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# **COVID-19 Impact on Fruit and Vegetable Markets**

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## COVID-19 Impact on Fruit and Vegetable Markets

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**Abstract:** Canadian fruit and vegetable markets were significantly impacted by the spread of the novel coronavirus (and Covid-19 disease), beginning in March, 2020. Due to the closure of restaurants, bars, and schools, produce growers and distributors were forced to shift supplies almost entirely from the foodservice to the retail channel. Shippers reported labor and logistical constraints in making the change, but the fresh produce supply chain remained robust. In the long term, we expect lasting changes in consumers' online food-purchasing habits, heightened constraints on immigrant labor markets, and tighter concentration in fresh produce distribution, and perhaps retailing.

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## **COVID-19 Impact on Fruit and Vegetable Markets**

The spread of novel coronavirus, and the COVID-19 disease it causes, has had unprecedented impacts on all food markets, including the market for fruits and vegetables. Throughout the value chain, grower-shippers accustomed to just-in-time inventory management systems and retailers able to stock every product with minimal interruption faced shocks in both supply, and demand. In this article, we review the nature of these changes due to the spread of COVID-19 in Canada and elsewhere, and document some of the industry's response, from consumers and retailers, through to produce suppliers. We divide our analysis into short-term, or immediate, impacts on the fruit and vegetable supply chain, and then consider longer-term impacts that are likely to persist for the entire duration of the pandemic, and perhaps longer. Our primary interest is on the implications to Canadian markets, but given the degree of integration between horticultural supply chains in Mexico, the United States and Canada, we will provide a North American perspective and focus on the key overlapping issues across the three countries.

### **Short-Term Impacts**

In the near term, no one in the industry has been spared. As of March 12, 2020, fully 86% of industry members – from grower-shippers through retailers – reported either “some effect,” or “significant effect” on their operations (Nickle 2020a). Among the various issues affecting their day-to-day operations, taking time for “contingency planning” represented the most substantial change to their daily routines. Finding workers, scheduling workers, and ensuring their safety are the most important operational concerns. These operational issues, however, are only the tip of the spear as the industry undergoes fundamental changes and dislocations in an otherwise well-operating value chain.

In the short term, closing restaurants and schools – the near-complete loss of an entire distribution channel -- has had the most dramatic impact. In 2017, foodservice (both restaurant and institutional) sales in Canada totaled \$65.0 billion, while sales in the retail channel were \$74.0 billion (USDA 2018). It is reasonable to assume that total food consumption does not change, however, so the volumes lost to the foodservice channel are likely being picked up by retail. In response, suppliers are setting up packing lines, and converting existing lines, to move from foodservice to retail buyers. Using US data as evidence, by March 8, 2020, as quarantine measures began in only the most affected of the states in the US, retail food sales were already up some 10.6% in total, and 4.5% in fresh produce (Nickle 2020b).

We expected this shift to accelerate as the virus spread, and it did. By March 24, volumes of fresh produce in the retail channel were up 23.2% over the previous year (Lutz 2020). Unit prices in the foodservice sector tend to be higher than retail (USDA 2020), but expenditure in each channel is roughly the same, so this means a roughly 25% shift in volume across supply chains that differ in fundamental ways.<sup>1</sup> That is, the set of wholesale distributors for the foodservice sector are not always the same as those that service retail accounts, and many retail accounts are served directly by grower-shippers. While foodservice distributors will clearly see an almost complete loss of demand, retail distributors need to be able to pack more frequently, have trucks in place more quickly, and anticipate moving greater volumes in the next few months. This will demand unprecedented flexibility in terms of shifting lines, and suppliers, as needs change.

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<sup>1</sup> USDA (2020) estimates the farm-share of the food-away-from-home dollar at \$0.064 and the farm-share of at-home food at \$0.24. If the wholesale price of food in each case is approximately equal, and the farm and retail shares of expenditure are approximately equal, then food volumes away-from-home are approximately 25% of the at-home total.

