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Introduction

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) administers an annual Food Safety Monitoring (FSM) program to test samples of Ontario produce, apple cider, sprouted seeds, in-shell nuts, minimally processed and processed fruits and vegetables for chemical and/or microbial contamination.

This page describes how OMAFRA collects and assesses samples, and includes a summary of the program's testing results from the past five years. For information about the ministry's sampling programs for maple syrup or honey, please see the page entitled "OMAFRA's Honey Monitoring Program and Results" and "OMAFRA's Maple Syrup Monitoring Program and Results."

Sample Collection

Samples of produce are collected by OMAFRA inspectors who are appointed under Ontario Regulation 119/11 of the *Food Safety and Quality Act, 2001*. Samples are randomly collected from points of sale, processors and distribution centers across the province; including retail stores, roadside stands, farmers' markets, warehouses and farm gate. All samples undergo laboratory analysis by the University of Guelph's Agriculture and Food Laboratory for one or more types of contaminants.

All samples are collected and transported according to strict sampling and transportation protocols to ensure that sample integrity and chain of custody are maintained throughout the collection and testing process.

Sampling Plan Design

The FSM program consist of two parts:

1. Routine monitoring

2. Compliance sampling

Routine Monitoring

Under the routine monitoring program, samples of fresh produce, minimally processed or processed produce, sprouts and apple cider are collected randomly from a variety of producers or processors across the province. A sampling plan specifies the commodity types and the number of samples to be collected from each county; but does not specify the collection locations. Collection locations and producer operations are randomly chosen by the inspector. The ministry develops this sampling plan each year using a risk-based approach which considers several factors when determining the types and quantities of produce to be tested. These factors include:

1. Dietary importance/consumption patterns
2. How commodities are consumed (raw, cooked)
3. Worldwide outbreak data
4. Program testing data from previous years
5. Production volumes in Ontario
6. History of non-compliance

If a sample tests positive for a pathogen, chemical or other contaminant at a level that exceeds the limit set by Health Canada, program staff follow-up with the producer (see "Compliance Activities" below) and the producer is then moved to the compliance sampling part of the program.

Compliance Sampling

Rather than sampling randomly from various producers across the province, compliance sampling involves the collection of samples from specific producers. These producers are identified based on their history of non-compliance. Samples are collected from these producers until they have maintained two consecutive years of compliant results for their products. The producer is then removed from the compliance sampling program. These producers may be sampled again under the routine monitoring part of the program.

Types of Laboratory Analysis

Samples are analyzed by the University of Guelph's Agriculture and Food Laboratory for one or more of the following:

- Microbial contaminants (e.g., *Salmonella* spp., *E. coli*, *Campylobacter*)
- Agricultural chemical residues (i.e., pesticides)
- Toxins (patulin or aflatoxins)
- pH
- Water activity

Laboratory Results and Compliance Activities

All producers receive a letter that details the testing results for their sample(s).

When contaminant levels above Health Canada's acceptable limits are detected, the producer is immediately notified by OMAFRA staff. Arrangements are made for an OMAFRA Risk Management Specialist to follow-up with the producer to help identify the cause(s) of the contamination and suggest corrective actions. Results which pose a potential food safety risk are also reported to the Canadian Food Inspection Agency (CFIA) for possible follow-up action. The CFIA is responsible for conducting risk assessments of the product and determining if a recall is required. The Ministry of Health may also be notified.

Food Safety Monitoring Program Results 2014 - 2018

This section summarizes the results of OMAFRA's FSM program from the past five years. The results from this program are not statistically viable and cannot be used to generalize the state of the produce industry.

The summary is organized by commodity type as follows:

1. Fresh fruit and vegetables
2. Sprouted seeds

3. Minimally processed fruits and vegetables
4. Apple cider
5. Processed products
6. In-shell nuts

1. Fresh Fruit and Vegetables

Whole, harvested fruits and vegetables that were offered for sale or intended for sale were tested for either microbial contaminants or agricultural pesticide residues. The tables below detail the specific produce types and the quantity tested over the past five years; followed by a summary of any adverse results found.

