disruption to the California agricultural supply chain that is challenging its resiliency. It was caused by sudden and unexpected shocks to the California agricultural supply chain: (i) the shelter-in-place order and closing of all restaurants, and (ii) the immediate collapse of U.S. food service demand as schools, universities, hotels, travel, and entertainment industries shut down. Approximately 50 percent of U.S. food consumption was out of the home prior to the COVID-19 pandemic, and this is now less than 10 percent during the pandemic.

The immediate impact of COVID-19 on California input suppliers and crop, floricultural, and animal production was observed as growers plowed under perishable leafy greens, reduced milk supply, and thinned livestock herds. For example, animal processing was impacted as beef and pork processing plants closed due to worker health concerns as COVID-19 spread through meat packers. This left the California cattle industry with an increasing number of cattle ready for processing. Seasonal industries with peak sales this time of year were some of the hardest hit, including the floriculture industry that lost its typical Mother's Day sales. Other disruptions to input suppliers include issues with landing aqueous ammonia shipments at ports, resulting in significant losses to chemical suppliers and delays for growers preparing fields for planting.

It is important to acknowledge that some sectors/markets have seen an increase in business activity during the COVID-19 pandemic. For example, consumer retail purchases of shelf-stable items resulted in an increase in demand for rice and processed tomato products. Some citrus purchases, like oranges, have reportedly increased due to its perceived safety and Vitamin-C immune system benefits. The impact of the COVID-19 pandemic is commodity, market, and business-specific. In aggregate, the losses far outweigh the isolated benefits.

It is also important to view these additional costs caused by COVID-19 in the context of the broader policy and regulatory environment. Producers across the state are managing higher water costs, labor costs under AB 1066 and SB 3, and water shortage (e.g., 2020 is a dry year resulting in water cutbacks to senior water rights holders). The COVID-19 pandemic is disrupting demand and creating additional costs at the same time that growers are dealing with other industry pressures.

Given the dynamic nature of the impact of the COVID-19 pandemic, this analysis presents an initial assessment of the YTD economic impact and range of annual costs. The analysis should not be viewed as an exhaustive inventory of impacts. As the pandemic changes and the industry moves further into planting and harvest seasons, new and revised data will become available and additional economic impacts will become clear.

The report is structured as follows. The following section describes the method and data applied to quantify changes in market demand and other direct costs. Section 4 describes and quantifies economic impacts for each crop type included in the analysis. This is followed by an input-output (multiplier) analysis of indirect and induced economic impacts of these direct impacts on ancillary industries. A concluding section offers summary remarks, outlook, and additional work to be done.

3. Economic Impact Analysis Methodology

The economic analysis quantifies direct economic impacts to producers and processing industries, and secondary (multiplier) effects on related industries. Impacts to the retail sector, food service, and food retail industries, are described but not included in the multiplier effects. Losses to the restaurant industry alone are staggering and significantly increase the total impact of the COVID-19 pandemic. Impacts are reported as expected annual change in gross industry sales (alternatively referred to as gross revenue or gross value) or direct cost.

Data were compiled from sources that are cited throughout the report. However, since the pandemic is rapidly changing, the industry continues to adjust, and not all crops are in season, data are not available for all crops or business sectors. A series of interviews with industry members were conducted over a span of three weeks in early May. Interview topics ranged from general discussion of COVID-19 pandemic impacts to specific cost impacts and changes in business operations in response the shutdown. Interview feedback was used to cross-reference industry data, and where appropriate, applied to calculate cost or market impacts for a specific sector. A series of supplemental surveys were conducted for selected industries and used to fill data gaps in the analysis.

Direct economic impacts include changes in gross industry revenues (sales) and costs. Gross revenue is decomposed into changes in production quantities and/or price. These changes are a result of adjustments in the supply chain or consumer demand that ultimately affect producer prices or amount of product delivered to final consumers. For example, restaurant closures resulted in canceled contracts for some commodities that would be a loss in gross revenue to the producer (or shipper or processor, as appropriate). Direct costs include changes in business operating practices in response to the COVID-19 pandemic. For example, covering testing and contact tracing costs for employees, testing, spacing crews, labor shortages (due to COVID-19 and related absenteeism), sanitation, and providing additional personal protective equipment (PPE).

Direct impacts are estimated using YOY changes.² Next, the YTD observed impacts are used as a basis to project for the remaining calendar year. Given the uncertain outlook, two scenarios were developed for most crops, one where the economy begins to recover in June and gradually increases through the end of the year, and one where another wave of pandemic shuts down the food service sector in the summer and fall months. The gradual increase is generally defined as a linear trend such that the monthly YOY change is zero by December of this year. The higher impact scenario applies the YTD impacts to subsequent months. Specific assumptions are discussed for individual crops or sectors below.

It is important to note that other factors not attributable to the pandemic continue to affect California commodities and are reflected in these YOY changes. For example, tariffs have impacted the industry over the last several years and the strength of the U.S. dollar against export market currencies affects trade with these countries. Since data are limited and the pandemic is still in progress, this analysis adjusts for these effects in the direct economic impacts of each crop or market segment based on industry feedback and other available data sources. Future studies that will benefit from complete industry data will be able to develop a more sophisticated economic framework to isolate the impact of the COVID-19 pandemic from other market changes, quantify impacts that are only qualitatively discussed in this report, identify other resource and regulatory conditions (e.g., water supply conditions and increasing labor wages), and evaluate other adjustments in the supply chain.

Secondary economic impacts are estimated using the Impacts for Planning and Analysis (IMPLAN) model and data developed by MIG, Inc. The 2014 R3 database was applied, and all dollar impacts were indexed

² For some industries/crops, such as dairy, it was determined that YOY changes were not appropriate because too many other factors had changed since the prior year. In these instances, monthly changes using YTD data are used (e.g., change in sales Jan-Feb compared to March, April, and May).

to current dollars using the GDP Implicit Price Deflator. IMPLAN is an input-output model that can be used to quantify the effect of changes in expenditures in one sector of the economy on all related sectors. Gross revenue impacts were modeled as a change in final demand for the relevant industry sectors. A single scenario for all direct impacts (for each specific sector/crop) was developed in IMPLAN rather than developing and reporting individual analyses for each crop/sector. This improves readability of the document and emphasizes the direct industry impacts.

The onset of the COVID-19 impacts was sudden and simultaneous across the supply chain, and the IMPLAN analysis attempted to account for that. Direct impacts at different points in the supply chain were adjusted to avoid double counting. For example, a lower farm-gate price would not be counted at both the farm level and to the processor. Also, many direct impacts to crop sales occurred after the crop was already produced, so they represent a reduction in business income but not a reduction in all of the inputs used to produce the crop. The IMPLAN model is designed to assess the secondary effects of relatively small changes in economic conditions, so its results from such a major shock as the COVID-19 pandemic should be viewed cautiously. Therefore, results rely as much as possible on impacts identified directly from data gathered for this report, and then IMPLAN was used to estimate secondary impacts where possible.

The total economic impact is the sum of the direct and secondary impacts for each sector. Total economic impacts include estimated changes in employment, value added, and output value (sales). Results are presented by sector where feasible and in aggregate.

4. Direct Economic Impacts

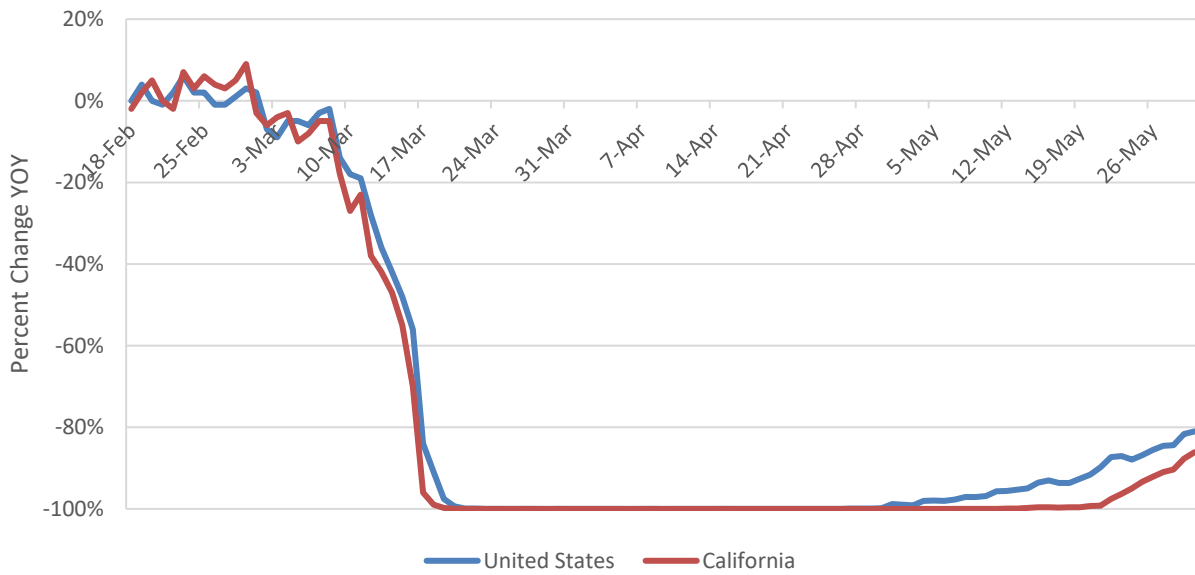
This section summarizes direct economic impacts of COVID-19 on California agriculture. The first subsection describes changes to the three destination sectors - food service, retail, and export. The second subsection summarizes effects on the production sector in general. The following subsections present the effects by individual crop and livestock production sectors.

4.1 Food Service, Retail, and Export Markets

The economic impact of COVID-19 on food service, retail, and export markets is not included in the measures of economic impact reported in this report. However, since this analysis is concerned with impacts to producers and related industries, it is important to describe impacts of the pandemic to retail, food service, and export sectors.

The food service sector has been decimated by the COVID-19 shelter-in-place orders. Institutional demand from schools, hospitals, day care, offices, and other government establishments stopped as those facilities shut down. At the same time, customer traffic for restaurant dine-in effectively stopped. Figure 1 illustrates the percent change in YOY restaurant seated diners (online reservations, phone reservations, and walk-ins) by week. Early 2020 traffic began slightly above 2019 rates, consistent with broader economic activity, but then rapidly dropped as the pandemic progressed. In-person diners were zero by March 19th when shelter-in-place orders were issued across the state. In-person seated diners have only started to increase slightly beginning mid-May, and California still lags the U.S. average.

Figure 1. Year-Over-Year (YOY) Percent Change in Restaurant Seated Diners

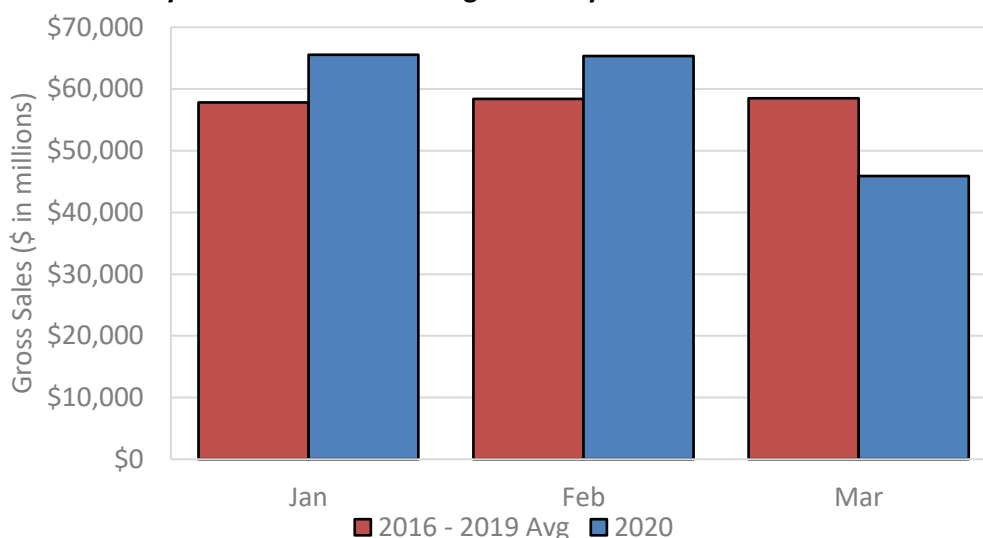


Source: Open Table State of the Restaurant Industry Data

The loss of restaurant bookings caused significant economic damage to the restaurant industry. According to the California Restaurant Association, around 76,000 food and beverage establishments in the state employed over 1.8 million workers at the start of the year. The National Restaurants Association estimates around 52 percent of family meals were at restaurants prior to the pandemic. It estimates that 4 in 10 restaurants remained closed, even with take-out service options, and that as much as one-third of restaurants may remain closed even after the pandemic ends. According to U.S. Census data, gross sales of food service and beverage establishments dropped by 23 percent between February and March 2020. YOY change in sales is down similarly, around 23 percent, or over \$13 billion in that month alone. April data are not available but are expected to show additional decline in sales since the shelter-in-place orders were implemented in mid-March.³ Figure 2 illustrates monthly gross sales for the U.S. food and beverage sector in 2020 and 2016 – 2019 average.

³ The National Restaurants Association projected around \$80 billion in losses through the end of April.

Figure 2. Monthly Restaurant and Beverage Industry Gross Sales



Source: US Census, Estimated Monthly Sales for Retail and Food Services; NAICS 722

Retail sales of food and beverages have increased as consumers increased home meal preparation. The grocery industry reported that retail outlets had an initial spike in purchases as the pandemic emerged. This was characterized by “panic buying” of staple household items and cleaning products (e.g., paper towels and toilet paper) as well as non-perishable goods. Most of the increase in food purchases was in “center of store” staples, which are typically not fresh specialty crops produced in California. However, this does include some frozen products (e.g., frozen strawberries) that are grown and processed in the state. Some prices have increased for products where food service supply and packaging were not able align with retail demand (i.e., greater costs to supply to retail). However, for many items the increase in retail purchases has not resulted in greater price increases due, in part, to price gouging restrictions under Penal Code Section 396. Governor Newsom has extended these limits through September of this year.

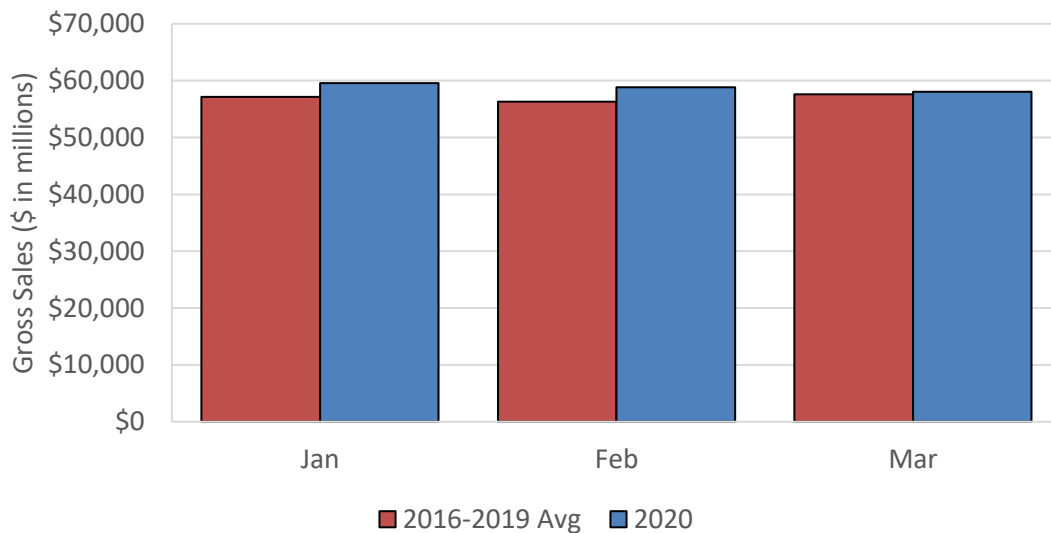
Industry experts interviewed for this study described how the initial panic buying by consumers subsided after a few weeks. Consumer purchases then shifted to larger baskets to accommodate fewer grocery trips. Purchases continued to focus on center-of-store food, non-perishable products, and prepackaged products (perceived to be safer). Many retail outlets began rationing to prevent shortages, however limited availability of some products, such as paper products and flour persist. It is interesting to note that a desire for additional packaging runs counter to historical trends away from packaging due to increasing environmental awareness. Some fresh produce shippers also noted that there seems to be less brand-awareness for consumer purchases. This is consistent with more online and delivery shopping options, and the added convenience of this type of shopping for the consumer.

Grocery stores have invested to meet changing consumer needs. Stores adjusted logistics to keep items in stock. Additional sanitation, gloves, masks, plexiglass, and other safety measures were implemented to protect employees and customers. Bulk and hot food bars were closed and replaced with pre-packaged to-go items. Other industry changes included additional shifts for stocking, marking for social

distancing, and frequent cleaning of high-touch areas. Major grocery stores have reported paying workers more for working during the pandemic, with payments ranging from an additional \$1-\$3 per hour wage to flat bonuses.