Farm products destined for the retail and foodservice channels are largely fungible. That is, a head of lettuce contracted to a foodservice distributor is largely the same as one that would be sold to retail. However, that is where the similarity ends as fresh produce in the retail channel is far more likely to be purchased on contract than it was 20 years ago, and more likely to be sold under contract than produce in the foodservice channel. Contracting for fresh produce helps buyers ensure a consistent supply of high-quality produce from trusted suppliers, with lower transactions costs than purchasing from a spot, or terminal, market. However, these dedicated relationships break down when end-markets disappear. Contracts in the retail fresh produce market are subject to a wide range of *force majeure* clauses that render them unenforceable in the event of an “act of God,” which, we suspect, includes pandemic spread. From a business perspective, sellers servicing foodservice buyers will need to find alternative buyers in the retail channel and vice versa – retail buyers will need to quickly locate suppliers that have been selling to foodservice buyers. All of this search activity also needs to be completed before the current crop, which is highly perishable in most cases, becomes unsellable through any channel.

In fact, perishability separates the fresh produce industry from most other agricultural sectors, particularly in terms of the most visible impact of COVID-19 on the retail market. Hoarding in both the US and Canada is rampant. However, consumers are only stockpiling non-perishable items as they, perhaps expecting to be completely excluded from food stores, are forward-buying in the anticipation of not being able to purchase any of their basic needs. However, retailers have managed to keep relatively complete assortments of fresh fruits and vegetables, at reasonable prices. Suppliers of non-perishables will feel their Armageddon in July or August when the current demand spike has run its course, and consumers take months to work through their stockpiles of items. Producers of perishable items are experiencing little of the

same forward-purchasing. There are reports of sporadic stockouts in some of the more storable produce items – table potatoes, onions, and sweet potatoes, for example – but most items in the fresh-produce aisle appear to be readily available.

Some of the trends discussed above for the fresh produce sector are less prevalent for processed (frozen and canned) fruits and vegetables, which is a non-trivial market in Canada. In fact, the value of processed fruit and vegetable production in Canada is approximately \$7 billion (StatsCan 2020b). Anecdotal evidence suggests that, like several non-perishable products, consumers have been stockpiling frozen fruits and vegetables, which has the potential to dampen current and future sales of fresh produce. Furthermore, depending on consumers' experiences with processed fruits and vegetables, any short-term changes in the mix of fresh and processed fruits and vegetables has the capacity to alter shopping patterns in the future. This may prove to be an important time to the marketers of both fresh and processed fruit and vegetable firms to maintain, attract, and expand their consumer base (Kapsak, 2020).

There are many reasons why fresh-produce shelves remain relatively well-stocked, while non-perishables disappear quickly, reflecting differences in both supply and demand. First, decisions to grow most vegetables (and seasonal berries) are made from 3 – 6 months in advance of retail shipments, depending on the item in question. Therefore, the onset of a crisis that occurred as rapidly as COVID-19 does not necessarily interrupt the biological process of planting and harvesting. While the crops may be available in the field, harvesting crops that are currently in the field may face some difficulties as growers in the Southern US (the main source of imports to Canada) are reporting some problems obtaining H-2A workers (the usual source of seasonal harvesting laborers). Rising unemployment among domestic workers in the coming months may provide a ready supply of substitute workers, but attracting workers to the fields will

require higher wages, and production costs. As the pandemic began to move through the US, suppliers reported little difficulty in moving their usual volume of fresh fruits and vegetables to retail stores.

Second, on the demand side, the fact that consumers are stocking up on non-perishable items means that they are likely substituting across-categories within the store at a rate that we have not seen before. Retailers are, by now, very sophisticated in terms of their use of inventory and demand-management data in order to optimize prices and assortments in real time. The fact that shelves are empty for some categories (toilet paper, pasta, for example) and not others (apples, tomatoes, strawberries, for example) is a testament to the knife's edge upon which retailers operate. Even a small change in demand leads to category-reallocations within the store that result in perceptions of scarcity, even though retail supply chains remain relatively robust.

There is evidence that category-substitution, even in normal times, is relatively strong. Empirically, we know that consumers exhibit substitution patterns between different foods and between different food categories. Okrent and Alston (2011) examine the own- and cross-price elasticities of demand for six food-at-home categories (including fruits and vegetables), two beverage categories, and a food-away-from home category. Their results show that the fruit and vegetable category has important substitution patterns with the cereal and bakery category, meats, and non-alcoholic beverages (which includes fruit juices). So, in addition to any future switching patterns we see between individual fruits and vegetables, and between fresh and processed fruits and vegetables, Okrent and Alston (2011) suggest that consumers will also substitute across food categories. With this shock-driven demand reallocation, however, budget constraints are likely to have substantially stronger effects, so past estimates may understate the true state of affairs. Even items that were complements, such as meat and potatoes, may become



substitutes as stockpiling in one leaves less money for the other. Intuitively, if the budget share of toilet paper is typically 1%, the demand for toilet paper is almost meaningless to apple purchases, but when it becomes 20%, toilet paper purchases drive apple demand down through the budget constraint. Although there are no reports of retailers price-gouging in hoarded-item categories, it is conceivable that higher retail prices for these items could, in turn, generate higher demand for fresh produce as the spread of the virus worsens.