Fruits and Vegetables Tested for Microbial Contaminants

Samples were tested for microbial contaminants including generic *E. coli*, Shigatoxigenic *E. coli*, *Salmonella* spp., and *Campylobacter*.

Table 1: Number and types of fresh fruits and vegetables analyzed for microbial contaminants from 2014 to 2018.

Fruit or Vegetable Type Tested	2018	2017	2016	2015	2014
Apples	17	30	N/A	N/A	N/A
Asian Vegetables	20	N/A	N/A	N/A	N/A
Basil	61	N/A	N/A	N/A	14
Beans	30	N/A	N/A	N/A	N/A
Broccoli	52	50	52	45	42
Cantaloupe	15	N/A	N/A	N/A	N/A
Carrots	45	53	67	79	82
Cauliflower	11	N/A	N/A	31	N/A
Celery	9	8	N/A	N/A	N/A
Cherry	15	N/A	N/A	N/A	N/A
Cilantro	46	N/A	N/A	N/A	8
Field cucumber	33	73	76	68	N/A
Fresh herbs	N/A	23	25	21	N/A
Green Onions	20	20	N/A	N/A	62
Kale/Spinach	103	49	54	50	41
Lettuce	119	107	115	119	117
Microgreens	22	19	20	20	18
Other	1	1	N/A	2	5
Parsley	54	32	26	32	30
Pears	9	N/A	N/A	N/A	N/A
Peas	22	N/A	N/A	N/A	N/A
Raspberries/Blueberries	55	52	47	45	41
Strawberries	49	400	106	121	125
Sweet Pepper	32	55	49	N/A	N/A
Tomatoes	49	108	113	116	126
Watermelon	10	N/A	N/A	N/A	N/A
Annual Total	899	780	750	749	711

2018: Eleven samples tested positive for generic *E. coli* levels greater than Health Canada's allowable level. Two were cilantro, three lettuce, two parsley, two spinach, one carrot and one celery. One sample of basil tested positive for *Campylobacter*.

2017: Two lettuce and one spinach sample contained generic *E. coli* levels greater than Health Canada's allowable level. One of the leaf lettuce samples was also positive for Shigatoxigenic *E. coli*.

2016: Four samples tested positive for generic *E. coli* levels greater than Health Canada's allowable level. The sample types were lettuce, broccoli, carrots and parsley. One sample of lettuce tested positive for *E. coli* spp.

2015: Six samples tested positive for generic *E.coli* levels greater than Health Canada's allowable level. The sample types were lettuce, spinach, dill, cilantro, parsley and carrot.

2014: Seven samples tested positive for generic *E.coli* levels greater than Health Canada's allowable level. Three of the samples were spinach and one sample each of lettuce, raspberries, broccoli and basil.

Fruits and Vegetables Tested for Chemical Contaminants

Samples were tested for the presence of more than 500 agricultural chemical (pesticide) residues. Chemical levels were compared to the allowable limits set by Health Canada under the *Pest Control Products Act*. These limits are unique to each chemical/commodity type. The table below summarizes the number and type of fresh fruits and vegetables analyzed for chemical residues 2014-2018.

Table 2: Number and types of fresh fruits and vegetables analyzed for chemical residues from 2014 to 2018.

Fruit or Vegetable Type Tested	2018	2017	2016	2015	2014
Apples	9	13	17	25	18
Asian Vegetables	14	5	N/A	1	N/A
Basil/Cilantro	51	6	5	N/A	N/A
Beans	12	20	35	N/A	N/A
Bell Pepper	23	11	1	45	35
Broccoli	11	N/A	1	40	35
Celery	N/A	7	N/A	N/A	N/A
Corn	N/A	N/A	N/A	N/A	36
Cucumber	N/A	20	35	44	N/A
Kale	68	33	28	24	N/A
Lettuce	30	N/A	N/A	53	46
Green Onions	11	5	N/A	N/A	N/A
Other	N/A	N/A	N/A	N/A	5
Parsley	43	N/A	N/A	N/A	N/A
Peach	13	N/A	N/A	N/A	N/A
Raspberries	11	24	27	N/A	N/A
Spinach	43	11	15	18	25
Strawberries	11	27	N/A	N/A	N/A
Tomatoes	N/A	18	36	N/A	N/A
Annual Total	350	200	200	205	200

2018: 31 samples contained chemical residue levels above Health Canada's allowable limits: 14 parsley, seven kale, five basil, two cilantro, one strawberry, one raspberry and one spinach. Two of the kale and one parsley contained two chemical residue levels above Health Canada's allowable limits.