U.S. Census data illustrates increased retail food sales, showing a trend of initial panic buying that has since fallen back to more average levels. Retail sales were up between 3 and 6 percent in January and February, and approximately 2 percent in March. Over the three-month period for which data are available, grocery sales are up by approximately 3 percent on average, or around \$5.4 billion in additional sales. As noted above, sales are up but stores are also incurring higher costs.

Figure 3. Monthly Food and Grocery Industry Gross Sales

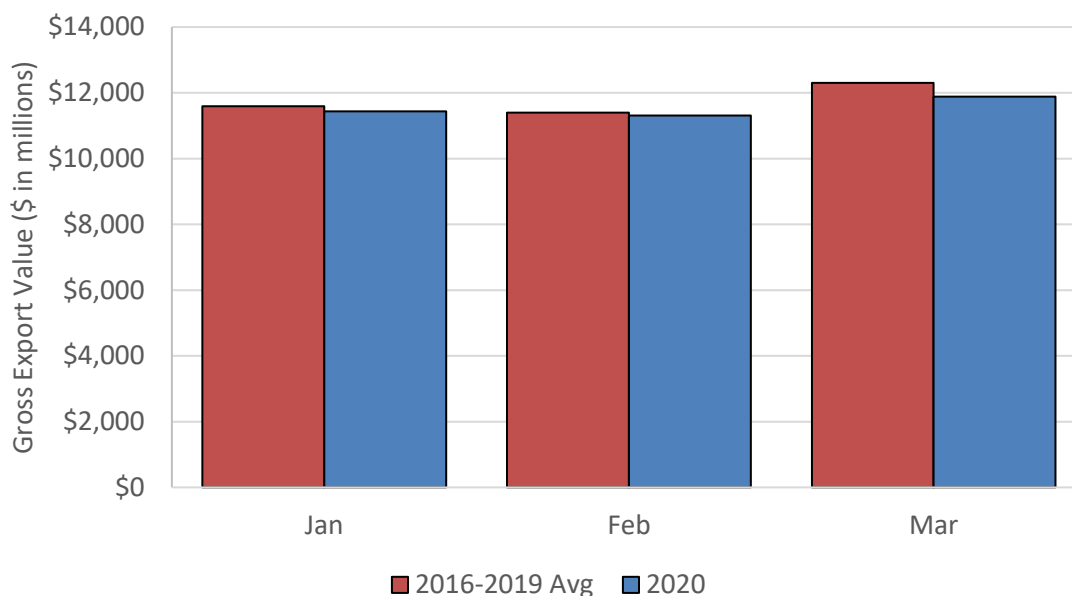


Source: US Census, Estimated Monthly Sales for Retail and Food Services; NAICS 4245

California fresh, frozen, and processed produce is exported around the world. For some commodities, such as nut crops, over 70 percent of annual production is exported. Industry groups reported disruptions in the international supply chain as the pandemic unfolded. Impacts varied by commodity and export market. Vessels have been left at port waiting for entry due to health and testing requirements, which has increased shipping costs. Some ports effectively shut down for extended periods of time. For example, India, a key export market for California almonds, has been hit hard by the pandemic and its ports have received limited traffic. Export market impacts for each commodity are described in following subsections.

Figure 4 illustrates the trends in total export value for Agricultural and Related Products. January and February values were down between 0.8 percent and 1.5 percent. Preliminary data for March exports show a decline of 3.5 percent. The downward trend in exports is consistent with increasing disruptions to global food trade. The response to the pandemic in China and other Asian countries started in February, which coincides with the accelerating trend of declining U.S. exports. The average decrease in exports was approximately 2 percent, or around \$700 million, through March. Commodity-specific export data, described in following subsections, for April and May show that losses continued to increase.

Figure 4. Monthly Agricultural and Related Product Export Value



Source: Foreign Agricultural Service U.S. Trade Data; Agricultural and Related Products Export Value

These types of purchasing patterns in domestic retail, foodservice, and export markets affect producers at various points in the supply chain, ultimately resulting in farm-gate crop price impacts. The following subsections describe economic impacts for major California crops, input suppliers, and related businesses. There are additional economic impacts to indirect industries due to the food service sector shut down. For example, for the rendering industry there is a drop in kitchen grease, animal stock, meat surplus, bones, and other products that have ripple effects that are not quantified or discussed in this analysis.

4.2 Agriculture and Food Business Direct Cost Overview

Operating costs have increased for producers, processors, manufacturers, and distributors during the COVID-19 pandemic. These costs vary by commodity and industry group. For example, spacing of employees for social distancing at cherry packers and almond handlers using human sorting has slowed down lines by up to 50 percent. A 20-foot line that would typically have up to 6 paired sorters now has 3 staggered sorters to allow for a safe distance between employees, resulting in a loss of productivity. Employers also implemented new training programs. For example, the California Strawberry Commission handles training for grower foremen for its members and reported that it quickly integrated CDC guidelines for employee health, sanitation, and social distancing into its programs. Since this training is already covered under existing association fees, additional training costs for its members are minimal. Examples of direct costs imposed by the COVID-19 pandemic are included in the commodity subsections below, and generally include:

- Operating practices/costs
 - Increased spacing of sorting/packing crews
 - Fewer workers in high traffic areas

- Increased hand washing and breaks
- Mandatory sanitation (e.g., equipment after each use and facilities daily)
- Employee safety
 - Paid sick leave
 - Additional Workers Compensation claims
 - Mandatory masks, gloves, and other personal protective equipment (PPE)
 - Mandatory temperature checks
 - Testing and contact tracing
- Training and equipment
 - Employee health/COVID-19 training sessions
 - Employee training for new workplace practices
 - Plexiglass, other barriers
- Logistics
 - Freight/containers for shipping out of California ports (due to reduced container traffic from China)
 - Increased labor costs for bonuses/hazard pay and adjustments for other logistics
 - Limited air freight due to reduced flights
 - Other transportation, storage, shipping constraints
 - Change in product mix to shift from food service to retail markets (packaging, shipping, transportation)
 - Storage/cold storage/warehousing for nonperishable items

In addition to these direct costs, all industry representatives contacted for this study emphasized the impact of the pandemic on supply chains and uncertainty. For example, grocery stores with an established transportation and wholesaler network reported missed shipments, limited drivers, and constraints on refrigerated carriers. Uncertainty about local, state, and federal guidelines, concerns about protecting employee health, and liability were also noted as additional concerns affecting current business planning. With the global economy heading into a pandemic-induced recession, all industries noted they were closely monitoring short-run impacts in addition to these longer-run changes.

4.3 Leafy Greens

The gross value of leafy greens produced in California, including lettuces, spinach, cabbage, and other mixed greens, is around \$2.5 billion annually. Lettuces account for more than \$1.8 billion. It is important to note that some of the lettuce industry is also recovering from an E. coli scare in the fall of 2019 that impacted sales during the holiday season.

The COVID-19 pandemic ramped up during the middle of harvest in the Imperial and Coachella Valleys. The immediate impact of the shutdown was a crash in food service demand for leafy greens. Shippers positioned for that industry suffered immediate impacts that resulted in dumped product and fields that were not harvested. Several Imperial Valley growers interviewed for this study reported losing entire crops totaling millions of dollars in product.

Harvest started in April and May in the Central Coast production regions from Santa Maria to the Salinas Valley. Grower-shippers shifted production and packaging from food service to retail. Logistical constraints including packaging, timing of pack lines, shipping, and retail partners were identified as factors that limited the ability to shift from food service to retail markets. This resulted in additional crop losses and increasing costs.

The impact of the COVID-19 pandemic on the industry is illustrated using movement and price data for January – April 2020 compared to the same period in 2019. As noted earlier, one confounding factor in YOY changes is the lingering effect of the E. coli outbreak in late 2019. The data show total movement was up slightly in January and then dropped rapidly starting in late February and continuing through May. The most significant changes in movement were from greens originating in the Coachella and Imperial Valleys. Across the leafy green crops included in the analysis, the average change in YOY movement between March and May was a decrease of 2 percent to 40 percent compared to the same period in 2019. Table 3 summarizes monthly movement by crop originating in California through all shipping modes (USDA AMS 2020).

Table 3. Monthly Leafy Greens Movement, 2019 and 2020 (10,000 lb. units)

	Cabbage	Endive	Escarole	Iceberg	Romaine	Other Lettuce	Spinach
2019							
Jan	980	1	20	2,405	2,700	495	410
Feb	845	10	20	2,240	2,440	525	445
Mar	975	5	20	2,445	3,125	625	455
Apr	925	20	35	19,180	14,080	4,000	555
May	990	25	45	24,270	18,525	3,630	500
Total	4,715	60	135	50,540	40,865	9,270	2,360
2020							
Jan	1,155	5	10	3,490	3,220	665	440
Feb	1,185	5	10	3,210	2,780	625	400
Mar	1,185	5	15	5,335	4,095	780	485
Apr	930	25	30	20,105	16,185	1,940	465
May	860	20	30	18,760	15,395	1,705	380
Total	5,315	55	95	50,895	41,675	5,715	2,170
% Chg.							
Jan	17.6%	200.0%	-47.4%	45.2%	19.3%	34.6%	7.8%
Feb	40.2%	-66.7%	-50.0%	43.2%	13.9%	18.7%	-10.1%
Mar	22.0%	0.0%	-31.8%	118.0%	31.1%	25.1%	6.1%
Apr	0.3%	27.8%	-12.1%	4.8%	15.0%	-51.5%	-15.7%
May	-13.1%	-18.5%	-32.6%	-22.7%	-16.9%	-53.0%	-24.1%
Chg.	3.0%	0.0%	-25.5%	-3.7%	-0.1%	-46.3%	-11.9%

Source: USDA; All entries rounded so columns may not sum to totals

Shipping point price⁴ data were compiled for 2019 and YTD 2020 for conventional products only. Prices shown reflect spot market prices; a significant share of leafy greens are grown under contract and these prices are not generally reported. Any impact to contract price, cancellations, and crop losses are not reflected in these price data. Including these losses would increase the total economic impact to the industry. Table 4 summarizes the YOY change in shipping point price by commodity. January prices were up slightly YOY, which is consistent with feedback from Imperial Valley growers. Shipping point data show prices generally decreasing as the pandemic increased in April and into May, with lettuce prices down as much as 40 percent YOY in some months. Prices have rebounded slightly in late May as the economy continues to reopen.

Table 4. Leafy Greens Monthly Shipping Point Prices, \$ per carton/pack

	Cabbage	Endive	Escarole	Iceberg	Romaine	Other Lettuce	Spinach
2019							
Jan	\$23.22	\$18.04	\$28.64	\$14.12	\$8.62	\$15.52	\$22.03
Feb	\$20.91	\$14.83	\$23.17	\$16.38	\$11.62	\$15.01	\$13.18
Mar	\$21.71	\$11.02	\$19.70	\$20.36	\$13.62	\$14.57	\$18.41
Apr	\$15.20	\$9.91	\$18.39	\$11.21	\$11.53	\$13.54	\$13.62
May	\$16.90	\$10.13	\$18.68	\$8.43	\$8.85	\$10.53	\$16.14
Avg	\$19.59	\$12.79	\$21.71	\$14.10	\$10.85	\$13.83	\$16.67
2020							
Jan	\$11.47	\$12.25	\$17.18	\$22.11	\$11.00	\$11.05	\$18.83
Feb	\$9.01	\$11.73	\$16.78	\$10.23	\$7.29	\$7.88	\$10.61
Mar	\$10.71	\$12.34	\$16.78	\$12.49	\$9.50	\$9.24	\$13.10
Apr	\$10.57	\$11.64	\$13.25	\$9.84	\$8.97	\$7.81	\$9.85
May	\$15.55	\$15.53	\$15.72	\$10.51	\$8.46	\$7.11	\$18.60
Avg	\$11.46	\$12.70	\$15.94	\$13.04	\$9.04	\$8.62	\$14.20
% Chg.							
Jan	-50.6%	-32.1%	-40.0%	56.6%	27.6%	-28.8%	-14.5%
Feb	-56.9%	-20.9%	-27.6%	-37.5%	-37.3%	-47.5%	-19.5%
Mar	-50.7%	12.0%	-14.8%	-38.7%	-30.3%	-36.6%	-28.9%
Apr	-30.5%	17.5%	-27.9%	-12.2%	-22.2%	-42.3%	-27.7%
May	-8.0%	53.3%	-15.8%	24.6%	-4.4%	-32.5%	15.2%
Mar-May Chg	-29.7%	27.6%	-19.5%	-8.7%	-19.0%	-37.1%	-13.8%

Source: USDA; All entries rounded so columns may not sum to totals; pack units include cabbage 50lb crate, endive 25 lb. crate, escarole 25 lb. crate, iceberg 50 lb. carton, romaine 40 lb. crate, other lettuce 20 lb. crate, spinach 20 lb. carton.

The YOY February-May change in gross industry sales is used to illustrate the impact of the COVID-19 pandemic. February is included in the calculation because industry interviews indicated that some early impacts started in late February. The YOY change in the gross value of leafy greens reported by the U.S. Department of Agriculture (USDA) February - May was approximately \$47.1 million. Most of this is

⁴ Prices shown reflect spot market prices; a significant share of leafy greens are grown under contract and these prices are not generally reported. Any impact to contract price, cancellations, and crop losses are not reflected in these price data.

attributable to the COVID-19 pandemic. Table 5 illustrates the YOY change in gross industry revenues by month.

Table 5. Leafy Greens Monthly Gross Sales Value (\$ in millions)

	Cabbage	Endive	Escarole	Iceberg	Romaine	Other Lettuce	Spinach		
2019									
Jan	\$4.6	\$0.00	\$0.1	\$6.8	\$4.7	\$1.5	\$1.8		
Feb	\$3.5	\$0.03	\$0.1	\$7.3	\$5.7	\$1.6	\$1.2		
Mar	\$4.2	\$0.01	\$0.1	\$10.0	\$8.5	\$1.8	\$1.7		
Apr	\$2.8	\$0.04	\$0.1	\$43.0	\$32.5	\$10.8	\$1.5		
May	\$3.3	\$0.05	\$0.2	\$40.9	\$32.8	\$7.6	\$1.6		
Total	\$18.5	\$0.13	\$0.6	\$108.0	\$84.1	\$23.4	\$7.8		
2020									
Jan	\$2.6	\$0.0	\$0.0	\$15.4	\$7.1	\$1.5	\$1.7		
Feb	\$2.1	\$0.0	\$0.0	\$4.1	\$2.6	\$0.7	\$0.8		
Mar	\$2.5	\$0.0	\$0.1	\$9.3	\$4.9	\$0.8	\$1.3		
Apr	\$2.0	\$0.1	\$0.1	\$39.5	\$28.8	\$3.0	\$0.9		
May	\$2.7	\$0.1	\$0.1	\$39.4	\$26.0	\$2.4	\$1.4		
Total	\$12.0	\$0.2	\$0.3	\$107.7	\$69.5	\$8.3	\$6.1		
% Chg.									
Jan	-41.8%	239.6%	-70.0%	127.3%	52.2%	-4.3%	-8.3%		
Feb	-39.6%	-60.4%	-63.8%	-44.8%	-53.6%	-58.5%	-27.6%		
Mar	-40.0%	12.0%	-36.1%	-6.7%	-42.3%	-56.9%	-24.2%		
Apr	-30.1%	46.8%	-38.2%	-8.1%	-11.2%	-72.4%	-39.4%		
May	-20.0%	22.7%	-43.9%	-3.7%	-20.5%	-68.3%	-12.4%		
Avg	-35.2%	16.4%	-49.9%	-0.3%	-17.4%	-64.4%	-21.5%		
Change	Feb-May	YOY	-\$4.6	\$0.0	-\$0.2	-\$8.9	-\$17.0	-\$15.0	-\$1.5

Source: USDA AMS; ERA Economics calculations using spot market price data

The total annual impact of the COVID-19 pandemic depends on how quickly the food service industry recovers and begins increasing leafy greens purchases. Another wave of the virus and/or shelter-in-place orders would result in additional losses, potentially during harvest in the Central Coast production regions. The other factor affecting impact is consumer purchasing patterns. If consumers continue to purchase nonperishable items and cut back on spending during the recession, this will reduce retail demand for leafy greens.

Given the uncertain outlook, two scenarios were developed, one where the economy begins to recover in June and gradually increases through the end of the year, and one where another wave of pandemic shuts down the food service in the summer and fall months. The average monthly losses shown above are applied in both scenarios. Losses are adjusted in proportion to the total leafy greens sector value (\$2.5 billion) based on the value reported through May 2020 (approximately \$250 million). Under these

scenarios, the annual direct economic impact to the leafy green crop sector is estimated between \$141 and \$480 million dollars.

In addition to crop losses, movement, and price impacts, growers-shippers have incurred additional management, training, and equipment costs. Other costs include higher labor costs to run longer hours for some crews to meet increased retail demand for some customers. Additional packing costs include additional masks and the dip in productivity to meet social distancing requirements. Industry representatives interviewed for this study explained additional steps that the industry is taking to protect the health and safety of its workers including additional training and sanitation. Preventing virus transmission in the workplace and at home is essential for protecting the workforce. Similar costs are being incurred in other parts of the supply chain, including cooling, packing, and transportation. These costs are difficult to quantify but are expected to increase.