Category substitution, and the eventual run-down of household inventories of non-perishable items, may have important implications for future purchases of fresh fruits and vegetables, and dietary quality. If households substitute between non-perishable (or frozen) products that were stockpiled and stored during late-winter and the spring of 2020, this could have non-trivial effects in fruit and vegetable markets and lead to a range of market responses in mid- to late 2020. We know that consumers substitute readily between fresh and frozen fruits and vegetables (Blumberg Thompson 2020), so this effect is likely to be strong. First, the consumption of stockpiled items could begin to occur at the same time that harvest seasons begin for many Canadian-produced fruits and vegetables, and this would place downward pressure on prices of fresh produce markets. This scenario would be particularly difficult for small and medium-sized fruit and vegetable producers that rely more heavily on local and regional markets for their products.

Second, and perhaps more importantly, different food categories provide different micro- and macronutrients to consumers, and the stockpiling and the potential large substitution patterns between food categories could have implications for dietary quality in Canada. Fruits and vegetables, in particular, are important sources of dietary fiber and many vitamins and minerals. Any substitution patterns stemming from the eventual management of stockpiled (mostly

cereals) may inadvertently discourage consumers from eating the recommended amount of fruits and vegetables (Canada Food Guide 2020).

Of course, much of the produce sold in Canada is imported. In fact, in 2018, total retail sales of fresh fruits and vegetables produced averaged about \$125 million (CDN) per month (StatsCan 2020a), while imports averaged approximately 7 times that amount (Statista 2020a). Consequently, most of the impact of changing consumption patterns will be felt by importers, including wholesalers, distributors, and retailers, and any impact on availability will be determined by conditions in the US fresh fruit and vegetable supply chain. Among domestic stakeholders in the fresh value chain, importers, including distributors, wholesalers, and retailers will be the most directly impacted. In fact, retailers may experience changes that last well beyond the duration of the pandemic.

Borders remained open to commercial traffic well into the crisis. However, further restrictions on cross-border movement will dramatically affect trade-dependent firms, like those in the fruit and vegetable industries. Losing access to US imports will clearly limit Canadian retail sales this summer to items grown primarily in Canada, reducing the variety of fresh items that Canadian consumers have become accustomed to.

Reflecting consumers' fears of being in proximity to others, online food sales surged as the pandemic spread. Prior to the spread of coronavirus, only 1.5% of groceries were sold online in Canada, a number that had grown to over 9.0% by the third week of March (Charlebois 2020). In fact, grocery chains were reporting surges in online orders of up to 300% (O' Malley 2020), and some were limiting physical access to stores. While much of this online ordering activity was surely for non-perishable and household items, the fact that many supermarkets charge fixed online delivery fees means that shoppers have an incentive to order their entire shopping list

online, and avoid the risk of shopping in physical stores. Once consumers learn how to shop online, and experience the benefits in terms of convenience and speed, many will remain online shoppers at least occasionally. For fresh produce retailers, many believe this experience could represent the tipping point that moves fresh food delivery beyond only tech-savvy, regular online purchasers to the center of mass of the food-buying public.

Direct channels, such as farmers markets and farm stands, have become an important source for fresh fruits and vegetables. While small in volume in Canada (StatsCan 2020a), farmers markets often represent the face of the industry as they attract the most engaged segment of the fresh-produce market. Although social distancing likely means the end of most face-to-face markets for fresh produce in the short term, it also provides an opportunity for community-supported agriculture (CSA) organizations to seize a market opportunity by expanding local delivery services.