2017: Eight samples contained chemical residue levels above Health Canada's allowable limits; four kale, one wax bean, one bell pepper, one bok choy and one cilantro.

2016: Five samples contained chemical residue levels above Health Canada's allowable limits; two kale, two raspberries and one basil.

2015: Four samples contained chemical residue levels above Health Canada's allowable limits; two bell peppers and two kale.

2014: Four samples contained chemical residue levels above Health Canada's allowable limits; two lettuce, one arugula and one bell pepper.

2. Sprouted Seeds

Sprout samples were collected from sprouting facilities across the province. Five samples were collected during each visit. All samples were tested for the presence of coliforms, generic *E.coli*, *Listeria monocytogenes*, *Salmonella* spp., and Shigatoxigenic *E. coli*. Table 3 below summarizes the number of sprout facilities sampled and the total number of samples collected each year. A yearly summary of samples that tested positive for one of the above pathogens or contained pathogen levels above Health Canada's allowable levels is provided below.

Table 3: Sprout samples tested for microbial contaminants from 2014 to 2018.

	2018	2017	2016	2015	2014
Total Samples Collected	180	220	180	175	165
Number of sprout facilities samples	16	20	20	19	17

2018: One sample was positive for *Listeria monocytogenes*.

2017: 220 samples were collected from 20 different sprout facilities. All samples tested negative for microbial contamination.

2016: 180 samples were collected from 20 different sprout facilities. All samples tested negative for microbial contamination.

2015: 175 samples were collected from 19 different sprout facilities. Three samples tested positive for *Listeria monocytogenes*.

2014: 165 samples were collected from 17 different sprout facilities. Two samples tested positive for *Listeria monocytogenes* and five samples tested positive for *Salmonella* spp.

3. Minimally Processed Fruit and Vegetables

Minimally processed fruits and vegetables are fruits and vegetables that have been peeled, cut, sliced or shredded in order to prepare and package it for sale as ready-to-eat or ready-to-cook. Examples of minimally processed include bagged chopped salad or packages of sliced mushrooms. Minimally processed samples were tested for the presence of generic *E. coli*, *Listeria monocytogenes*, *Salmonella* spp. and Shigatoxigenic *E. coli*. Table 4 below shows the number of minimally processed samples tested each year and the number of samples that either tested positive for one of the above pathogens or contained pathogen levels above Health Canada's allowable limit.

Table 4: Minimally processed samples tested for microbial contaminants from 2014 to 2018.

Minimally Processed Commodity Type	2018	2017	2016	2015	2014
Apples	1	N/A	N/A	1	5
Beets	N/A	1	N/A	N/A	N/A
Bell Pepper	2	3	7	7	6
Broccoli	3	4	4	7	8
Cabbage	7	6	9	5	6
Cantaloupe	N/A	1	1	1	5
Carrots	11	16	14	19	21
Cauliflower	1	3	N/A	2	6
Celery	3	5	5	6	12
Cucumber	N/A	N/A	1	N/A	N/A
Grapes	N/A	N/A	2	N/A	N/A
Honeydew	1	2	1	1	5
Kale	4	5	3	5	N/A
Leek	2	1	N/A	N/A	N/A
Lettuce	3	4	5	9	19
Mixed fruits	N/A	N/A	N/A	3	N/A
Mixed greens	1	1	N/A	N/A	1
Mixed vegetables		2	2	5	5
Mushrooms	19	22	22	33	40
Onions	4	1	5	4	10
Radicchio	1	1	N/A	N/A	N/A
Rutabaga	1	N/A	N/A	N/A	N/A
Spinach	1	N/A	N/A	N/A	N/A
Tomatoes	2	2	N/A	2	2
Watermelon	1	N/A	N/A	N/A	N/A
Zucchini	2	N/A	N/A	N/A	N/A
Annual Total	70	80	81	110	151

2018: 70 samples were collected from 29 processing facilities in Ontario. All samples tested negative for

microbial contamination.