The industry also noted changing consumer preferences for packaging. In recent years consumers and producers have preferred reduced packaging to reduce the environmental footprint; now packaging is viewed as a more hygienic and desirable attribute by consumers. The industry is adjusting to these packaging preferences. At the same time, an erosion in consumer brand loyalty has occurred as consumers are more focused on household staples and put less emphasis on specific name-brand products.

4.4 Processing Tomatoes

California processing tomatoes generate a farm-gate value between \$0.9 and \$1.0 billion annually (CDFA 2020). Processed tomato product exports (including paste, sauce, ketchup, diced, other misc. products) are valued around \$700 million annually (USDA AMS 2020). Most acreage is planted under contract between March and June, with earlier and later plantings in some years depending on weather, market, and water supply conditions. Early industry reports were that 2020 was shaping up to be a normal year for the industry, with projected acreage comparable to last season (around 230,000 acres) (USDA 2020). One notable caution for that outlook is that water supply is below normal this year. Both the State Water Project and Central Valley Project have announced significant reductions in deliveries to their agricultural users.

The COVID-19 pandemic coincided with the early part of tomato planting season. Most plantings are under contract with a processor that processes, markets, and sells a range of tomato products to retail, food service, and export markets. The immediate impact of the COVID-19 pandemic has been a reduction in food service demand for processed tomato products. Most processors are set up to produce bulk paste or diced products and would incur costs to shift facilities and produce for retail business. Domestic retail demand has increased as consumers purchase more center-of-store shelf-stable items, including canned tomato products.

The impact of the COVID-19 pandemic on tomato growers is felt through any changes in contracted acreage and price paid by the processors. Early industry reports based on interviews with industry experts indicate that some processors, particularly those more focused on the food service market, did reduce contracted acreage by a few percent in response to the dip in demand. It was also noted that

planted acreage could have been reduced further, but most acreage is transplanted, and the plugs had already been produced and paid for at nurseries. If another wave of COVID-19 forces processors to shut down, affects labor availability, or otherwise disrupts the industry, additional impacts could occur during harvest. It is too early in the season to speculate on these potential impacts.

Direct economic impacts of the COVID-19 pandemic are estimated for growers and processors. The direct impact to producers is estimated as the change in planted acreage due to the COVID-19 pandemic. Based on industry feedback, a reduction in contracted acreage of 3-5 percent, or between 7,000 and 12,000 acres, statewide is applied. Using the 5-year historical average statewide price (\$76.77/ton in real dollars⁵) and yield (49 tons/ac) results in a direct impact to growers of between \$26.3 and \$45.1 million this year.

The impact of COVID-19 on processors is more difficult to assess. Tomato paste and canned products are storable. The immediate response to a drop in domestic or export demand is to increase inventories. However, increasing inventories incurs carrying costs, and the increase in total supply available puts downward pressure on prices in the future. Food service demand for processed tomato products is down, but retail demand is up because consumers are purchasing more storable food items. Industry sales and store scanner data necessary to quantify the net effect of these trends were not available for this study. Feedback from industry professionals is that, in aggregate, these effects in the domestic market are offsetting. However, the impact varies widely by individual processor.

The third market segment for California processed tomato products is exports. Export quantity is down for most tomato products through March 2020. The changes are driven by a combination of the COVID-19 pandemic and other market conditions, including carryover inventories, consumer demand in export markets, and production in other markets. For example, Italy was hit hard by COVID-19 and this may have affected tomato plantings this year. Italians consume sauce and canned products as staple ingredients in many dishes. Shelter-in-place orders shifted Italian consumers to retail purchases, including larger basket purchases at the store. Similar to the domestic market, tomato product sales in Italy have increased as a result.

Table 6 summarizes 2019, 2020, and YOY change in export volume by product type. Export quantity is down for paste, sauce, and other tomato products. Organic exports are up YOY, but account for a small share of total export volume. Total January – March export volume is down approximately 10 percent YOY. January is included in the impact calculation because disruptions in export markets started in late January and early February as the pandemic spread through other parts of the world.

⁵ In nominal dollars, the 5-year average is \$74.90/ton

Table 6. Processed Tomato Product Export Quantity, 2019 and 2020 (metric tons)

	Paste	Sauce	Ketchup	Misc. Whole	Organic	Other Whole/Pieces
2019						
Jan	26,105	14,180	8,980	5,395	1,800	2,185
Feb	25,415	12,680	10,175	6,210	1,670	2,820
Mar	27,525	13,170	13,015	7,055	1,810	3,570
Apr	26,070	12,205	10,980	5,300	1,980	1,945
2020						
Jan	18,240	13,225	10,295	4,830	2,215	1,870
Feb	19,375	11,505	9,755	5,500	2,160	2,760
Mar	27,055	12,945	11,235	6,660	2,515	2,755
Apr						
% Chg.						
Jan	-30.1%	-6.7%	14.6%	-10.5%	23.1%	-14.4%
Feb	-23.8%	-9.3%	-4.1%	-11.4%	29.3%	-2.1%
Mar	-1.7%	-1.7%	-13.7%	-5.6%	39.0%	-22.8%
Apr						
Jan-Mar YTD	-18.2%	-5.9%	-2.8%	-8.9%	30.5%	-13.9%

Source: USDA FAS; All values rounded; 2020 April data not available

Tomato export prices are generally up since 2019. However, the increase in price does not offset the decrease in quantity, and as a result total export value is down. Table 7 summarizes 2019, 2020, and YOY change in export value by product. Paste and sauce are down 17 percent and 4 percent. All other products, including whole, pieces, organic, and ketchup, have increased by 4.3 percent. Total January – March export value is down by 5.9 percent, or \$62 million dollars. An industry summary prepared by Bruno and Evans (2020) provides additional discussion of ongoing and expected impacts.

Table 7. Processed Tomato Product Export Value, 2019 and 2020 (\$ in millions)

	Paste	Sauce	All Other
2019			
Jan	\$20.0	\$14.3	\$16.7
Feb	\$19.7	\$13.0	\$19.2
Mar	\$22.5	\$13.7	\$23.7
Apr	\$20.8	\$12.6	\$19.5
2020			
Jan	\$15.1	\$14.4	\$19.5
Feb	\$15.4	\$12.2	\$19.8
Mar	\$21.2	\$12.8	\$22.8
Apr			
% Chg.			
Jan	-24.7%	0.7%	16.6%
Feb	-22.0%	-6.2%	3.5%
Mar	-5.5%	-6.8%	-3.7%
Apr			
YTD	-16.9%	-4.0%	4.3%

Source: USDA FAS; All values rounded; 2020 April data not available

As noted earlier, changes in the export market are driven by other factors in addition to the COVID-19 pandemic. Expected impacts this year depend on the rate of recovery in the global economy, additional flareups of the virus, and shutdowns in the US and around the world. Since tomato products are generally storable and consumers are purchasing more shelf-stable items, it is likely that impacts will be less significant than for fresh produce.

To illustrate the range of potential COVID-19 impacts, YTD losses of \$62 million are included and two scenarios are developed: one where the recovery starts in June 2020 and gradually increases through the end of the year, and another where consumer demand rebounds rapidly and the export market increases resulting in no additional losses. Both scenarios assume that the impact to the domestic food service market is fully offset by the increase in the retail market. Under these scenarios, estimated losses are between \$62 and \$166 million through the end of the year. Total losses to both processors and growers are estimated to be between \$88.3 and \$211.1 million through the end of the year.

Other direct production costs to processors and growers are similar to other industries and not quantified in this analysis. Social distancing, training, and additional sanitation add to processing/production costs. Growers have staggered planting crews to minimize contact and increased training to prevent potential transmission of the virus on the job or at home. Masks and other PPE are being issued at an additional cost. Other grower costs not quantified include education, planter partitions, training, and modifications to crew spacing and schedules. Looking forward, if the global food service sector remains weak, this would result in greater inventory of processed product, fewer tomatoes contracted next season, and lower demand for seed, transplants and other inputs for next year and into the future.

4.5 Berries

The California berry industry produces around \$2.8 billion per year in value. Strawberries account for around \$2.4 billion in value, with blueberries, raspberries, and other miscellaneous berries accounting for around \$0.4 billion annually. It is an economically important industry to the state, employing about 55,000 individuals during peak harvest and providing jobs for rural communities across the state.

The immediate impact of the COVID-19 pandemic on the berry industry was caused by the shutdown in food service purchases. Most of the berry market is for domestic frozen or fresh consumption, with about 12-16 percent (by value) exported annually (CDFA 2020). Grower-shippers scrambled to adjust operations to meet retail demand. Industry feedback indicates that some businesses were able to make this adjustment, but it did not fully offset the loss of the food service market. Crop losses were reported across the state. Industry impacts were most significant in March and April, when some contracts were cancelled, and crops were destroyed. Producers in Southern California reported several instances of shippers canceling orders.

Industry experts interviewed for this study indicated that they have been able to recover from the initial dip by confirming contracts with buyers over the remainder of the season. However, they also noted that a second wave of the virus could affect harvesting later this season. Berries have a short harvest window, so delay or disruption to crews could cause significant crop losses.

The impact of COVID-19 on the industry is illustrated by comparing USDA movement and shipping point data for January – April 2020 to the same period in 2019. Similar to other fresh produce, total movement was up slightly in January and then dropped starting in late February continuing through May. Prices were up in May, which according to experts interviewed, is in response to a rebound in retail demand and stabilization of the supply chain.

Table 8 summarizes monthly movement of strawberries originating in California, price, and gross value (USDA AMS 2020). Prices are for a specific package of strawberries and do not include organic product. The total gross value declined by 2 percent, or about \$17.5 million, YOY.

A second estimate was developed based on the percent price reductions in March and April. This was developed because industry interviews were inconsistent with USDA price movement data, with the industry reporting a dip in prices during the late March to early April timeframe. Industry estimated impacts were closer to \$100 million. The drop in price during the COVID-19 shelter-in-place order period was 25 percent in March and 9 percent in April when, according to industry experts, the most significant impacts occurred. Applying a price reduction of 10 percent, which is at the lower end of the range and is consistent with industry feedback, direct impacts to the industry are estimated at \$75 million⁶. Therefore, the estimated range of YTD direct impacts to the strawberry industry is between \$20 and \$75 million.

⁶ Calculated as 10% multiplied by the 2019 March-May gross value.

Table 8. Strawberry Movement and Value, 2019 and 2020

	Quantity (10,000 lb units)	Price (\$ per 8 1lb pack)	Gross Value (\$ in millions)
2019			
Jan	1,599	\$23.47	\$46.9
Feb	1,059	\$19.75	\$26.1
Mar	5,162	\$15.23	\$98.3
Apr	22,730	\$11.43	\$324.8
May	27,389	\$9.43	\$322.8
2020			
Jan	2,495	\$11.08	\$34.6
Feb	3,129	\$11.29	\$44.2
Mar	7,201	\$11.50	\$103.5
Apr	20,978	\$10.35	\$271.3
May	28,004	\$9.92	\$347.1
% Chg.			
Jan	56%	-53%	-26%
Feb	195%	-43%	69%
Mar	40%	-25%	5%
Apr	-8%	-9%	-16%
May	2%	5%	8%
Total	7%	-32%	-2%

Source: USDA; missing February price data interpolated using January and March

The total direct impact to the berry industry (including berries other than strawberries) depends on how quickly the food service sector opens after current shelter-in-place orders are lifted, if another wave of the virus occurs, and how consumer retail demand for fresh and frozen berries develops over the remainder of the year. Two scenarios were developed to approximate the total annual losses, one where the economy begins to recover in June and gradually increases through the end of the year so that YOY change in strawberry industry value is zero by December 2020, and one in which average monthly losses, between January and May, continue through the end of the year. In both scenarios, estimated strawberry industry losses are applied proportionally to the other berry industries. The higher impact scenario that is consistent with industry feedback was applied (\$75 million instead of \$20 million impact). Using this approach, the direct economic impact to the berry industry are estimated between \$144 and \$280 million.

The industry reports that other costs of complying with social distancing and operational changes have been burdensome, but manageable. The Strawberry Commission handles training for foremen for its members and was able to adapt and implement CDC guidelines into its training materials. This includes implementing sanitation measures and distancing for harvest, breaks, and interaction between workers during harvest. These training costs are covered by existing member fees. However, it was noted that the impact of an additional outbreak of COVID-19 is a serious concern for the industry. The industry is

working to mitigate the transmission of the virus from the home environment into the workplace and to educate workers about how to prevent the spread of disease.

4.6 Dairy

The dairy industry has been hit hard by the COVID-19 pandemic. Food service demand from institutions and restaurants dropped rapidly and is projected to remain low into the future. The export market has also been disrupted as importers reduced demand and freight industries adjust to travel restrictions. Domestic retail demand (e.g., grocery stores) initially spiked as more consumers shifted to purchasing milk and other dairy products at the store but has since settled back toward long-run averages. California fluid milk purchases are a small share of California dairy industry sales. Sumner (2020) provides a broad overview of industry impacts and changes.

California dairies produce around \$9.3 billion in output value per year (CDFA 2020). Most of this value is attributable to dairy products, with the remainder coming from livestock sales. Dairies generate more than 15,000 full time equivalent (FTE) jobs, many of which provide incomes for residents in economically disadvantaged communities in the San Joaquin Valley. California dairies produce fluid milk products, soft dairy products like yogurt, hard products like cheese, butter, and dried products including whey and milk powder. Dairy processing industries (defined to include fluid milk manufacturing, butter, cheese, cream, and dry product sectors) generate around \$15 billion in gross sales annually and support over 18,000 FTE jobs (CDFA 2020).

Favorable market conditions boosted sales through early 2020. Industry representatives interviewed for this study noted that 2020 was shaping up to be a good year. The Phase 1 trade deal with China was about to be signed which would reduce some non-tariff export market barriers and allow exporters to apply for retaliatory tariff exemptions. Some businesses specializing in the export market were focused on increasing customers and sales in China, but that market rapidly deteriorated with the spread of the virus in Wuhan and subsequently the world. In addition to the pandemic, the dairy industry has faced other pressures including water supply (sustainable groundwater management and water delivery cutbacks), tariffs, and labor supply.

The impact of the COVID-19 pandemic is estimated by comparing preliminary 2020 dairy industry data for April – September (using current data through April, and futures market prices through September) to 2019 conditions. While this approach excludes the effects of seasonal changes, the story it tells much more closely matches industry reports about the timing and magnitude of impacts. Data used to estimate YOY differences primarily come from publicly available state and federal outlets and is supported by data gathered through outreach to California producer organizations.

Milk producers are dealing with over-supply as both demand from food service businesses and exports have fallen. As a result, prices have fallen dramatically. Some producers have reported throttling back production by adjusting feed rations, though agencies have yet to report any major changes in quantities of milk coming off the farm.

Table 9 summarizes changes in California dairy production and value. Gross value dropped by around 20 percent in April and could fall up to 40 percent based on futures market prices. This drop in prices would trigger price loss coverage payments for dairy farmers at all federally offered coverage levels. Initial payments should be substantial due to high prices at the end of 2019. This means that dairies might not experience their lowest prices until mid-fall. With price loss coverage, estimated total direct YOY loss under the COVID-19 pandemic at the producer level would be \$1.1 billion through the end of 2020. A sensitivity range is developed and described below to bracket the potential future losses.

Table 9. Monthly Utilization, Production, Price, and Total Output of California Dairies

	January - March	April	May	June - September
<i>Utilization by Milk Class (AMS)</i>				
I	21%	24%	24%	21%
II	6%	5%	5%	6%
III	7%	1%	1%	7%
IV	65%	70%	70%	65%
<i>Statewide Production (NASS)</i>				
Total (Million Lbs)	3,538	3,538	3,538	3,538
<i>Price by Class per CWT (AMS/Futures Markets)</i>				
I	\$18.01	\$16.64	\$12.95	\$18.24
II	\$10.20	\$9.55	\$7.73	\$10.89
III	\$16.77	\$13.07	\$10.17	\$15.00
IV	\$15.91	\$11.40	\$8.87	\$11.91
Weighted Price	\$16.05	\$12.57	\$9.80	\$13.43
Total Value (Millions)	\$507	\$397	\$309	\$424

Sources: USDA AMS and NASS; Futures Market. See citations within table.

