

# FARE Share

Sharing valuable insights

## What's Inside?

This issue of *FARE Share* features research about barriers to adoption of precision agriculture technology on farms in both Canada and the United States.

Next up is a collection of consumer-related food studies – from the impacts of expiry date and nutrition warning labels to the influence of menu design on choice. A follow-up article about the GM food acceptance is also included in this edition.

You'll also read about the benefits of trade diversification and Canadian agri-food exports to Asia.

Stay safe and healthy.

**Contact:**  
**Getu Hailu**  
**Editor, *FARE Share***  
**ghailu@uoguelph.ca**

*The FARE Share Newsletter features research and analysis from faculty and students in the Institute for the Advanced Study of Food and Agricultural Policy in the Department of Food, Agricultural and Resource Economics (FARE).*



## Precision Ag Adoption

*By: Nicholas Bannon, FARE Undergraduate Student and Recipient of the 2018 University of Guelph President's Scholarship; Sean Mitchell, Undergraduate Student and Recipient of the 2016 University of Guelph Chancellor's Scholarship; and Alfons Weersink, Professor, FARE*

Farm size, crop types, topography, climate and labour use are some of the differences between farming operations located in Ontario, the Prairies, and in the Midwest U.S. Surprisingly, despite these differences, farmers in these regions face nearly identical barriers to further adoption of precision agriculture technologies.

To determine the level of adoption for precision agriculture technology in crop production, surveys were distributed to input suppliers including members of the Ontario Agri-Business Association (OABA) and Canadian Association of Agri-Retailers (CAAR).

One question asked respondents their perception of various barriers that prevent their customers (i.e., farmers) from adopting precision agriculture technologies and services.

### Similarities across regions

Not only was the percentage of respondents who 'agreed' or 'strongly agreed' that each factor was a barrier in producer adoption of precision agriculture technologies similar across regions, but the exact rankings of the barriers, especially

the largest barriers, between regions are almost indistinguishable.

The three most-agreed-upon barriers for further adoption were identical for the Prairies, Ontario and the Midwest U.S. The most important barriers to adoption across all regions were:

1. Pressure on farm incomes preventing precision agriculture use;
2. Cost of precision agriculture technologies and services is greater than the benefit received; and
3. Lack of producer confidence in the agronomic recommendations made based on the data generated by site-specific data.

The order of the remaining barriers was commonly only one spot below or above the ranking of the same barrier in the Prairies. For example, 'interpreting and making decisions with precision agriculture takes too much time' was ranked as the fourth-largest barrier for producers in the Prairies, and the fifth-largest barrier for producers in Ontario and the Midwest U.S.

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# Menus & Consumer Choice



*By: Andrew Baynham, Research Associate; Yeyang Zhang, M.Sc. Graduate Student; Michael von Massow, Assoc. Professor and OAC Chair in Food Systems Leadership; Yu Na Lee, Assistant Professor, FARE*

The modern menu looks vastly different from historical versions. Early menu designer, William Doerfler, highlighted it was not necessarily the most popular items that should be placed in high-traffic areas but a promotion or higher-margin item that is not quite as popular. Recent literature has continued to focus on the end choice, but not how a consumer arrives at that choice. Our research focuses on how people are moving through the menu and how information can affect the different search dynamics displayed by consumers.

options were observed most often directly after an unhealthy option. Participants who chose healthier entrées, on average, took a longer time to scan the menu and consider more information than their counterparts.

## **Nutrition labels affect choice**

Through an additional eye-tracking study, we examined how nutrition information labeling on restaurant menus affects consumers' choices. Do consumers notice the numeric calorie information on chain restaurant menus, and do they use that information to reduce their calorie intake?

## **“Do consumers notice the numeric calorie information on chain restaurant menus, and do they use that information to reduce their calorie intake?”**

In this research, we present one of four menu labeling schemes (i.e., numeric calorie labels, percent daily value labels, traffic light labels, and physical activity equivalent labels) to each participant. Eye-tracking results show that ‘traffic light’ and ‘physical activity calorie equivalent’ labels increase consumers’ visual attention compared to ‘numeric calorie’ labels. However, this is not necessarily related to the use of labels and may not change consumers’ food choices.

Regression results give us a different understanding that the participants found ‘percent daily value (%DV)’ labels were significantly more useful since Canadian consumers were more familiar with the expression of %DV format. This demonstrates that Canadian consumers are significantly more affected by %DV labels than other labeling formats, and unfamiliarity of other labeling formats would reduce the influence on choosing foods with lower calories. This provides evidence that calorie information can be another tool to be used by the consumer for narrowing down their choice set.