Shifting fruit and vegetable consumption from restaurants to home-based meals has potentially-important implications for food waste. There are three mechanisms at work; however, leaving the net effect uncertain. First, Gooch, et al. (2010) estimate that some 51% of food waste in Canada occurs in the home, while the foodservice sector is responsible for 8% -- much different from the proportions of food volume consumed at home and away-from-home. Therefore, shifting consumption from foodservice to households may, in fact, increase the amount of fresh produce that is wasted. Second, over-purchasing is one of the key drivers of household food waste. If anxiety over the viability of the fresh produce supply chain leads to hoarding, or at least over-buying, then more fresh produce will be wasted as a result. On the other hand, perceptions of scarcity are likely to lead households to become more efficient, both

in their use of food on hand, and in planning food purchases. Determining which effect dominates would be a fruitful question for future research.

### **Longer-Term Impacts**

There are other effects that are more likely to persist, or that reflect long-term developments in fresh-produce supply chains. We identify three of the most significant in this context as access to labor issues in the fresh-produce growing industries of the US and Canada, consolidation, and the move to online food purchasing.

Canada obtains most of its fresh produce from the US (Statista 2020a). Reliance on imports, mainly from the US, means that anything that interrupts production and distribution schedules in the US may have dramatic effects on Canadian availability. In that regard, a shortage of farm workers in produce-growing regions of the US – not just harvest workers, but for a wide range of production jobs – has for many years been perhaps the most important issue facing fresh-produce growers, well before the spread of COVID-19 (Richards and Patterson 1998; Hertz and Zahniser 2013; Richards 2018). Because this issue is structural, endemic to the US labor market, and defies an easy political solution, there has been a patchwork of policy remedies suggested, and enacted, over the past 40 years. The US Immigration and Nationality Act of 1952 established the H-2 guestworker visa program, which was later divided into the H-2B program for seasonal workers in non-agricultural industries (and subject to strict limits) and the H-2A program (not subject to limits on the number of workers). Due to its bureaucratic and heavily-regulated nature, workers hired under the H-2A program represented only a small share of all agricultural workers each year, some 40,000 workers out of a total workforce of over 1.0 million. In recent years, however, heightened enforcement of immigration laws in the US, reduced out-migration from Mexico, aging of the workforce in the US, and the reluctance of

domestic workers to do farm labor meant that the share of H-2A workers rose from 7.7% of the entire workforce in 2008 to some 21.1% in 2018 (see Figure 1, USDA 2020b).

As the coronavirus spread in early 2020, restrictions on cross-border movement between the US and Mexico meant that growers could no longer rely on a ready supply of H-2A workers. While the spread of COVID-19 began before the harvest season for most fruits and vegetables, growers could not conduct early-season planning for the coming harvest. Somewhat perversely, perhaps, unemployment caused by the shock to the US economy more generally has provided an immediate pool of available workers. However, during the previous period of relatively high unemployment during the financial crisis of 2008-9, growers could not attract domestic workers, even by promising higher wages. As counterintuitive as it may seem, US workers' reluctance to do farm jobs may mean that crops go unharvested, despite a real demand for the final good, and plenty of workers able to do the job.

Domestic production in Canada faces many of the same issues. Canada admits some 60,000 guestworkers annually, many of whom are employed in the fresh fruit and vegetable industry (Grant 2020). While workers are still allowed into the country, difficulties in obtaining approval in Mexico, and traveling to Canada, may mean that far fewer than are needed make the trip this growing season. Moreover, Canadians – even newly unemployed Canadians – are not likely to take these jobs and risk losing unemployment support. If growers are forced to raise wages to attract domestic workers, the price of domestically-grown produce may rise substantially.<sup>2</sup>

Second, we expect the rate of consolidation to increase throughout the fresh-produce supply chain. Similar to the rest of the economy, much of the growth of small business in the

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<sup>2</sup> Harvesting wages can amount to 80% of the cost of producing many fruits and vegetables.

produce sector during the 2009 – 2020 recovery and boom period was fueled by debt. While the consequences of debt-funded growth, and declining cash flow, are more obvious in the shale-oil industry, bankruptcies and consolidation will also rise in the fresh produce industry. In periods of financial instability, only large, stable firms with the ability to service interest payments and sustain business relationships through cash-shortages survive. Further, there is little reason to believe that per-capita consumption of fresh produce will change as we emerge from the pandemic, so the same amount of business will essentially be spread among fewer businesses. Among empirical industrial-organization economists, the linkage between concentration and market power is far from settled. But, it is undeniable that the potential for margin expansion by large retailers on the consumer side, powerful packers and distributors on the wholesale-buying side, and exporters selling into the Canadian market will be much greater in the absence of a strong, competitive fringe of small firms.