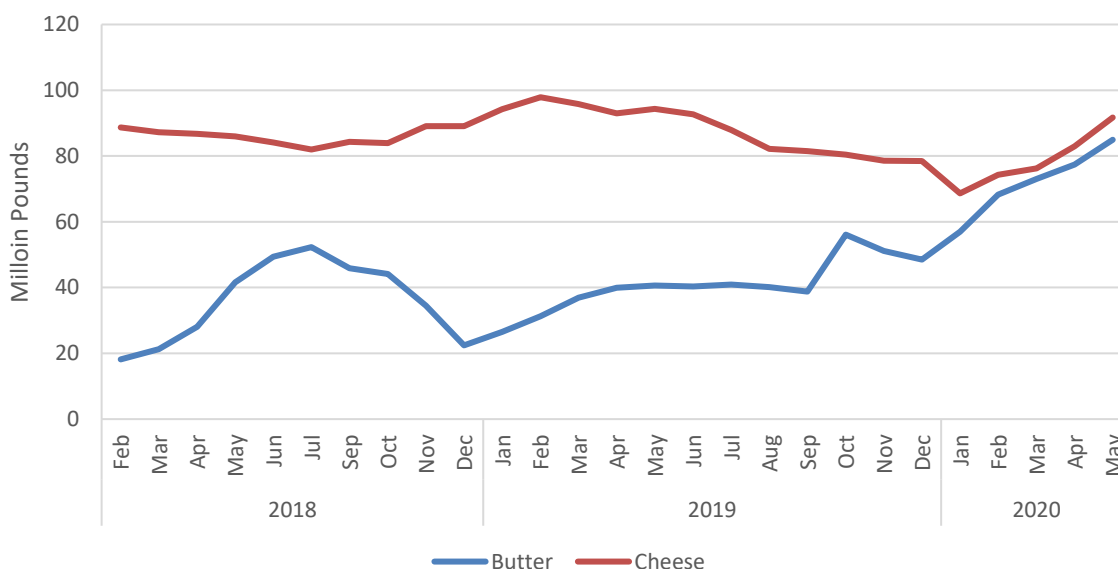
Changes in processing sector output values are more complicated. Consumer demand is up for some products, particularly retail products, as evidenced by limited milk and butter on store shelves at the beginning of the pandemic. Processors have struggled to meet the demand for these products, driving prices up. On the other hand, demand for processed wholesale dairy goods is down and many of these products are being diverted to cold storage stocks. Table 10 summarizes wholesale product movement reported in the National Dairy Product Sales Report. Movement of butter and cheese was up during the beginning of the year as cold storage facilities scooped up inexpensive products. National cold storage holdings are now at their 36-month peak and movement of these products is expected to fall sharply. Figure 5 illustrates national cold storage stocks.

Table 10. Changes in Wholesale Markets for Processed Dairy Goods

		Butter	40 LB Cheddar	500 LB Cheddar	Dry Whey	Nonfat Dry Milk
Prior 12 Month Average	Average Monthly Price	\$2.22	\$1.82	\$1.75	\$0.37	\$1.07
	Movement (million LBS)	16.70	52.78	49.47	27.13	92.33
February	Average Monthly Price	\$1.82	\$1.95	\$1.95	\$0.37	\$1.25
	Movement (million LBS)	35.64	60.60	60.60	28.13	98.62
March	Average Monthly Price	\$1.75	\$1.81	\$1.81	\$0.38	\$1.12
	Movement (million LBS)	16.81	47.15	47.15	22.92	82.25
April	Average Monthly Price	\$1.31	\$1.52	\$1.52	\$0.37	\$0.97
	Movement (million LBS)	18.66	43.72	43.72	19.12	84.48
Current Price / 12 Month Average		-41%	-17%	-13%	1%	-9%
Current Movement / 12 Month Average		12%	-17%	-12%	-30%	-8%

Source: National Dairy Products Sales Report

Figure 5. National Cold Storage Stocks



Source: USDA Dairy Market News

Weighted by the shares of processing by product type shown in Table 10, as of April the processing industry was down 13 percent from its typical output. With output expected to fall and prices expected to remain low for the next several months (with prices recovering based on futures market data), total revenue losses in the dairy processing industry through the end of the year are estimated to equal \$547 million.

Food service, institutional, and export market demand for dairy has dropped, but retail demand is up. It is difficult to quickly shift production into alternative products. Consumer demand for retail products has increased as consumption at home has gone up. This is reflected in higher dairy product prices at stores. Table 11 summarizes May 2019 and 2020 retail dairy prices, and YOY percent change. Prices are generally up between 14 percent and 45 percent, depending on the product and market.

Table 11. Retail Price Changes for Dairy Goods

	May 2020	May 2019	Increase
Cheese (8 oz block)	\$3.22	\$2.22	45%
Cheese (8 oz shredded)	\$2.85	\$2.18	31%
Milk	\$2.99	\$2.49	20%
Milk (organic)	\$4.99	\$2.97	68%
Yogurt	\$1.00	\$0.88	14%

Source: USDA National Retail Report

Federal assistance for farmers and businesses is one offsetting factor. However, the amount of assistance is capped which is a disadvantage for large dairies. The average dairy herd size in California is around 1,300, compared to Midwest regions where dairy herd size averages closer to 200. In addition, state requirements for employers to provide additional sick pay for workers exposed to COVID-19 has increased labor costs. With scarce workforce supply, this is an ongoing industry concern.

The effects of the COVID-19 pandemic on the dairy industry are substantial and have likely not yet peaked. If prices remain below operating costs for a large part of the year, this could result in smaller herds and fewer dairies next spring. Price supports should provide some temporary relief, but producers will need a strong recovery to prevent shutdowns of financially vulnerable businesses. If markets for beef were strong the scale of this output loss would typically lead to high levels of culling, but only limited evidence of this behavior among producers has been reported.

Given these uncertainties, a range of impacts were developed over a projected recovery pattern based on dairy futures prices. Current YTD prices and quantities are used through May 2020. Futures prices are used through the end of the year, and output is varied based on the change in YOY production in a high and low scenario designed to represent the range of potential impacts. Applying this approach, the direct impact to producers and processors is estimated between \$1.37 and \$2.32 billion this year.

4.7 Rice

The annual gross value of California rice production is around \$776 million (CDFA 2020). The USDA rice outlook indicates that acreage is set to rise to a total of 500,000 acres in the 2020/2021 season.

Impacts of the COVID-19 pandemic on rice growers have largely come from increased production costs. Markets have remained relatively steady. Cash prices are up 4 percent since January and exports were also up 4 percent YOY through March. Rice produced in California is heavily dependent on export markets with 40 - 60 percent of the crop typically exported to markets in Japan and around the world. Industry experts estimated that rice sales are evenly split between domestic and export markets in 2020. Table 12 provides an overview of cash prices and export value.

Table 12. Year Over Year California Rice Price and Export Value Trends, by Month

		Jan	Feb	Mar	Apr	May
Brewers (\$/cwt)	2019	\$16.25	\$16.50	\$16.50	\$16.50	\$16.50
	2020	\$16.00	\$16.00	\$16.00	\$16.00	\$16.00
Medium (\$/cwt)	2019	\$38.00	\$38.00	\$38.00	\$38.00	\$37.63
	2020	\$37.00	\$37.33	\$37.60	\$40.13	\$40.00
Second Heads (\$/cwt)	2019	\$18.25	\$18.50	\$18.50	\$18.50	\$18.50
	2020	\$18.50	\$18.50	\$18.50	\$18.50	\$18.50
Export Value (\$ millions)	2019	\$62.94	\$50.22	\$72.99	-	-
	2020	\$68.68	\$64.50	\$60.65	-	-

Source: USDA GATS

Although producers report minimal direct impacts so far, they still face economic uncertainty coming off of a dry winter/spring. Following a warm May, agricultural water users can expect reduced deliveries this year. This could affect planting and water supply later in the season.

Rice milling, packaging, and shipping costs have increased due to the pandemic. Social distancing, PPE, training, and additional sanitation increase operating costs. So far, the industry has been able to absorb these additional costs. The industry has shifted away from food service packaging where demand has fallen by 80 percent, to retail packaging where demand is strong. To date, industry sources report that the increase in price has approximately offset the increased costs associated with the pandemic.

Given the shortage in the world rice market and increases in retail demand that have resulted in a projected increase in rice production, coupled with a price increase, at this time it is likely that COVID-19 pandemic impacts to the California rice industry will be modest.

4.8 Beef (Cow-Calf and Feedlots) and Poultry

California is the fifth largest beef producing state in the country. Beef production in California starts with cow/calf producers. Calves are usually raised with their mother to a weight of 500 to 600 pounds and then sold as stockers to a backgrounder who will continue to grow them on grass and grain until they reach about 900 pounds. In the next stage they are sold as feeders to the feedlot where they are fed intensively until they reach slaughter weight.

The primary impact of the COVID-19 pandemic on the beef industry is due to a reduction in beef processing capacity, coupled with the evaporation of food service demand. This has led to a simultaneous reduction in the quantity demanded at different stages coupled with a fall in prices at all intermediate stages except at final retail demand. This double impact on profitability is propagated backwards through the stages of beef production in California, ultimately resulting in a substantial decrease in the price paid to cow/calf producers of 15-25 percent. Cow/calf producers, unlike backgrounders and feedlots, are constrained by high fixed costs and the rigid pasture-based cycle of breeding and finishing the calves. Given these rigidities and the traditionally slim profit margins in cow/calf production, these price reductions impose substantial losses on the sector. One estimate from

Oklahoma State University calculates that producers are currently losing \$112 dollars per mature breeding animal (OSU 2020).

Backgrounding producers are caught between prices they pay for stocker calves and prices they receive for feeders. Table 13 shows that the price for feeders has dropped by about 18 percent between January and May. This feeder price drop is somewhat less than the price drop in stockers, but the backgrounding sector still suffers from the loss of the quantity demanded by feedlots which face slightly lower slaughter prices and significant reductions in the final quantity demanded by meat processors. These costs vary based on changes to feed prices. Feedlot operators, like backgrounders, incur fixed costs of facilities, and in many cases have a substantial investment in partially finished animals for which demand has been significantly reduced. These animals will have to be maintained at a cost and sold at a higher and less profitable weight to balance this reduction in demand. Given this reduction of throughput at the feedlots, feeders are facing both a reduced demand and lower slaughter prices, which have fallen by 23 percent between January and May.

Table 13. Changes in Live Cattle Prices

	January	February	March	April	May
Feeder \$/CWT	\$147	\$140	\$119	\$116	\$121
Slaughter \$/CWT	\$60	\$66	\$70	\$55	\$58
Head (Turlock Auction)	9,200	7,500	7,900	4,200	2,900

Source: AMS Livestock, Poultry, & Grain Market News. Turlock Auction Yard.

Beef price declines of 10 – 15 percent are consistent with USDA estimates of total output losses of 11 percent in the month of April. Early reports suggest that the total number of cattle being sold at the beginning of the year was well above 2019. It is unclear how much of this was a result of high January and February prices and how much came from panic selling at the onset of the pandemic. Regardless, since March the industry has suffered a significant drop in sale quantities.

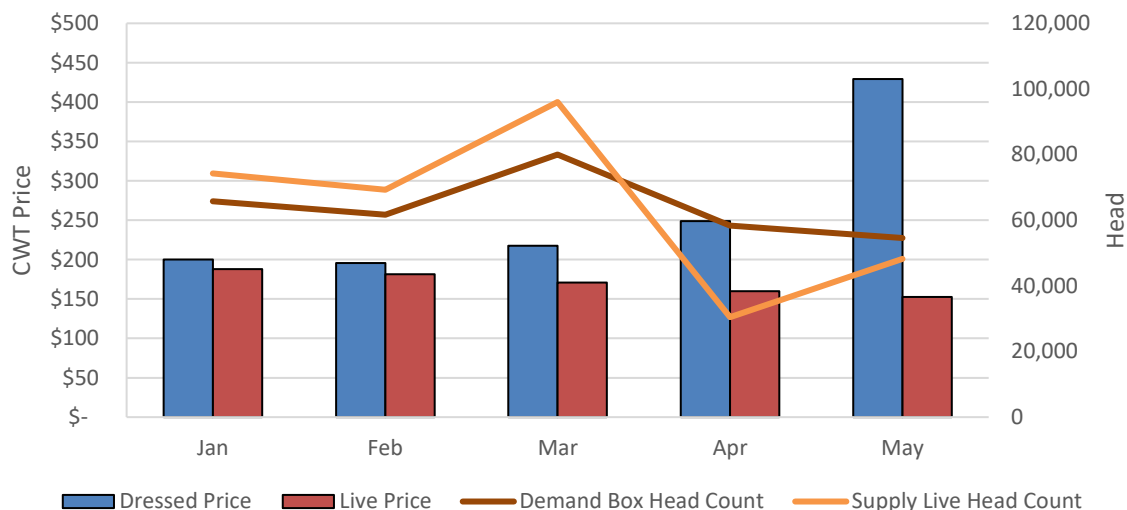
The direct impact of the COVID-19 pandemic is estimated using current YTD industry data and a projected recovery path over the rest of the year. Under an optimistic scenario of gradual improvement to full recovery by the end of the year, the total annual impact to ranchers and feedlots is estimated to be 17 percent of annual output, or approximately \$760 million.

As more processing facilities experience local outbreaks, the meat processing industry is turning into a chokepoint within meat supply chains. Inability to process at adequate quantities depresses price for producers and creates shortages that drive prices up for consumers. The ability of processors to adapt and return to full production will have a significant influence on total losses in the livestock industry over the coming months. The meat processing estimates presented below are preliminary based on data available through April and May of 2020.

National slaughter and processing data were compiled and used to assess impacts in the beef processing industry. This analysis applies market information from slaughterhouses and meat packers. Weekly slaughter reports from the USDA AMS show above-average slaughter volumes during March followed by a steep drop starting in April. As demand for carcasses from meatpackers dried up, slaughterhouses

began to reduce their purchase prices for live cattle and increase prices for dressed carcasses. Figure 6 illustrates these trends. The difference between the dressed and live price lines suggest slaughterhouses were able to increase their margins to recoup quantity losses.

Figure 6. Monthly Beef Slaughterhouse Trends



Source: AMS Livestock, Poultry, & Grain Market News

Similar trends exist for meat packers. For most commodities, prices and quantities slipped in April. Early price reports indicate similarly low volumes; however, prices have increased rapidly in May, indicating that stocks are being depleted. Higher prices will enable processors to recoup some of their losses in volume, though it appears that revenue will still be far behind where it would have been in the absence of the pandemic. Table 14 summarizes price and quantity movements of selected wholesale beef commodities.

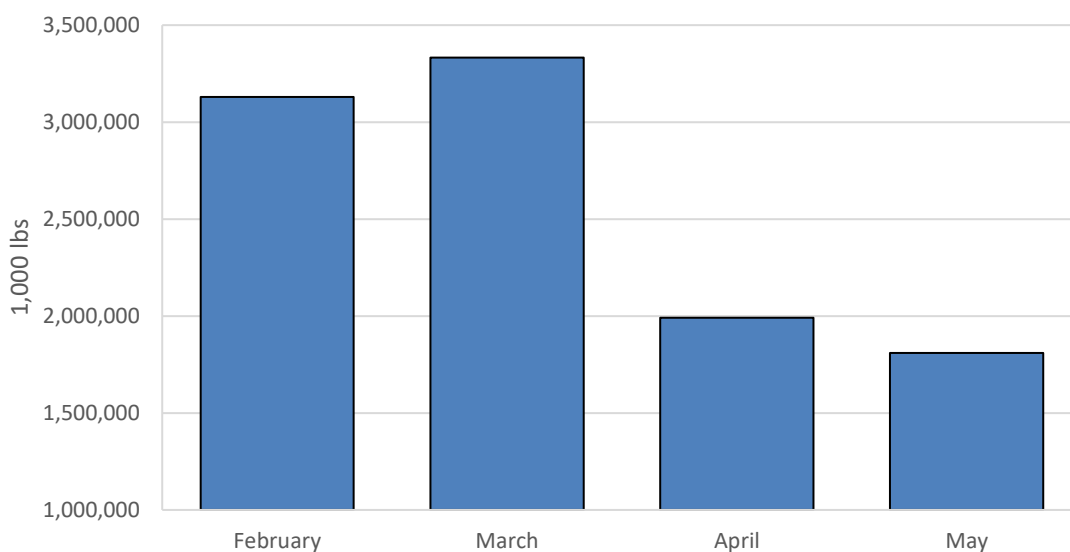
Table 14. Trends in Wholesale Prices and Quantities for Processed Beef Products

		Brisket	Tri Tip	Ribeye	Round	Ground Beef (81%)
February	lbs/wk	1,570,000	184,000	407,000	10,000	958,000
	\$/lb	\$2.48	\$2.96	\$7.13	\$2.30	\$1.80
March	lbs/week	1,308,000	338,000	552,000	8,000	1,127,000
	\$/lb	\$2.44	\$3.26	\$7.75	\$2.50	\$2.34
April	lbs/week	712,000	166,000	357,000	9,000	747,000
	\$/lb	\$2.21	\$3.51	\$6.73	\$2.97	\$2.89
May	lbs/week	810,000	201,000	139,000	4,000	656,000
	\$/lb	\$4.85	\$5.40	\$10.48	\$4.20	\$4.21

Source: AMS Livestock, Poultry, & Grain Market News

Figure 7 illustrates total processed beef quantity. It shows that quantity was reduced by half between February and May. As expected, the wholesale price increased substantially for all categories, partially offsetting the increase in processing cost and loss of throughput due to the pandemic.

Figure 7. Total Quantity of Processed Beef Products (1,000 lbs/week)



Source: AMS Livestock, Poultry, & Grain Market News

In the egg and poultry meat sector, the COVID-19 pandemic has created some short-term positive price impacts on egg markets, however the overall effect has been negative. Broiler/fryer prices dropped 35 percent between March and April. Early May prices indicate a reversal to the trend, and futures markets project broiler prices returning to early 2020 levels within 12 months. Table 15 summarizes recent changes in western region broiler prices and movement. By the end of 2020, the estimated impact on broiler/fryer production is a revenue loss of approximately \$141 million.