2017: 80 samples were collected from 29 processing facilities in Ontario. All samples tested negative for microbial contamination.

2016: 81 samples were collected from 27 processing facilities in Ontario. All samples tested negative for microbial contamination.

2015: 110 samples were collected from 35 processing facilities in Ontario. One sample of shredded cabbage tested positive for generic *E. coli* above Health Canada's allowable level.

2014: 151 samples were collected from 39 processing facilities in Ontario. All samples tested negative for microbial contamination.

4. Apple Cider

Samples of pasteurized, UV treated, and unpasteurized apple cider were tested for patulin (a toxin produced by mould) and microbial contamination (*Shigatoxigenic E. coli*, *Salmonella* spp., *Cryptosporidium*). A summary of the results from each year are summarized below.

Table 5: Number of apple cider samples tested 2014-2018.

	2018	2017	2016	2015	2014
Total samples collected	50	50	50	50	50

2018: 50 samples were collected. Five samples contained patulin levels greater than Health Canada's allowable level.

2017: 50 samples were collected. One sample contained patulin at a level greater than Health Canada's allowable level. One sample was positive for *Cryptosporidium*.

2016: 50 samples were collected. Three samples contained patulin levels greater than Health Canada's allowable level.

2015: 50 samples were collected. Two samples contained patulin levels greater than Health Canada's allowable level.

2014: 50 samples were collected. Two samples contained patulin levels greater than Health Canada's allowable level. One recall was initiated by the Canadian Food Inspection Agency as a result from this testing.

5. Processed Products

Processed fruits and vegetables are canned or preserved (e.g. pickled vegetables, fruit butters and salsas). All processed products are tested for pH, mesophiles and water activity to determine if these factors could support the growth of *Clostridium botulinum*. Results from 2014 to 2018 are summarized below.

Table 6: Number of processed product samples tested 2014-2018.

	2018	2017	2016	2015	2014
Total samples collected	150	125	95	350	73

2018: No food safety concerns were identified.

2017: One sample of mushroom soup had a pH and water activity that could support the growth of *Clostridium botulinum*. A Class 1 recall was initiated by the Canadian Food Inspection Agency for this product.

2016: One sample of black bean and yam chili had a pH and water activity that could support the growth of *Clostridium botulinum*. A Class 1 recall was initiated by the Canadian Food Inspection Agency.

2015: No food safety concerns were identified.

2014: No food safety concerns were identified.

6. In-shell Nuts

Samples of in-shell nuts were collected from nut producers across the province. Starting in 2016, multiple samples were collected during each visit. Nut types included hazelnuts, walnuts, pecans and chestnuts. All samples are tested for Shigatoxigenic *E.coli*, *E.coli* O157, *Salmonella* spp. and aflatoxins. Results from 2015 to 2018 are summarized below.

Table 7: Number of nut samples and nut producers tested 2015-2018

	2018	2017	2016	2015
Total samples collected	35	25	3	5
Number of nut producers samples	4	4	1	5

2018: All samples tested negative for microbial contamination and aflatoxins.

2017: All samples tested negative for microbial contamination and aflatoxins.

2016: All samples tested negative for microbial contamination and aflatoxins.

2015: All samples tested negative for microbial contamination and aflatoxins.

Additional Resources

The *Food Safety and Quality Act, 2001* and Ontario Regulation 119/11 can be found at www.e-laws.gov.on.ca. To obtain FSM program results from prior to 2014, please contact OMAFRA's Food Safety Inspection Delivery Branch at 1-877-424-1300 or email fpo.omafra@ontario.ca.

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