## **“Canadian consumers are significantly more affected by %DV labels than other labeling formats, and unfamiliarity of other labeling formats would reduce the influence on choosing foods with lower calories.”**

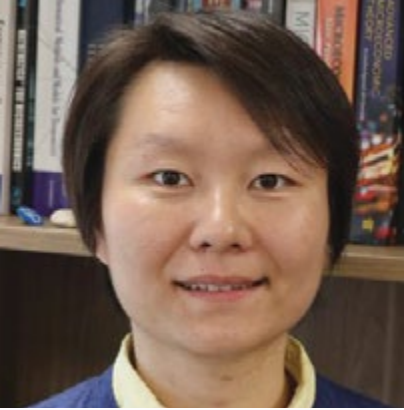


## **Eye-tracking experiments**

Do you narrow down choice first from price then calorie information, or do you have a predetermined choice before glancing at the menu? We use multiple eye-tracking experiments to understand how and what information affects a consumer. Our research uses Markov chain transition matrix and regression techniques to understand how this dynamic plays out.

Preliminary results from the transition matrix suggest that there are two main effects at play. First, price is used more as a secondary criterion for reducing the choice set. This could be because price is typically considered before a consumer enters the restaurant, and consumers, therefore, have an idea of the price range they are opting into before they see a menu.

Second, there is a comparison happening between entrées that are considered healthy and ones that are unhealthy. The healthier



# Impact of Expiration Dates

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## Precision Agriculture Adoption

Interestingly, the only noticeable difference in the ranking was that respondents from the Midwest U.S. ranked the barrier ‘soil types in their area limit the profitability of precision agricultural practices for producers’ as the fourth-largest barrier to adoption; Prairies respondents ranked this barrier sixth, and Ontario respondents ranked it seventh. The difference between the ranking of this barrier in the Midwest U.S. and Ontario is most interesting. The two areas have similar crop rotations (i.e., largely corn and soybeans), so it was expected that the influence soil types have on precision agriculture adoption would have been more similar between those two regions.

Overall, the barriers preventing more farmers from adopting precision agriculture technologies is similar between the Prairies, Ontario and the Midwest U.S., despite the differences in the structure of farms.

The high adoption rates for certain categories of precision agriculture technologies, such as guidance systems and observational mapping, are due to the value provided to farmers relative to the cost. In contrast, the uptake for variable rate technologies is lower due to the high upfront costs and the benefits that are less certain. Regardless of the net benefits, low crop prices will slow the adoption of new technologies.

Source: Food Focus Guelph

By: Tongzhe Li, Assistant Professor, FARE; Kent D. Messer, University of Delaware; Harry M. Kaiser, Cornell University

Food retailers have long used expiration dates to convey positive messages about product quality and mitigate consumer concerns about food safety. However, according to the Natural Resources Defense Council (NRDC), many people are throwing out perfectly safe food mainly because they do not understand what the stamped date does and does not mean.

**“This is of interest to both food retailers and policy makers because it has implications for reducing food waste, and improving retailer profitability and consumer welfare.”**

This study has two objectives. First, we investigate how the presence of expiration dates affects consumer preferences for perishable food products by comparing preferences for the date-labeled products with preferences for products with no marked expiration date. We are particularly interested in seeing whether the existence of expiration dates changes consumer preferences both before and after the date is reached. Second, we examine the effects of three different types of expiration dates – ‘best if used by,’ ‘use by,’ and ‘expires on’ – on consumer preferences. This is of interest to both food retailers and policy makers because it has implications for reducing food waste, and improving retailer profitability and consumer welfare.

We draw inferences from a pre-registered experiment; in consultation with industry stakeholders and no deception is used. The analysis is based on a framed field experiment involving 373 adult subjects who participated in a reverse

Becker–DeGroot–Marschak (BDM) auction designed to elicit consumers’ willingness to accept yogurt smoothies of various known ages (before, on, and after the expiration date) with and without expiration date labeling. This experiment sheds light on several issues related to expiration date impacts.

### Dates affect consumer preference

The main finding is that expiration dates influence how consumers devalue perishable food products when the age of the product increases. Without the presence of an explicit expiration date, consumers have a steady, constant-rate negative trend in their devaluation of perishable food as it ages. However, the introduction of an expiration date label significantly changes consumer preferences for the aging product. The expiration date stigmatizes the product after it passes the date, as the level of concern displayed by consumers is not consistent with the scientific risk of the product at that age. Relative to the same product with no expiration date label, consumers perceive the labeled product to be of lower quality or less safe once it ‘expires.’