Table 15. Changes in Broiler Market Conditions

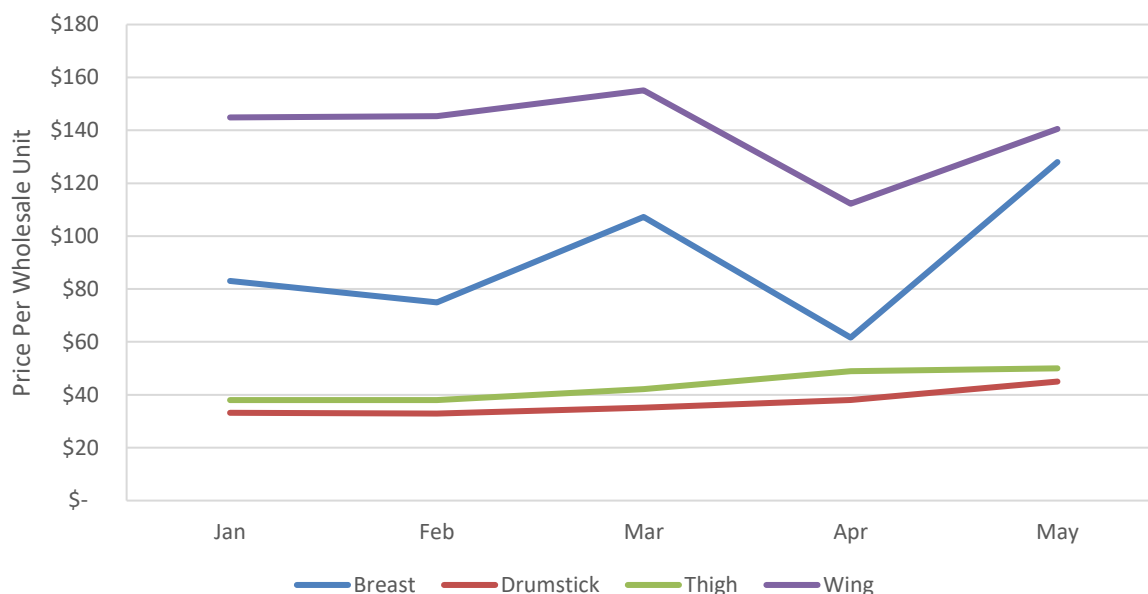
	January	February	March	April	May
Whole Bird Price (Average)	\$93.14	\$82.52	\$86.56	\$55.52	\$69.70
LA Average Weekly Movement (1,000 lbs)	1,606	1,386	1,757	1,398	1,166

Source: AMS Boiler Market News Report.

Producer egg prices jumped in March as retail demand for table eggs increased, but much of this increased demand has been offset by decreases in demand for eggs sold for export, food service, or other food processing. The increase in price was tied to the cost of shifting from food service processing/packaging to the retail market. Estimated YTD increased retail demand for shell eggs has increased poultry output by \$23 million, while changes in the meat markets have reduced output by \$22 million, resulting in a net increase of \$1 million in output. Early price reports for May indicate that shell eggs are selling closer to 2019 averages and processing prices are returning to normal, but this may mask losses due to higher costs incurred during the ongoing pandemic. It is also not clear if retail and food service demand will settle back into more normal pattern over the summer months.

The poultry processing industry has also been hit hard by COVID-19. Prices for wholesale poultry products typically sold in retail markets have seen little price movement, however prices for wings and breasts took a significant decline following the implementation of COVID-19 shelter in place restrictions. Figure 8 illustrates wholesale prices for commonly purchased poultry products.

Figure 8. Wholesale Price of Selected Chicken Parts



Source: AMS Livestock, Poultry, & Grain Market News

The impact of the COVID-19 pandemic on the meat industry has been substantial and is likely to increase further. Estimated direct annual revenue losses are around \$800 million this year, even assuming a gradual recovery starts in the summer of 2020. If another wave of virus hits, or the country falls into a deep recession, these losses would increase. Saitone (2020) provides a nice overview of the constraints and outlook for the beef industry under the pandemic.

4.9 Cotton

California cotton is comprised mostly of American Pima and Upland cotton varieties. Pima dominates California acreage with roughly 75-80 percent. California is also the main producer in the United States of American Pima cotton with 89 percent of total acreage in 2019 followed by Texas, Arizona, and New Mexico. Pima cotton generally receives higher price than Upland depending on color-leaf-staple combinations, and yields around 3.5 480-pound bales per acre depending on the crop year.

As of the 2017 Census of Agriculture, California had 501 cotton farms, farming 301,665 acres and producing over 861,000 bales. Farm receipts of California cotton in 2017 totaled around \$509 million. In 2018, this value was estimated to be \$589 million and 914,000 bales. In 2019 60,000 fewer acres were planted, and value was down. Cotton employment averaged about 2,100 jobs on cotton farms over the last few years and about 250 jobs at cotton gins. Cotton employment is seasonal following harvest, with spikes in on-farm employment from June through November and December for cotton ginning.

Cotton has been substantially impacted by the COVID-19 pandemic. In general, demand for cotton has decreased as mills around the world closed and consumers scaled back retail purchases of clothing and other cotton products. This is especially the case for mills located in China that import American Pima. In addition to mills being shut down, domestic retail for cotton products has dropped dramatically since shelter-at-home orders were enacted. As a result of these changes, a portion of the 2019 inventory is unsold. As shown in Table 16, expectations for planting in 2020 were already down as of March, and the COVID-19 pandemic has lowered expectations even further.

Table 16. California Cotton Acreage

	Pima	Upland
2019	204,000	54,000
2020 March Projection	195,000	45,000
2020 April Projection	145,300	58,200

Source: USDA; Industry planting projections

In part due to rain during the Pima planting season in mid-April, and increased inventories of the unsold 2019 crop, projected Pima acreage is down. Original estimates of 195,000 acres of Pima are projected to be even lower. In addition, only 85 percent of Upland acres were planted as of May 17, 2020 compared to 95 percent at the same time last year. Bales ginned are down as well as seen in Table 17. From December 2019 to March 2020, prices are down on average by 12.5 percent from last year, with Upland spot market prices dropping below 50 cents/pound, levels not seen since 2008/2009. During the week of May 22, no forward contracting or domestic milling for California cotton took place, though exports may increase as China begins to open.

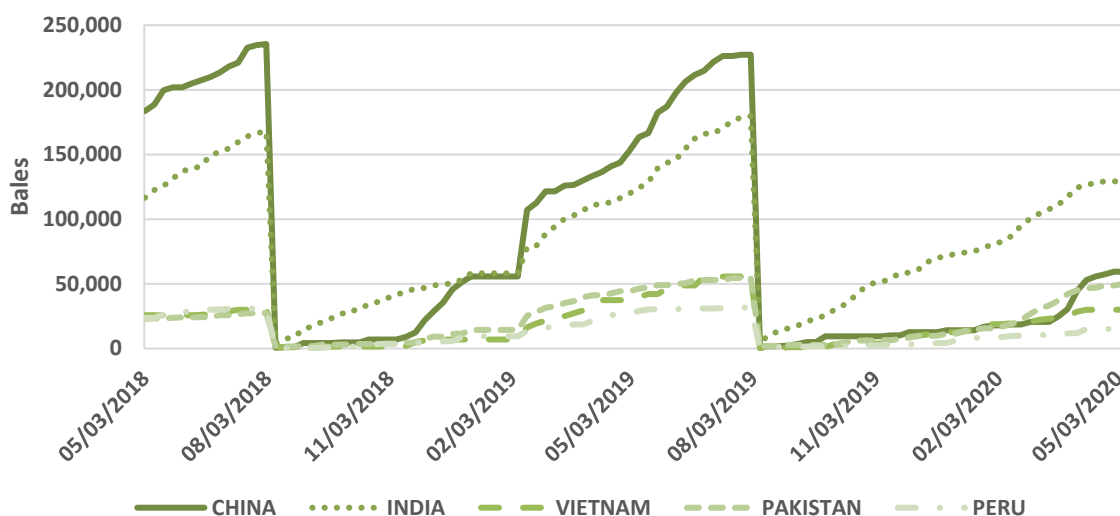
Table 17. Monthly Bales Ginned

	2018 Crop	2019 Crop	% Change
Upland			
<i>Nov</i>	50,950	51,700	1%
<i>Dec/Jan</i>	85,650	90,950	6%
<i>Feb</i>	15,950	2,300	-86%
Pima			
<i>Nov</i>	202,350	191,300	-5%
<i>Dec/Jan</i>	308,500	285,300	-8%
<i>Feb</i>	81,200	68,300	-16%

Source: USDA

YOY changes are used to estimate the impact of the COVID-19 pandemic. The American Pima export market experienced a larger relative decrease in demand than other markets for cotton. Since California is the major US Pima producer, it has experienced the brunt of the losses. The largest importer of American Pima is China. Exports typically begin to increase in mid-November after harvest and continue through summer. The 2019 crop did not follow this pattern, with Chinese exports not really increasing until April. The top 5 export countries accounted for 85 percent of total Pima and 61 percent of total Upland exports at this time last year. Through early May 2020, they make up 70 percent and 67 percent respectively. Figure 9 illustrates these trends. Total Upland exports are slightly above last year but with depressed prices.

Figure 9. United States American Pima Accumulated Exports, Weekly Through May 2020



Source: USDA

Total direct impacts of COVID-19 are caused by decreased demand in domestic and international markets and a change in quantity produced. In addition to direct impacts on cotton, the COVID-19 pandemic has impacted the cottonseed market as demand for livestock feed has dropped. Current projections have cottonseed prices down about 15 percent. Using the most current data and YOY changes, the California cotton industry has suffered decreased revenues of \$166 million. Table 18 summarizes these changes.

Table 18. Market Year-to-Date March/April California Cotton Value, 2019 and 2020 (\$ in millions)

	Avg. Farm Price (\$/bale)		Bales(tons) Repaid/Liquidated		CA Cotton Total Value	
	2018/19	2019/20	2018/19	2019/20	2018/19	2019/20
Pima (bale)	\$552	\$432	365,717	131,114	\$201.88	\$56.64
Upland (bale)	\$337	\$286	123,609	86,081	\$41.71	\$24.61
Cottonseed (ton)	\$156	\$170	342,000	290,000	\$53.35	\$49.30
				Total Impact	\$296.94	\$130.55 (\$166.39)

Source: USDA; ERA Economics' estimates

Looking forward, it is not clear if impacts will increase or start to stabilize. China is slowly beginning to increase imports as mills begin to open, but weak macroeconomic conditions, trade uncertainty, and the potential for another wave of virus are likely to limit industry growth. Other impacts of the COVID-19 pandemic include labor market changes and increased operating costs to comply with state and local health directives. These additional costs to cotton growers and gins are not included in the direct impacts reported in this study.

4.10 Grapes (Wine, Table, Raisin)

California wine, table, and raisin grapes are different crops in terms of market, cultural practices, costs, and varieties. The impact of the COVID-19 varies, so each is analyzed separately. Raisin grape impacts are not included in this assessment due to limited industry data available at the time of publication.

California table grapes have a seasonal fresh market that generates around \$2.2 billion in gross value annually. Estimating the impacts of COVID-19 on grape producers in California is difficult. Even the earliest harvests in the Coachella Valley do not begin until late May. This time of year, most table grapes being consumed are imports from the Southern Hemisphere.

Industry data appear to show that through early May 2020, port-of-entry prices and quantities of imported grapes were relatively unaffected by the pandemic. Retail prices on the other hand have noticeably declined. Similar to other fresh produce, the collapse of food service demand has pushed additional supply into the retail market.

Table 19 displays short run trends in the table grape markets. These indicators provide some intuition as to what the remainder of the year holds for grape producers. It is likely that the quantity of grapes produced and sold will be relatively unchanged. The small differences in imports and the fact that grapes are a perennial crop supports this prediction. However, pricing and movement for California table grapes depends on consumer retail demand.

Table 19. Selected Grape Industry Market Trends

	January	February	March	April	May	
Imports (Chile to Los Angeles Port of Entry, 10,000 lb units)						<u>Jan – April Total</u>
Volume 2019	5,912	13,985	22,399	23,635	7,415	65,931
Volume 2020	4,776	14,020	29,824	15,974		64,594
Change	-19%	0%	33%	-32%		-2%
Retail Prices (USDA Survey)						<u>Jan-May Change</u>
Black Seedless	\$2.24	\$ 2.18	\$2.00	\$2.08	\$1.88	-16%
Red Globe	\$2.44	\$2.52	\$2.09	\$2.24	\$2.23	-9%
Red Seedless	\$2.49	\$2.79	\$2.46	\$2.62	\$2.08	-16%
White Seedless	\$2.49	\$2.84	\$2.85	\$2.85	\$2.16	-14%

Source: USDA AMS

The impact of the COVID-19 pandemic was estimated by applying the YOY change in price to the average production quantity. These impacts apply to the entire season and therefore represent annual expected impacts. Using this approach, the total expected output loss to California table grape growers in 2020 is around \$140 million.

The impact of the COVID-19 pandemic on California wine grapes is split into expected impacts on producers and wineries. Wine grape growers include integrated wineries and vineyards/growers producing for one or more wineries under contract or for the spot market.

The pandemic shut down wine tasting rooms, cellar-door tastings, and restaurants. This had a devastating effect on demand for wine. It has been particularly bad for smaller wineries and specialty labels that are not sold through retail outlets. As the season progresses and California growers begin to harvest wine grapes, growers are likely to see wineries pass on impacts in the form of lower grape prices, particularly for the spot/bulk market.

Winery impacts are estimated using results of a WineAmerica (2020) study and comparing YOY trends in grape movement and pricing. Grower impacts are estimated using industry data and YOY trends in imports.

California accounts for 80 percent of domestic wine production. Production is segmented across several varieties and quality levels, and these segments have been affected differently by the pandemic. High volume producers serving retail markets are the most likely to have realized a slight bump in sales during the COVID-19 pandemic since consumers have shifted to retail purchases. At the other end of the spectrum, small wineries who rely on cellar-door and direct-to-consumer sales to support their operations have been hit hardest.

A survey of wine industry impacts conducted by WineAmerica found that approximately 20 percent of wineries surveyed stopped production entirely and 67 percent had slowed production. Wineries reported laying off between 20 and 40 percent of their workforce. Visitors to wineries decreased 80 percent between February and March. On average, the survey found that wineries were facing 63 percent reductions in sales. WineAmerica estimated the total loss to survey respondents, which represented 10 percent of all U.S. wineries, to equal \$40.4 million in the month of March.

One positive change for the wine industry has been an increase in retail sales. For example, Nielsen Beverages reported an increase in domestic wine sales of 27 percent between March 5th and April 25th. Nielsen also reported that the largest increase in sales had come from large volume products such as boxed wine, indicating that domestic consumers were buying greater quantities. However, consumers were buying at a lower price point, so overall industry revenues may be reduced. This trend can be seen in wholesale wine price indices. Vinex, a global wine trading platform, has reported a 4 percent decrease in wholesale wine prices.

COVID-19 pandemic impacts were estimated based on changes in direct to consumer sales, wholesale sales, and exports using the results of Wine Institute data (Moramarco 2020). The break-down by sales outlet is as follows:

- Direct to consumer sales include tasting rooms, wine clubs, and other subscription type programs. This sector of the wine economy depends on in-person visits that are unlikely to recover for at least several months. Direct-to-consumer sales make up 40 percent of the wine industry's wine sales revenue.
- Wholesale sales include products that ultimately go to restaurants or retail. We estimate that wholesale sales make up 53 percent of total sales revenue.
- Finally, exports make up the remaining 7 percent of industry sales revenue.

The impact to the wine industry is based on YTD price and quantity changes compared to the recent historical average in each of the three broad sales channels. Expected 2020 impacts assume a linear recovery rate through the end of the calendar year. Changes in direct to consumer sales are based on the estimates from the WineAmerica survey described above. Wholesale market changes are based on retail sales changes estimated by the Nielsen Beverage Company and changes in wholesale wine prices reported by Vinex (Nielsen 2020, Vinex 2020). Exports are estimated using USDA FAS data available through March 2020. Table 20 summarizes these changes by industry sector.

Table 20. Components of Wine Industry Impact Assessment

	Peak Volume Change	Peak Price Change	Share of Volume	Share of Value	Change in Value as a Share of Industry Total
Direct to Consumer	-65%	0%	30%	40%	-15%
Wholesale	12%	-4%	62%	53%	2%
Export*		-3%	5%	7%	<-1%
Total Change in Industry Value					-13%

Source: WineAmerica, Vinex, Nielsen Beverage Company, USDA FAS, and SVB; *Changes in Exports measured in change in total value

The net industry impact is estimated to be about a 13 percent decline in sales. Applying this to gross industry sales value, and netting out the lower cost of raw input purchases, results in a gross impact of \$1.27 billion due to the pandemic and the related economic downturn.