Another potential long-term trend that may emerge from the COVID-19 pandemic is the way consumers purchase food, and how they buy fruits and vegetables. The move to online grocery shopping has been particularly notable given the share of online purchases made by retirees and households that have not traditionally purchased groceries from home (Charlebois 2020). This has important implications for produce as there is evidence that some consumers are more likely to make healthier purchases when groceries are ordered on-line, or at least less impulsive as consumers tend to use automated shopping lists online (Pozzi 2012). In predicting how this short-term response to COVID-19 will affect fruit and vegetable sales (both fresh and processed), the outlook will depend greatly on customers' satisfaction to their initial online shopping experiences in March and April 2020. Online grocery sales are expected to reach 30%

of total grocery sales by 2025 (Albrecht 2020); some are now predicting that our experience with COVID-19 will be a defining moment in North America's embrace of online grocery shopping. Any further movement online will only accentuate the consolidation effect described above. After Amazon's purchase of Whole Foods in 2017, the movement online and increased concentration of retail grocery sales came to be viewed as essentially two manifestations of the same underlying dynamic. Supermarket retailing is notoriously capital intensive, and endogenizing fixed costs is an important tool for strategic competition among grocery retailers (Ellickson 2007). Online grocery may appear to consumers to be "just an app," but to do it in a way that competes with Amazon requires building distribution centers, establishing a delivery network, integrating with physical stores, and expanding geographic reach. Small, independent, neighborhood stores may not be able to compete in a world in which consumers demand online grocery options.

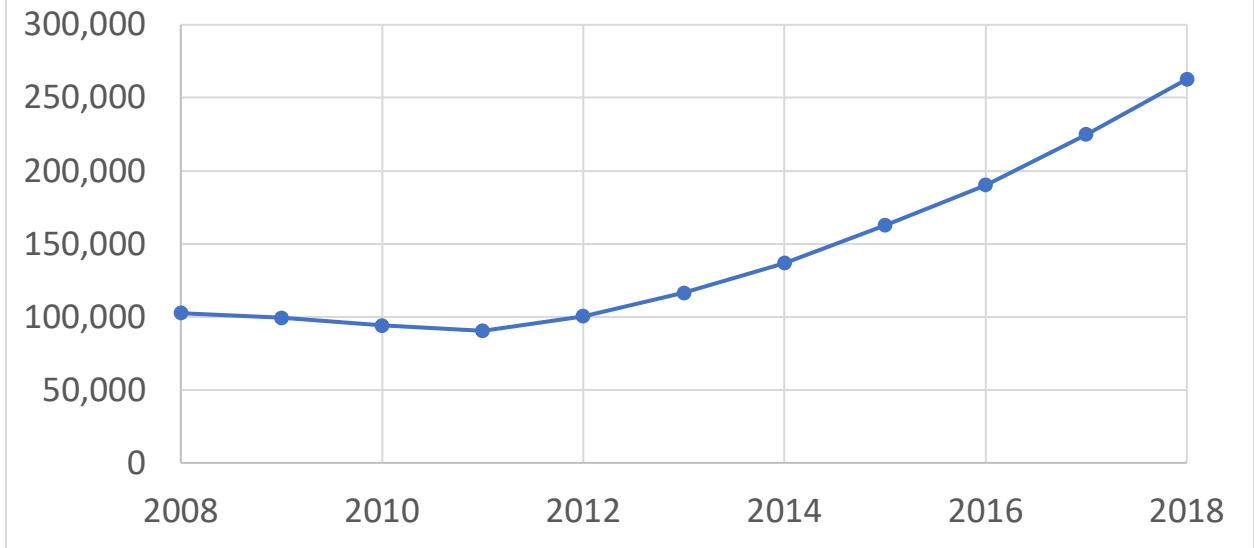
## **Conclusion**

In conclusion, we believe the greatest impact of the COVID-19 pandemic, in the short term, will be felt through the realignment of fresh produce supply chains due to the closure of nearly all foodservice outlets. As consumers move to buying food almost completely through the retail channel, distribution infrastructure specific to retail will remain strained throughout the spread of the disease, and will test supply-chain relationships for some time after. Over the longer term, the potential impacts will be felt through input markets, most notably labor, and structural changes in the industry that may undergo fundamental, and largely irreversible shocks, such as consolidation and a move toward online shopping. The fact that Canada imports much of its fresh-produce requirements does not insulate it from these shocks. Rather, the price of imported produce will rise with the cost of production in the US, and any changes in the structure of the

exporting industry. These changes, while rational responses to short-term incentives, may change fresh fruit and vegetable distribution forever.