Impacts to wine grape growers are difficult to assess because it is early in the season. Grapes grown under contract should be insulated from any short-run price impacts except in cases of severe financial stress for specific wineries. However, prices in the bulk/spot market are expected to fall.

The cost of wine grapes is approximately 22 percent of variable wine production costs, and the normal retail markup is at least 100 percent (Vega et al 2003). The proportion of the total wine revenue reduction that is likely to be passed on to growers in the form of lower prices and an anticipated 25 percent drop in quantity purchased in each quality category is at least \$200 million. One response is to upgrade the quality of grapes used to produce wine at a given price point by passing on much of the cost to wine grape producers who will be faced with excess capacity in the 2020 vintage. Some of this excess capacity would be smoothed out by increased storage of the higher value vintages.

The impact of the COVID-19 pandemic on California’s wine industry will continue to evolve over the coming months as consumers adjust purchases, the export market adjusts, and the current year California crop is harvested.

4.11 Citrus

California is the largest producer of fresh citrus products including navel oranges, valencia oranges, grapefruit, lemons, tangerines, clementines, and mandarins. An average of 80 percent of oranges and grapefruit, 75 percent of lemons, and 70 percent of tangerines and mandarins are typically sold to the fresh market. The value of California citrus production totaled over \$2.1 billion in 2019, down from \$3.4 billion in 2017. USDA March forecasts projected total output for the 2019/2020 season to be down by 4 percent for most citrus crops compared to last year (USDA 2020).

Citrus is storable on the tree, which allows for picking-to-order to smooth shocks in supply chain logistics or a drop in purchases from key food service partners. This flexibility has helped the industry manage the pandemic so far.

Industry feedback on the effect of COVID-19 pandemic on the citrus industry indicated that impacts were relatively limited, except for lemons which are importantly linked to the restaurant industry. This is consistent with data that show sales of oranges and mandarins increasing at retail outlets. One hypothesis for the increase in retail purchases is that citrus is perceived to be safe (peel is a natural wrapper) and is a good source of Vitamin C.

The export market volume may increase with the removal of the Section 301 tariffs under the Phase 1 trade agreement with China. These developments should provide an export stimulus for the California citrus industry, which has been dealing with a retaliatory tariff rate around 70 percent.

Industry movement data were used to estimate the impact of the COVID-19 pandemic. Since March, citrus movement (in aggregate) appears to be down, though complete information on the movement of citrus products is typically delayed so these data will be refined and revised.

The price producers receive is known as the Packing House Door (PHD) price. Packers then sort products and sell them to terminal markets. For many large operations this step in the supply chain is integrated and limited information about the PHD price exists. Terminal market prices on the other hand are readily available. Table 21 gives an overview of production by citrus fruit type and terminal use.

Table 21. Citrus Production and Terminal Price Summary

Crop		Boxes (millions)		\$ per 7/10 carton	
		Production	Expected	Price	Price
		18/19	Production 19/20	2019	2020
Navel	Fresh	30.6	30	\$28	\$23
	Processed	10.2	10		
Valencia	Fresh	6.5	6.1	\$16	\$21
	Processed	2.5	2.4		
Grapefruit	Fresh	2.6	3.3	\$22	\$21
	Processed	0.6	0.8		
Tangerines	Fresh	19.8	17.6	\$31	\$28
	Processed	6.2	5.5		
Lemons	Fresh	16.7	13.9	\$34	\$32
	Processed	6.1	5.1		

Source: USDA AMS

The prices listed in the table above are cash prices which may differ from previously negotiated contract prices. Producers with contracts will be less affected, however if food service or processing companies are forced to default on these contracts the impact to producers could be much greater. So far there is no evidence of this happening in the citrus industry, therefore changes in cash prices are expected to be reflective of the impacts felt by producers.

Applying the change in production quantity and price shown in table 21, the total impact to citrus producers would range between \$106 and \$221 million. The proportion attributable to lemon producers is approximately \$48 million. As noted above, it is likely that impacts to other citrus will be less than the upper range of \$221 million because the industry is experiencing an uptick in retail demand that is not reflected in industry statistics used for this analysis.

Approximately 25 percent of California citrus harvested is processed for juices and frozen products. The value of the frozen, canned, and dehydrated fruit processing industries in California is approximately \$11.5 billion per year⁷. The value of raw citrus products for processing is roughly \$600 million. In terms of total value of raw product used for fruit and vegetable processing, citrus accounts for roughly 20 percent. Therefore, the gross value of processed citrus products in California is about \$2.3 billion.

Industry interviews conducted for this study found that retail citrus prices are increasing. These claims however are not supported by currently available USDA retail price data. It is likely that the industry feedback is correct since USDA data are preliminary and will be updated. Table 22 provides an overview of national average prices for citrus products.

Table 22. National Average Retail Citrus Product Prices per lb or per 16oz

		Jan	Feb	Mar	Apr	May
Grapefruit	2020	\$1.23	\$1.19	-	-	-
	2019	\$1.31	\$1.32	\$1.37	\$1.34	\$1.37
Lemons	2020	\$1.95	\$1.96	-	-	-
	2019	\$2.36	\$2.27	\$2.28	\$2.22	\$2.17
Orange Juice	2020	\$2.32	\$2.32	\$2.28	\$2.40	-
	2019	\$2.41	\$2.43	\$2.45	\$2.45	\$2.45
Oranges, Navel	2020	\$1.24	\$1.22	\$1.17	-	-
	2019	\$1.34	\$1.30	\$1.35	\$1.28	\$1.33

Source: USDA AMS

Using orange juice as a proxy for the California citrus processing industry, estimated output is down 5 percent compared to last year. This equates to a loss of \$115 million for the processor sector. However, as noted earlier, prices have been slightly up and it is likely the industry will continue to do well later this year.

An additional scenario was developed to develop an upper-bound estimate of impacts based on industry interviews and survey feedback that a substantial share of citrus sales are linked to food service demand, and it is unclear when this sector will recover.

The high impact scenario assumes that food service demand slowly increases and recovers at a linear rate through the end of the year. The impact on citrus demand changes proportionally. Under this scenario, the estimated impact would equal \$220 million this year.

⁷ Using IMPLAN model sector data; coarse IMPLAN sectors include value from other industries in addition to citrus so this estimate should be viewed as an approximation.

4.12 Almonds, Pistachios, and Walnuts

The COVID-19 pandemic caused disruptions in domestic and international freight, export markets, and a global recession that will have unknown impacts on the nut industry in the future. These impacts are further complicated by ongoing tariff and trade uncertainty, increasing inventories, and a large California crop expected this year. For example, Chile walnut production is up this year, but early reports are that it will not be able to move through its entire crop, due in part to the pandemic. This will increase global supply when California's current crop comes on the market starting later this year.

California walnut, pistachio, and almond acreage and production has been steadily increasing for the last decade. As of 2019, there are around 340,000 acres of pistachios, 370,000 acres of walnuts, and 1.2 million acres of almonds. The gross value of California's walnut, pistachio, and almond crops was \$1.3, \$1.9, and \$6.1 billion in 2019 (USDA NASS 2020). The 2020 almond crop is projected to exceed 3 billion pounds (up 15 percent over last year). Strong domestic and export demand for nuts has driven this market growth. The expected downturn in the domestic and international economy due to the COVID-19 pandemic would impact demand and put downward pressure on future prices.

Nuts are produced for retail, food service, and export markets. Data on nut utilization by market segment were not readily available. Industry experts interviewed for this study estimated 60 percent of total purchases in domestic or export markets were for retail. Similar to other industries, the impact of the pandemic has been a sharp downturn in food service industry demand for nuts, interruptions in selected export markets, and an uptick in retail demand that does not offset the drop in food service demand. The impact is partially offset because nuts are storable and shutdowns for the initial wave of COVID-19 occurred in months when packing was mostly complete.

The economic impact of COVID-19 on the nut market is estimated using available export market data. Impacts occur through changes in price received and quantity shipped. These factors are related to each other through the supply and demand for each nut. The nut export market has generally been increasing over the last several years in both quantities shipped, and price received. Factors affecting monthly export value include, among others, the strength of the U.S. dollar against export market currencies, carryover inventories, production by other countries, consumer preferences, and COVID-19. Decomposing the changes in export market price and quantity into these individual components is beyond the scope of this analysis. The range of COVID-19 impacts are shown using 2019 and 2020 annual gross value data to illustrate year-over-year (YOY) changes that are driven in part by COVID-19.

Table 23 summarizes change in YOY gross export value by month and crop across all export partners for shelled and in-shell nuts. The weighted average change in January – March gross export value across all nuts was -5.2 percent. Almond exports are up slightly YOY, by about 7 percent on average, whereas pistachios and walnuts are down around 20 percent and 7 percent. The change relative to a 5-year (2015 – 2019) lagged average was also evaluated and showed similar trends in walnut export value, but an increase in pistachios and slight decrease in almond exports (around -2 percent) in some months.

Table 23. Walnut, Almond, and Pistachio Total Export Value by Month, 2019 and 2020 (\$ in millions)

	Shelled		In Shell		Total		% Chg YOY
	2019	2020	2019	2020	2019	2020	
Walnuts							
Jan	\$80.5	\$86.9	\$65.9	\$33.6	\$146.4	\$120.4	-17.7%
Feb	\$83.2	\$97.8	\$52.2	\$31.4	\$135.4	\$129.2	-4.6%
Mar	\$90.2	\$96.3	\$27.5	\$24.6	\$117.7	\$120.9	2.7%
YTD	\$253.7	\$280.8	\$145.2	\$90.1	\$399.0	\$371.0	-7.0%
Almonds							
Jan	\$340.9	\$329.1	\$93.7	\$123.5	\$434.6	\$452.7	4.2%
Feb	\$352.7	\$395.3	\$95.6	\$97.1	\$448.3	\$492.4	9.8%
Mar	\$366.1	\$375.1	\$62.8	\$84.7	\$429.0	\$459.8	7.2%
YTD	\$1,059.7	\$1,100.9	\$253.8	\$306.3	\$1,313.5	\$1,407.1	7.1%
Pistachios							
Jan	\$23.7	\$13.5	\$233.3	\$234.8	\$257.0	\$248.3	-3.4%
Feb	\$29.5	\$17.2	\$308.5	\$248.4	\$338.0	\$265.5	-21.4%
Mar	\$25.6	\$10.4	\$401.7	\$284.7	\$427.2	\$295.1	-30.9%
YTD	\$79.0	\$41.3	\$940.3	\$769.2	\$1,019.3	\$810.5	-20.5%

Source: USDA; indexed using GDP-IDP; all numbers rounded so entries may not sum to totals in all columns

The total impact of COVID-19 depends on how rapidly export markets and consumer demand recovers. Data show YTD exports are down a total of approximately \$143 million YOY across almond, walnut, and pistachio crops. Additional impacts occurred in April and May and are likely to continue through the rest of the year. If the world enters a prolonged recession this is likely to dampen domestic and export nut demand over the coming months and years. When coupled with increasing supply in California and other countries (e.g., strong walnut crop in Chile), this could depress prices further. Two impact scenarios were developed assuming the recovery occurs through the end of the calendar year (YOY change is zero by December), or more rapidly over the summer months, with the industry back to normal by August. Direct annual impacts would be between \$440 and \$650 million in 2020.

Aggregate industry data can mask important impacts on individual businesses. For example, in February India imposed additional tariffs on shelled walnuts. As U.S. exporters worked to get relief on tariffs, the global shutdown hit, leaving product unable to land at port in India. Since walnuts are not refrigerated this led to additional crop and quality losses on these shipments, with significant losses for those handlers.

There are additional impacts of COVID-19 on growers and handlers. Handlers are limited in their ability to shift from food service packaging to smaller consumer retail packaging. Sanitation guidance is changing daily, and this imposes compliance costs. Handlers will provide additional masks, gloves, and install safety equipment to protect workers. There is an additional threat of worker sick time and labor shortages. Growers are dealing with uncertainty in the availability of crop protection materials later this year. Handlers interviewed for this study reported costs around 15 to 20 cents per lb. Cost impacts include limited transportation as ships go to China but do not return, which limits cost-effective California export freight. It is harder to get ships out of Oakland to move goods.

Based on industry feedback, these additional costs represented a few percent increase over standard costs. Table 24 summarizes 2019 production quantity, price, and additional costs due to COVID-19. It is

important to note that the almond price has dropped in 2020 from around \$2.40/lb to closer to \$1.65/lb. This is due to the pandemic, tariffs, carryover inventories, and an expected large California almond crop this year. Since the impact of COVID-19 would only apply to handlers in late February through May 2019, this additional cost is applied to a range of 10 to 20 percent of the industry crop from 2019. The direct impact of these additional costs is between \$46 and \$78 million dollars, or between \$1 and \$2 per labor hour.

Table 24. Walnut, Almond, and Pistachio Total Export Value by Month, 2019 and 2020 (\$ in millions)

	Avg. Farm Price (\$/lb)	Production (millions lbs)	COVID-19 Cost (\$/lb)	Cost Impact (\$ in millions)	
				Low	High
Walnuts	0.985	1,306	\$0.05	\$6.5	\$13.06
Almonds	1.65	2,508	\$0.10	\$25.1	\$50.16
Pistachios	2.62	740	\$0.10	\$14.8	\$14.80

Source: USDA; ERA Economics and industry feedback

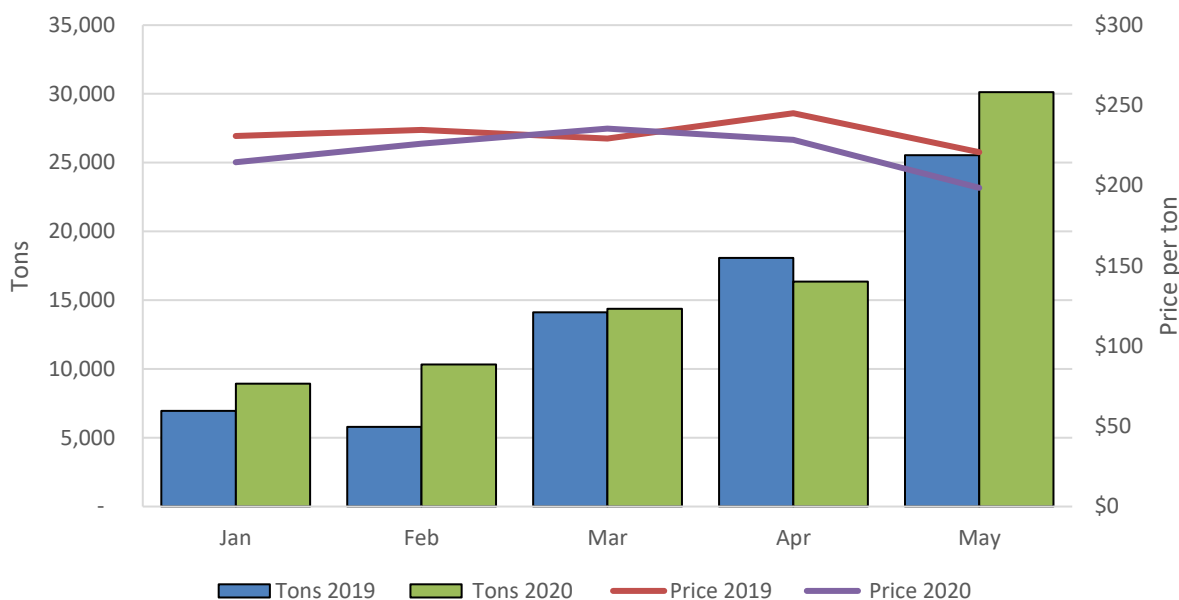
In summary, the impact of the COVID-19 pandemic on California’s nut industry is estimated between \$486 and \$728 million this year. Impacts are complicated by several factors. Global and domestic shipments have mostly increased over last year. Production has steadily increased to match increased demand, which has put downward pressure on prices that are beginning to show. These market forces may ultimately overshadow any effects that the pandemic may have. However, the uncertainty and risk faced by the industry was not quantified and is an important factor looking forward.

4.13 Hay and Feed Crops

Hay, feed, and grain crops have all been impacted by COVID-19, albeit somewhat more indirectly than other crops. Production of these crops in California are influenced by dairy, livestock, and ethanol markets. As these related industries have been impacted, so have purchases of feed. The total impact felt by producers of these inputs will ultimately depend on the responses and recovery of related industries.

The total value of grain and hay farming in California is around \$1.3 billion. Alfalfa accounts for around two-thirds of this value. YOY alfalfa movement is up 14 percent and cash prices are down 5 percent. Figure 10 illustrates trends and YOY changes.

Figure 10. Alfalfa Movement and Prices



Source: AMS Livestock, Poultry, & Grain Market News

Most of this difference in volume came during January and February when dairy market conditions were strong. As mentioned in the dairy subsection, it is likely that the true impact to dairy producers will be lagged and therefore the impacts to feed producers may also be lagged. Applying these aggregate quantity changes in dairy and livestock production, output from grain and hay producers could fall anywhere between 5 percent and 10 percent. This may be an underestimate since the industry price data driving this estimate were from early industry statistics that reflect market conditions in 2019. Prices are likely to fall as the dairy industry adjusts. This preliminary estimate gives a range of potential output loss in 2020 of \$65 - \$130 million.

As fuel purchases decreased during the pandemic, prices for ethanol fell and demand for dried distillers' grain (DDG) increased. DDG is a byproduct of ethanol production that is also used as a nutrient rich feed input for dairy and livestock producers. Given less ethanol demand, grain prices may continue to be depressed and dairy producers may look to supplement feed with other nutrient rich products. Demand for other feeds is also down due to the impacts to the dairy sector. This includes cottonseed and almond hulls.

Table 25 illustrates monthly prices by feed input in 2019 and 2020. Industry feedback indicates that 2019 almond hull prices topped out around \$120/ton FOB origin, starting around \$95/ton through December, and then peaking at \$120/ton before settling back to closer to \$110/ton. The 2020 crop prices are down, closer to \$95/ton, and have since decreased further to around \$75/ton. With June milk prices showing some signs of rebounding, this may spark hull demand and increase prices. Overall, feed prices are down because of the COVID-19 pandemic.

Table 25. Other Feed and Biofuel Price Trends

		Jan	Feb	Mar	Apr	May
Almond Hulls (Ton – FOB Madera)	2019	\$125	\$125	\$120	\$130	\$130
	2020	\$130	\$130	\$125	\$110	\$90
Cottonseed (Ton)	2019	\$274	\$269	\$286	\$286	\$286
	2020	\$273	\$270	\$264	\$281	\$283
DDG (Ton)	2019	\$212	\$206	\$211	\$215	\$196
	2020	\$211	\$208	\$218	\$254	\$208
Ethanol (Gallon)	2019	\$1.17	\$1.20	\$1.28	\$1.23	\$1.26
	2020	\$1.21	\$1.22	\$1.02	\$0.76	\$1.00

Source: AMS Livestock, Poultry, & Grain Market News

Feed manufacturers have reported additional business costs that have disrupted workflow. Lead times and availability of micronutrients added to feed have been impacted, making it more difficult to maintain production. Like other processors, feed manufacturers have incurred higher costs for labor, sanitation, training, and PPE. Manufacturers are seeing stabilization in some input markets, but total losses will ultimately depend on the ability of dairy and livestock industries to recover from the pandemic.

There were also indirect impacts of the COVID-19 pandemic on the California agricultural supply chain. One example of the indirect impact of the shelter-in-place policy has been reduced motor vehicle travel in the U.S. This reduced the demand for gasoline, and since corn ethanol is an additive, this reduced the demand for corn ethanol. This caused about 50 percent of the U.S ethanol plants to close, which reduced the supply of brewer grains, a dairy feed supplement. About 30 percent of the Midwestern corn crop goes into ethanol production. That reduction in corn demand caused corn prices to drop making U.S. corn a viable California animal feed ingredient. It also put pressure on other feed by-products such as almond hulls. These changes will continue to play out in markets over the coming months.

4.14 Cherries and Other Tree Fruit

It is difficult to estimate impact of the COVID-19 pandemic to the tree fruit industry because it is too early in the season for harvest and processing. Most fresh product on store shelves during the start of the pandemic were not grown in California.

The general consumer trend towards non-perishable items has led to a bump in canned fruit purchases but fewer fresh fruit purchases. This will be a benefit to the canned peaches, pears, and other fruit industries in the state. For example, typically about 60 percent of California pears go to processing with about a 50/50 retail and food service split. The recovery will dictate how rapidly the industry bounces back and the magnitude of fresh fruit losses.

Similar to other industries, the impact of the COVID-19 pandemic is the reduction in food service sales and additional costs to comply with social distancing and sanitation. Since the cherry industry was in the middle of harvest when the pandemic hit, and in the middle of a reportedly good crop this year, it is used as a case study to establish potential industry impacts.

The total value of the cherry industry in California is between \$150 and \$300 million annually. The total value of other tree fruit (e.g., apples, apricots, figs, kiwi, nectarines, peaches, pears, plums) is around \$400 million annually. The cherry industry was poised for a good crop this year, except for early May rains that resulted in some crop damage. Around 25 percent of the crop is typically exported, with the highest value trading partners being Canada, Japan, South Korea, and Mexico (USDA GATS 2020). Exports are typically at the front end of the season and the rest is consumed domestically as fresh and processed product.

Feedback from the cherry industry indicated that impacts include a dip in export market prices due to the COVID-19 pandemic, disruptions in shipping and international supply chains, and direct costs to packing sheds as they changed operations in response to the pandemic.

Export data were reviewed to assess YOY change in export market value. Export data were only available through March, which is not sufficient to establish the industry impact. Exports pick up in April through the end of the summer months. Table 26 summarizes recent trends in U.S. total export value by month for fresh (conventional and organic) sweet cherries. California sweet cherry export value is typically between \$50 and \$170 million per year (CDFA 2020).

Table 26. U.S. Total Fresh Sweet Cherry Exports (\$ in millions)

Year	Jan-Mar	April	May	Jun	July	Aug	Sept-Dec
2015	\$0.4	\$6.1	\$110.3	\$173.0	\$130.2	\$1.2	\$0.4
2016	\$0.2	\$9.4	\$98.3	\$186.7	\$152.7	\$4.1	\$0.6
2017	\$0.3	\$4.2	\$125.0	\$158.9	\$244.9	\$67.8	\$1.7
2018	\$0.3	\$0.5	\$64.1	\$188.6	\$219.8	\$22.0	\$2.2
2018	\$0.4	\$0.2	\$52.9	\$148.0	\$231.5	\$41.4	\$1.3
2020	\$0.4	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0

Source: USDA; includes conventional and organic fresh cherries

An industry survey conducted for this study reported that exports have taken a hit due to shipping and air freight issues for key Asian export markets. The industry survey found that prices were down as much as 40 percent, with an \$80 box down closer to \$45-\$50. Assuming that export quantity is unchanged, a 40 percent drop in price during the COVID-19 pandemic implies export value losses of \$20 to \$60 million in this year. The magnitude of losses depends on how quickly the global economy recovers and the ability of the domestic market to absorb additional supply.

Additional impacts include direct costs to packing houses and growers. An industry survey of 9 packing sheds showed the following COVID-19 measures are being implemented:

- Daily temperature checks
- Training
- Additional sanitation, hand sanitizing stations, vinyl barriers
- Continual sanitizing throughout sheds
- Additional break areas and social distancing

- Additional employees for high-touch point sanitizing including railings, bagging stations, lunch areas
- Staggering shifts to avoid large employee groups for breaks and other activities
- Plastic partitions on packing line
- Spacing of employees on the packing line, resulting in productivity losses
- Basic PPE

The additional cost of these activities includes direct material costs (e.g., partitions and additional employees), management opportunity costs (e.g., training time and establishing programs), and slowing down packing lines. Sheds surveyed for this study reported running at an average of 75 percent capacity due to additional sanitation and social distancing. Total employees working in the sheds are down by about 500 per shift across the sheds included in the survey. Industry representatives estimated that these additional direct costs and reduced productivity result in an increase in costs around \$2 per box. This is an additional cost of \$5 - \$6.5 million to the industry, depending on the final harvest.

Based on the results of the industry survey, limited USDA data, and expert feedback, the total direct impact of COVID-19 on California cherries is estimated between \$25 and \$65 million including export market loss and direct costs to growers/packers.

It is not clear if other tree fruit that are not currently being harvested will realize similar economic impacts. As noted earlier, some of the processing crops are likely to realize a bump in demand that would be a benefit. However, if there are significant disruptions in the export market and other impacts due to a second wave of COVID-19, there could be additional losses. Assuming other tree fruit would incur similar cost impacts as the cherry industry and applying the proportional loss in the cherry industry to the broader tree fruit industry value, estimated losses would be between \$49 and \$125 million this year. The exact impact will depend on the nature of the recovery from the pandemic. As noted above, it may result in a net benefit to some crops that are well-positioned for the retail market.

4.15 Floriculture and Nurseries

The gross value of floriculture and bedding crops is around \$1.1 billion annually. California nursery and propagative materials generate annual value around \$1.3 billion annually (USDA 2020). California is the largest cut flower producing state in the United States, accounting for about 80 percent of US production, and generating between \$200 and \$400 million in gross value annually (CDFA 2020). About 95 percent of the cut flowers produced in California come from the Central and South Coast, with most of the production in greenhouse facilities.

Floriculture (including cut flowers, bedding plants, potted plants, and other gardening crops) producers, retailers, and wholesalers have suffered substantial losses during the pandemic because of impacts to transportation and reduced demand.

With retail shops closed and large events like weddings on hold, grocery stores have become one of the few remaining sales channels for flowers. Even grocery store sales of flowers have suffered as shoppers focus on essential food and sanitation products. Flowers that are typically imported are not available,

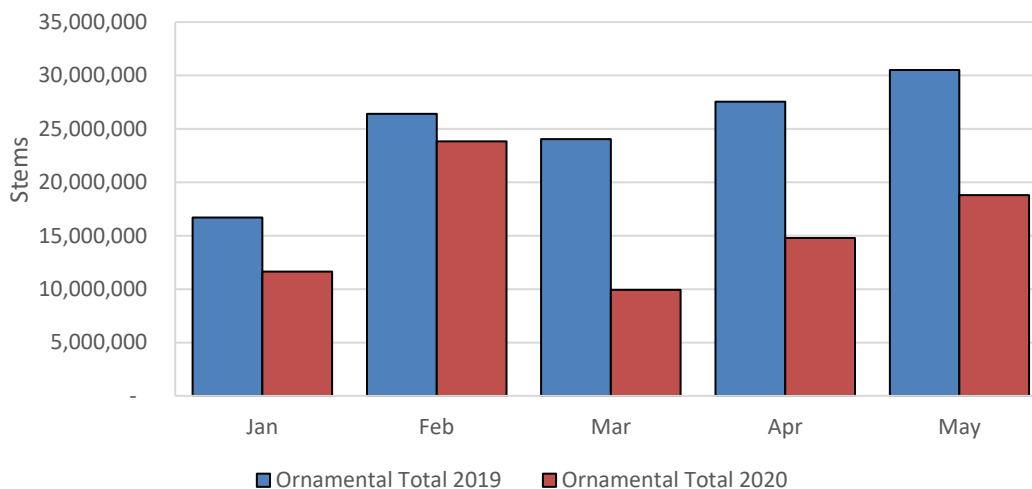
not for lack of supply but because disruptions in shipping have prevented their availability. This places additional burden on wholesalers, some of which have lost 75 percent, or more, of their monthly sales and have been forced to lay off over half their work force.

The COVID-19 pandemic hit in the April through June period over critical flower sales periods including Mother’s Day, graduation, Easter, and spring weddings. Since flowers are not storable and spring weddings have been delayed indefinitely, most of these lost sales will not be made up by increasing purchases later this year. The floriculture industry was also caught between shelter-in-place orders that allowed producers to continue operating as essential agricultural businesses but required retailers to close storefronts. This made it impossible to meet consumer demand during the important spring holidays.

An industry survey was conducted to estimate the range of impacts of the pandemic on the floriculture industry. In mid-April, growers were operating at 30 - 40 percent of typical levels and expectations for Mother’s Day were 70 – 80 percent of a normal year. This represents a devastating impact to flower sales because this period represents the largest sales period for the industry (particularly for flowers). In addition, as long as the ban on large gatherings is in effect, the institutional market (weddings and other large events) for flowers is dormant. Growers are facing a complete loss on many plantings that must be harvested at a prescribed stage of growth. Many producers are small family businesses with limited funds to ride out this sharp and unexpected contraction in demand.

Flower imports and associated wholesale and retail sales have been impacted by the logistical problems due to the pandemic and a drop in consumer purchases. California is a major destination for flowers coming from Asian countries. Imports account for around 64 percent of the total flowers purchased in the US. Figure 11 illustrates changes in ornamental imports to California destinations. Import quantity has declined by 37 percent YOY, with a clear drop starting in March as the pandemic hit. Imports have slowly started to recover as of late May, but still lag behind 2019 levels.

Figure 11. Ornamental Imports to California



Source: USDA AMS

The impact of the COVID-19 pandemic on nurseries has also been substantial. There is a strong probability that nursery operations will be subject to a similar demand shift and oversupply of product as cut flowers, since real estate sales that drive substantial landscape plantings are also down and may fall further. However, some retailers have reported an increasing interest in home gardening which has resulted in increased retail sales of propagative materials, but most have reported significant losses due to a drop in customers during the pandemic. Impacts could increase if the US enters a prolonged recession similar to 2009.

One business surveyed for the study summed up the impact of the pandemic on nurseries succinctly: curb-side pickup is no way to run a nursery. Businesses are not set up for this type of operation and this severely limited sales in March, April, and May. Reported YOY changes in gross sales in April were down over 75 percent. Sales have picked up slightly in late May, but YOY sales are still down over 20 percent YTD.

The estimated impact of the COVID-19 pandemic was based on aggregate industry value and industry feedback in surveys conducted for this study. March through May sales were down by approximately 60 percent across the industry. A 60 percent drop in YOY sales was applied to the average industry value (sales) for March and a 75 percent decrease was applied for April. Sales picked up slightly in May. A linear increase in sales was run through the end of the year such that YOY sales changes in December were down 10 percent. That is if the industry does not fully recover by December of 2020. This is supported by the observation that the US and other countries are heading into a recessionary period. The estimated total impact of the pandemic on California floriculture is approximately \$296 million this year and an additional \$308 million impact to the nursery sector. This does not include any impacts to sod or mushroom farms.

4.16 Other Vegetables and Dry Beans

California produces a variety of vegetable, melon, cole, and cucurbit crops. The total gross value is around \$4.5 billion annually. Most of these vegetables are currently out of season, except for production in Southern California and the coast. The impact of the pandemic on this sector will be commodity and case specific. However, to approximate the range of potential costs, this study evaluates impacts to onions, which were being produced in the Imperial Valley when the pandemic hit, accounting for gross annual value around \$166 million.

Price and movement data show substantial YOY changes in onion production and value. Table 27 gives an overview of changes in shipments, prices, and total value. In general, both prices and movements are down resulting in a drop in total gross output value of approximately 30 percent YOY. As businesses begin to reopen, it is likely that prices and movement will slowly recover. Allowing for a linear recovery starting in June, average the average annual decrease in gross sales would be approximately 17 percent this year, or about \$28 million.

Table 27. Changes in Onion Movements and Prices

			April	May	YTD
Leeks	Movement	2019	93	132	225
	(10,000 lbs)	2020	47	84	131
	Price	2019	\$671	\$591	\$631
	(\$/ton)	2020	\$706	\$569	\$637
		Value	\$ (146,300)	\$ (151,000)	\$ (297,300)
	Change	Percent	-47%	-39%	-41%
Red	Movement	2019	76	1,938	2,014
	(10,000 lbs)	2020	215	2,994	3,209
	Price	2019	\$1,080	\$965	\$1,023
	(\$/ton)	2020	\$630	\$502	\$566
		Value	\$267,000	\$ (1,840,000)	\$ (1,573,000)
	Change	Percent	65%	-20%	-12%
White	Movement	2019		484	484
	(10,000 lbs)	2020	22	548	570
	Price	2019		\$887.37	\$887.37
	(\$/ton)	2020	\$480	\$450.00	\$465.00
		Value	\$52,800	\$ (914,400)	\$ (861,600)
	Change	Percent	-	-43%	-38%
Yellow	Movement	2019	1,088	8,460	9,548
	(10,000 lbs)	2020	648	7,403	8,051
	Price	2019	\$417	\$434	\$425
	(\$/ton)	2020	\$311	\$334	\$323
		Value	\$ (1,261,000)	\$ (5,978,000)	\$ (7,239,000)
	Change	Percent	-56%	-33%	-36%
		Value	\$ (1,087,000)	\$ (8,884,000)	\$ (9,972,000)
Total	Change	Percent	-36%	-29%	-30%

Source: USDA AMS

As noted above, impacts to other row crops and vegetables are not known at this time and highly speculative. Using onions as a proxy for other vegetables, and applying proportional losses, would result in direct impacts up to \$750 million in 2020. Given the fact that harvest for many of these crops is later in the year this likely represents a high estimate. With some recovery underway by the time these crops begin full harvest, impacts are likely to be much less, particularly for fresh vegetables for processing. Adjusting for a 60/40 fresh/processing split would result in an estimated annual impact of \$450 million. This hinges on labor availability and the absence of further shelter-in-place orders.

For other commodities, such as dry beans, purchases have increased as consumers purchase more shelf-stable items. Feedback from the dry bean industry indicated that demand was up through the early part of the year. Following an initial spike in sales, it is not clear how long this trend will persist. The industry reported that YTD sales are up as much as 20 percent. It seems likely that the increase will persist as long as consumers are eating at home and purchasing fewer perishable items. The dry bean industry did

report additional costs for training, sanitation, and face masks, and described logistical/practical issues with getting employees to wear masks and adjust to the new normal. Other cost increases are tied to transportation – high demand to move product with limited equipment available, but products continue to ship.

Impacts are likely to be greater for small specialty vegetable growers. Industry representatives interviewed for this study noted that they realized a rapid drop in food service demand that left them scrambling to offload product. Packaging issues even limited them from donating to local foodbanks. For these types of specialty growers, it is likely that effect of the pandemic will continue to linger as long as restaurant demands are down.