Figure 1. Number of H-2A Certifications



Source: US Department of Labor (USDA 2020b).

## References

- Albrecht, C. 2020. Study: Online sales to hit \$143 billion by 2025. The Spoon. (<https://thespoon.tech/study-online-grocery-sales-to-hit-143-billion-by-2025/>). Accessed March 27, 2020.
- Blumberg, J. and G. D. Thompson. (2020). Heterogeneity in the demand for fruits and vegetables: How much can price and quantity reveal? Working paper, Department of Agricultural and Resource Economics, University of Arizona, Tucson, AZ.
- Canada Food Guide. (2020). Eat vegetables and fruits. (<https://food-guide.canada.ca>). Accessed on April 2, 2020.
- Charlebois, S. (2020). Why COVID-19 will change Canadian grocery industry forever: Expert. Retail Insider. (<https://www.retail-insider.com>). Accessed April 2, 2020.
- Ellickson, P. B. (2007). Does Sutton apply to supermarkets?. *The RAND Journal of Economics*, 38(1), 43-59.
- Gooch, M., Felfel, A., & Marenick, N. (2010). Food waste in Canada. *Value Chain Management Centre*, George Morris Centre, November.
- Hertz, T., & Zahniser, S. 2013. Is there a farm labor shortage? *American Journal of Agricultural Economics*, 95(2), 476-481.
- Kapsak, W. 2020. Now is the time to promote produce. *Produce Business*. (<https://www.perishablenews.com/produce/now-is-the-time-to-promote-produce/>). Accessed March 26, 2020.
- Lutz, S. 2020. Category Partners, personal communication.
- Nickle, A. 2020a. How the coronavirus is affecting the produce industry. *The Packer*. (<https://www.thepacker.com/article/how-coronavirus-affecting-produce-industry?>). Accessed March 21, 2020.
- Nickle, A. 2020b. Retail produce sales rising amid coronavirus concerns. *The Packer*. (<https://www.thepacker.com/article/retail-produce-sales-rising-amid-coronavirus-concerns?>). Accessed March 23, 2020.
- O'Malley, O. 2020. Coronavirus: Many large grocery chains experiencing online order delays. *GlobalNews*. (<https://globalnews.ca/news/6737747>). Accessed March 27, 2020.
- Okrent, A.M., and J.M. Alston. 2011. *Demand for Food in the United States: A Review of the Literature, Evaluation of Previous Estimates and Presentation of New Estimates of Demand*. Berkeley, CA: Giannini Foundation of Agricultural Economics Monograph 48. Available at: <http://giannini.ucop.edu/Monographs/48-FoodDemand.pdf>

- Pozzi, A. (2012). Shopping cost and brand exploration in online grocery. *American Economic Journal: Microeconomics*, 4(3), 96-120.
- Richards, T. J., & Patterson, P. M. 1998. Hysteresis and the shortage of agricultural labor. *American Journal of Agricultural Economics*, 80(4), 683-695.
- Richards, T. J. 2018. Immigration reform and farm labor markets. *American Journal of Agricultural Economics*, 100(4), 1050-1071.
- Statista. 2020a. Monthly import value of fruit, nuts and vegetables in Canada from 2014 to 2019. (<https://www.statista.com/statistics/466174>). Accessed March 27, 2020.
- StatsCan. 2020a. Channels of distribution for horticulture product sales and resales. (<https://www150.statcan.gc.ca/t1/tbl1/en>). Accessed March 27, 2020.
- StatsCan. 2020b. NAICS for fruit and vegetable preserving and specialty food manufacturing. (<https://www.ic.gc.ca/app/scr/app/cis/manufacturing-fabrication/3114>.) Accessed on March 27, 2020.
- USDA, Foreign Agricultural Service. 2018. GAIN Report: Global Agricultural Information Network. Washington, DC.
- USDA, Economic Research Service. 2020a. Food Dollar Series (<https://www.ers.usda.gov/data-products/food-dollar-series/>) Accessed March 22, 2020.
- USDA, Economic Research Service. 2020b. Farm Labor (<https://www.ers.usda.gov/topics/farm-economy/farm-labor/#employment>). Accessed March 23, 2020.