4.17 Olives and Olive Oil

The gross value of olives produced in California typically ranges between \$140 and \$180 million (excluding alternate-bearing years). Expectations for production in the current year are normal, with estimated industry value around \$160 million. Olives produced in California are either canned, pressed, or dried. By weight, most of the production is pressed (57%), followed by canning (32%), and dried olives (5%). By value, most of the output comes from canning (51%), followed by pressing (45%), and dried olives (4%).

Industry experts focused on pressed olives when discussing the impacts of the pandemic for this study. Pressed olives are the raw product used to produce olive oil. Even before the outbreak, the California olive oil industry was experiencing low prices. Prices for wholesale olive oil are down 16 percent YOY and national US exports are down 54 percent through March. While pressed olives are a somewhat small commodity in terms of value, the wholesale value of olive oil can be 2-3 times that of the unrefined olives. In total, the value of the wholesale olive oil in California is estimated at \$180 million. One offsetting factor is the spread of the bacterial disease *Xylella* from Italy into Spain. If this continues, European Union production could be reduced, and olive oil prices may recover.

Current estimates of retail and export changes in California olive oil were not available for this study; however, industry representatives were able to provide estimated changes in food service demand. YOY sales for olive oil in the food processing sector have dropped 60 percent. Typically, food service accounts for a quarter of all olive oil demand. Based on these estimates alone, the loss to olive oil producers this year is expected to total \$18 million. With more widespread impacts and cost increases, total losses could reach up to \$43 million.

4.18 Other Agricultural Businesses and Support Industries

As noted in the introduction section, this study should not be viewed as a comprehensive accounting of all of the impacts of the pandemic. It represents estimated industry impacts based on the best available information at the time. Other industries were contacted for this study and economic impacts were either not possible to quantify due to limited data, or they are included in other impact sections. These include:

- Seed industry

- Dry bean producers and warehousing
- Small specialty vegetable producers
- Plant breeders
- Pest Control Advisors
- Agricultural irrigation suppliers
- Community Supported Agriculture (CSAs) and farmers markets
- Other agricultural industry associations
- University and industry research labs

Crop protection products/services are an important consideration for the outlook of the industry. The pandemic has affected shipping and reduced access to PPE. KN95 masks were initially approved as a substitute to N95 masks for applicators at the state level, but that was not approved at the federal level. As such, access to N95 masks is critical for crop protection during the upcoming season. Other shipping issues were reported with vessels that had crews with COVID-19 suspected. At least one ammonia shipment was turned around and forced to return with a lighter load to come to port in Stockton. While not quantified as part of the total impacts reported in other sections of the report, these are substantial costs of the COVID-19 pandemic that could result in additional losses later this season. Limited ability to store and distribute crop protection materials in the state means that highly efficient supply chains can be quickly overwhelmed if another wave of the virus emerges.

Longer run industry impacts are an issue due to supply logistics and uncertainty. For example, growers are making planting decisions for berries and greens later this year. Seed producers are anticipating next year's crop. Industry feedback is that cucurbit seed plantings are down considerably this year. There are also logistical issues with importing seed from Asia for the 2021 crop year that will continue to play out over the coming weeks and months. This has broader implications for plant breeders and other support industries. Uncertainty in domestic and international consumer demand for fresh produce and other processed items is creating additional costs to business trying to plan for these uncertainties.

Other support industries are also affected by the pandemic. Businesses from agricultural irrigation services to crop services realized a decrease in sales. In addition, the shelter-in-place orders have effectively eliminated any in-person sales meetings, which will continue to impact business revenues over the coming months.

Other industry feedback included concerns about getting workers to return to jobs if they lost those jobs during the pandemic. The additional \$600/week payment in addition to unemployment insurance was cited as a disincentive for workers to come back to positions before the end of July. Childcare is also a significant challenge. With schools and daycares closed this has made it difficult or impossible for parents to continue working. Looking forward, it is not clear how rapidly daycares, summer schools, camps, and other summer childcare options will open, or if schools will be open in the Fall. This could impact labor supply over the rest of the year.

All trade shows and association meetings have been canceled. These are a significant source of revenue, particularly for smaller organizations. This will affect marketing and other support activities for the industries into the future.

5. Total Economic Impact

Total direct economic impacts described under Section 4 are estimated between \$5.9 and \$8.5 billion this year. Table 28 summarizes direct economic impacts by crop and sector. Estimated YTD impacts are shown in addition to the annual total. As noted throughout the analysis, the total annual impact depends on how rapidly the food service sector and other sectors of the economy recover.

Table 28. Direct Economic Impact Summary

Commodity/ Industry Group	Estimated YTD Impact	Annual Direct Economic Impact		Notes
		Range		
		Direct Impact Range		
Food Service, Retail, Export		-	-	U.S. total losses and California-specific impacts are shown but not included in impact totals
Processing/ Manufacturing		-	-	Impacts included in respective crop categories
Leafy Greens	\$47	\$141	\$480	
Processing Tomatoes	\$40	\$88	\$211	
Berries	\$48	\$144	\$280	
Dairy	\$277	\$1,370	\$2,320	
Rice	-	-	-	Additional milling costs and disruptions to logistics; otherwise expect normal year
Beef and Poultry	\$314	\$610	\$878	
Cotton	\$166	\$166	\$166	
Table Grapes	-	\$140	\$140	
Wine & wineries	\$532	\$1,400	\$1,610	
Citrus	\$92	\$164	\$311	
Nuts	\$205	\$486	\$728	
Hay and Feed Crops	\$24	\$65	\$130	
Cherries & Tree Fruit	\$45	\$49	\$125	
Flowers and Nurseries	\$206	\$660	\$740	
Olives and Olive Oil	\$7	\$18	\$18	
Other Vegetables	\$28	\$450	\$450	
Other Support	-	-	-	Impacts included in respective crops
Total	\$2,031	\$5,951	\$8,587	

The direct economic impacts were integrated into the IMPLAN model, used to quantify secondary economic impacts, and report total economic impacts. Total economic impacts are reported in terms of change in employment, total gross output value (sales), and value-added. Value added is a measure of net economic activity occurring in the state. For crops/industries with an estimated range of impacts (see table 28), a mid-point value was selected for IMPLAN modeling purposes. This mid-point impact equals approximately \$6.7 billion in total. A separate sensitivity analysis developed for the IMPLAN analysis is described below.

Table 27 summarizes the average annual direct economic impacts applied in the IMPLAN analysis. Impacts are split into producer (e.g., grower) and processor (which includes processing, manufacturing, and retail) for display purposes.

Table 29. IMPLAN Direct Economic Impacts

	Producer	Processor Impacts
Leafy Greens	\$361	\$0
Processing Tomatoes	\$40	\$114
Berries	\$212	\$0
Cotton	\$166	\$0
Nuts	\$62	\$545
Hay and Feed Crops	\$98	\$0
Cherries & Tree Fruit	\$87	\$0
Other Vegetables	\$600	\$0
Citrus	\$115	\$147
Table Grapes	\$140	\$0
Wine Grapes and Wineries	\$2	\$1,271
Olives and Olive Oil	\$0	\$18
Flowers and Nurseries	\$304	\$396
Beef and Poultry	\$473	\$297
Dairy	\$1,061	\$547
Total	\$3,522	\$3,236

In addition to an IMPLAN analysis of total economic impacts, EDD data were reviewed to estimate YOY changes in employment by agricultural sector. Compared to last April, total California employment (all sectors) fell from 52 million to 45 million, a change of 13 percent. Most of the change occurred between March and April of this year. This change has not been equitable between industries.

Table 30 displays the YOY changes in employment for all sectors, and selected agricultural and food related sectors according to EDD. Total farm jobs are down by 23 percent, or approximately 94,800. Food manufacturing jobs are down by 13,900. The majority of job losses are in the retail and restaurant industry, accounting for more than 650,000 jobs lost.

Table 30. California Employment, Selected Agriculture and Food-Related Sectors

	April-2019	April-2020	Total Change	% Change
Total, All Sectors	17,761,200	15,374,900	-2,386,300	-13.4%
Total Farm	409,100	314,300	-94,800	-23.2%
Food Manufacturing, Total	158,800	144,900	-13,900	-8.8%
Fruit & Vegetable Preserving & Specialty Food	24,500	21,500	-3,000	-12.2%
Dairy Product Manufacturing	17,600	16,600	-1,000	-5.7%
Animal Slaughtering & Processing	21,800	21,100	-700	-3.2%
Bakeries & Tortilla Manufacturing	43,300	38,800	-4,500	-10.4%
Other Food Manufacturing	34,900	31,500	-3,400	-9.7%
Beverage Product Mftg (includes wineries)	62,600	50,700	-11,900	-19.0%
Grocery & Related Products Wholesalers	111,700	106,900	-4,800	-4.3%
Grocery Stores	311,300	315,700	4,400	1.4%
Full-Service Restaurants	655,500	213,800	-441,700	-67.4%
Limited-Service Eating Places	700,400	530,300	-170,100	-24.3%
Special Food Services	77,800	40,200	-37,600	-48.3%
Drinking Places (Alcoholic Beverages)	34,900	6,700	-28,200	-80.8%

Source California Employment Development Department

Table 31 summarizes aggregate industry sectors. The most significant impact has occurred in the category with the highest employment, food service. Grocery stores saw a minor bump in employment, but nowhere near the magnitude that would offset the losses in the food service sector. On the production side, the largest changes are in the on-farm employment sector. One possibility is that there is some lag in the supply chain so that jobs do not reflect the extent of the pandemic in that month. Another possibility is that processors and wholesalers are not able to lay off as many employees and still maintain minimum operational demand. Support programs such as the PPP may also have prevented wider job losses initially.

Table 31. California Employment, Summarized Sectors

	April-2019	April-2020	Total Change	% Change
Farm Employment	409,100	314,300	-94,800	-23%
Food Manufacturing	221,400	195,600	-25,800	-12%
Food Wholesaling	111,700	106,900	-4,800	-4%
Grocery Stores	311,300	315,700	4,400	1%
Bars, Restaurants, and Food Service	1,468,600	791,000	-677,600	-46%

Source California Employment Development Department

In addition to being spread out across industries, employment impacts have also been geographically diverse. Table 32 displays changes in farm employment in selected counties. The areas that have been hit the hardest thus far are those with active harvests such as Imperial County and Monterey County. Typically, agricultural employment peaks in August, with its highest levels from May to October. If restrictions continue or resurface during this period, the Central Valley will likely experience a much heavier impact. Most impacts are concentrated in the rural counties in the state that typically have more of the agricultural and processing industries. These counties are disproportionately dependent on agriculture and agriculture-related industries. Workers have few alternative job options. However, total

job losses, including food service and other agriculture-related industries, have been substantial in larger metropolitan areas as well. Preliminary EDD data shows April employment decreased by 175,700 jobs YOY in Alameda and Contra Costa counties. The Los Angeles area (including Long Beach and Glendale) April employment was down 685,400 jobs YOY.

Table 32. Total Farm Employment, California and Selected Counties

	April-2019	April-2020	% Change
California, Total	409,100	314,300	-23.2%
Fresno	43,300	41,000	-5.3%
Imperial	10,600	2,000	-81.1%
Kern	56,100	40,800	-27.3%
Monterey	54,000	32,400	-40.0%
Sacramento, Yolo, Placer, and El Dorado MSA	8,600	6,800	-20.9%
San Joaquin	13,600	1,500	-89.0%
Tulare	38,600	27,800	-28.0%
Los Angeles	4,300	3,800	-11.9%
Alameda and Contra Costa	1,300	1,100	-15.4%
Ventura	28,100	22,200	-21.0%

Source California Employment Development Department

Direct changes in gross agricultural output affects other industries through indirect and induced effects. Indirect effects occur when an industry changes input purchase. In this case an example of an indirect effect would be producers not purchasing as many inputs because they are no longer farming as intensively. Induced effects occur when the employees change their household spending patterns. For example, a processing plant worker out of a job spends less discretionary income on food and entertainment in the local economy.

The IMPLAN model was applied to assess indirect and induced impacts. This approach works well for assessing changes in output when changes are relatively small. The COVID-19 pandemic represents a massive change to the industry. Therefore, the results presented in this section should be viewed with this in mind.

Direct impacts represent changes in production (e.g., a field is not planted) or loss of product (e.g., a field was not harvested). These have important differences for secondary impacts. In the latter case, all inputs were purchased and paid for. Changes in production are modeled as a reduction in output value, changes in gross sales due to prices changes or crop losses at harvest are modeled as a reduction in business income. This avoids overcounting some of the induced impacts. To evaluate the effect of this assumption, two scenarios are developed. One where impacts are modeled as described above. In the second scenario all estimated future changes (for the rest of 2020) are modeled as a change in output value. That is, the latter scenario represents more severe impacts where some production or processing stops entirely as a result of future waves of the virus.

Table 33 summarizes the results of the first scenario, representing expected future conditions. Total value-added losses equal \$4.1 billion dollars this year. Changes in labor income and gross output value are also reported. Employment impacts are around 36,600 jobs.

Table 33. Scenario 1 Total Economic Impact (\$ in millions)

	Employment	Labor Income	Value Added	Output
Direct	-2,580	-\$251.3	-\$462.3	-\$6,757.6
Indirect	-5,030	-\$374.5	-\$698.3	-\$1,336.7
Induced	-28,990	-\$1,692.3	-\$2,995.3	-\$5,051.5
Total	-36,595	-\$2,318.1	-\$4,155.9	-\$13,145.7

Table 34 summarizes the results of the second scenario, representing expected future conditions. Total value-added losses equal \$6.4 billion dollars this year. Changes in labor income and gross output value are also reported. Employment impacts are around 48,800 jobs.

Table 34. Scenario 2 Total Economic Impact (\$ in millions)

	Employment	Labor Income	Value Added	Output
Direct	-15,665	-\$1,494.8	-\$2,820.2	-\$6,757.6
Indirect	-13,350	-\$914.1	-\$1,592.4	-\$3,029.1
Induced	-19,810	-\$1,157.3	-\$2,049.0	-\$3,455.7
Total	-48,830	-\$3,566.2	-\$6,461.6	-\$13,242.4

The two scenarios provide a range of potential secondary and total economic impacts. The total impact to the California economy, measured as value-added, is estimated between \$4.1 and \$6.4 billion this year, with total job losses between 36,000 and 48,000.

6. Summary and Outlook

The financial impact of the COVID-19 pandemic on the California food production sector varies widely between different products and is manifest in the form of changes in the costs of production and processing, heavy dependence of demand from the food service, and shifts in retail demand by consumers. Some sectors such as rice and other processed products are likely to have little to no impact at all from the pandemic due to timing, changes in demand, and the nature of production. At the other extreme are sectors such as dairy, wine grapes, floriculture, and nurseries that have been hit hard both with cost increases and the collapse of demand for their product. Direct economic impacts to production sectors have been presented under a range of possible outcomes. Estimated direct impacts are between \$5.9 and \$8.5 billion dollars this year.

Secondary impacts and job losses were also estimated. Based on current EDD data, the number of farming-related jobs lost in April is down more than 120,000 YOY. Including the food service sector, there are 800,000 fewer jobs in April than the prior year. The IMPLAN analysis estimated total job losses between 36,500 and 48,800 in industries related to crop farming and processing alone. Total value-added losses, a measure of net economic activity in California, are estimated between \$4.1 and \$6.5 billion this year.

Given the short timeframe for the study and the equally rapid impact of the pandemic on most crop sectors, most estimates of direct impacts are based on changes in revenues by YOY (or month-over-month) comparison of January – May data. Interviews with industry representatives were used to fill data gaps and estimate how rapidly different food sectors would recover based on both production and processing activity. The estimates of rates of recovery varied widely. For example, egg production seems to be returning to the pre-pandemic level by the end of May. In contrast, the impact on small wineries heavily dependent on cellar-door sales are unlikely to see revenues returned to 2019 levels until confidence in the safety of travel returns. It seems likely that this is still many months in the future.

In the longer term, California's agricultural economy is strongly dependent on exports. The level of exports of specialty high value crops in California is going to be dependent on the world economy, and the ability of upper income consumers to spend on specialty foods. Agricultural exports are unlikely to return to pre-pandemic levels anytime in the near future for the following reasons. First, the current slowdown in the growth of Asian economies, principally China, is already in evidence. For the first time in three decades China has not established a target growth rate for their 2020 GDP. Europe is the other large market for California produce and their economic outlook is less optimistic than China with a heavy and contentious debt in the EU and high unemployment. A second factor that will dampen the food export environment is the change in attitude towards long supply chains that the pandemic has engendered. Already, there are some comments on the need for greater proportion of homegrown supply to reduce the risk of disruption.

The third factor which must be considered in conjunction with the projections in this report is the effect of a resurgence of the virus in the fall. If this occurs the projections that represent the annual impact in this study are all moot, and are likely to increase. However, given the current knowledge and the progression of the pandemic coupled with the potential for improved therapy and possible vaccines these estimations of the 12-month impact by food sector are, on balance, the most likely economic outcome for California agriculture.

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