The presence of the expiration dates also changes consumer preferences for the product before the expiration date is reached. In this case, consumers are more willing to consume the product with an expiration date perhaps because it signals a guarantee of quality or safety. We also find that different labels dates – ‘best if used by,’ ‘use by,’ and ‘expires on’ – resulted in similar reactions.

Since most products sold in the market have not passed their expiration dates, expiration date labels likely increase consumer welfare. Nevertheless, it will be important to design market strategies for products that are ‘expired’ but are still safe to consume.





# Trade Diversification and Canadian Agri-Food Exports

*By: Rakhal Sarker, Associate Professor; Saneliso Mhlanga, Research Assistant; and Monika Bischof, Undergraduate Student, FARE*

Sustainable economic growth and development in Canada, a trading nation, can be achieved through export diversification. This can take the form of adding new products to the existing portfolio of exports, breaking into new markets with the existing exports, or a combination of the two. Export diversification can enhance productivity, induce trade-promoting externalities and facilitate faster moves into value-added production. It can also reduce risk and stabilize export earnings. All these factors can contribute to additional macroeconomic stability in Canada.

It is widely believed that there is enormous potential for further economic progress in Canada through export diversification. To this end, Canada signed and implemented 14 regional and bilateral trade agreements. One of the most recent is the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), a free trade agreement between Canada and 10 other countries in the Asia-Pacific region: Australia, Brunei, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore and Vietnam.

While the CPTPP provides Canada with preferential access to key markets in Asia and Latin America, little is known about the extent of these trade benefits to Canada's agri-food sectors. How would the CPTPP change the dynamics of agri-food trade between Canada and major Asian countries such as China, India, Bangladesh, and Vietnam? These countries experienced rapid growth in population and per capita income in recent years and represent emerging destinations for Canadian agri-food exports with significant growth potential.

What are the key agri-food commodities exported to and competitive in these Asian countries? What can be done to maintain and enhance the competitiveness of Canada's agri-food exports in these markets? What needs to be done to create additional agri-food trade opportunities in these markets? While these are the central issues being investigated under this project, we focus on just one issue in this report. Have agri-food exports from Canada to these Asian countries become more diversified over time? We explored this question using quarterly data from 1990:1 to 2018:4.

Note, however, export growth and export diversification across countries is often uneven due to differences in resource base, import needs, capacity to import, technology and productivity. In addition, trade policy in each country evolves through time in response to changes in economic, political and social environments. Despite trade rules prescribed by the World Trade Organization (WTO), countries continue to impose trade barriers.

**“Despite all these factors potentially influencing agri-food trade patterns between countries, the degree of export diversification reveals how destination-specific exports may have become less vulnerable through time.”**



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High tariffs are permitted for some products in many countries. Rising domestic support in large exporting and importing countries also undermine a level playing field for trade in agri-food commodities. Moreover, sanitary and phytosanitary (SPS) measures and technical barriers to trade can also influence the growth in trade over time. Despite all these factors potentially influencing agri-food trade patterns between countries, the degree of export diversification reveals how destination-specific exports may have become less vulnerable through time.

### **Assessing export diversification**

We use the Herfindahl-Hirschman Index (HHI) to assess export diversification in select Asian countries. A country with a perfectly diversified export portfolio will have an index close to zero, while a country that exports only one product will have a value of 1 (the least diversified).

Results show that China is the most diversified country, followed by Bangladesh, Vietnam and, lastly, India. China’s economic growth has been much faster than the economic growth of the

three other countries. Furthermore, China’s domestic agricultural policies and trade policies have also changed more rapidly over the past few years than those in comparison.

Our results reveal that export diversification to these Asian countries suffered a setback during the financial crisis. The extent of this setback, however, varies across countries. It was the worst in Vietnam, followed by China, Bangladesh and India. It is also worth noting that agri-food exports from Canada to these Asian countries became more diversified after the financial crisis than before. Finally, the rate of export diversification varies across four destinations. This is very encouraging news for agri-food exporters from Canada.

While COVID-19 pandemic has the potential to change agri-food trade patterns across countries, the experiences of the last few months suggest that as long as Canada proactively maintains its position as a consistent supplier of quality agri-food commodities, it is likely to strengthen trade relationships between Canada and most countries in Asia and South America.

## **GM Food Acceptance**

*By: Emma Burger, MSc Student; Andreas Boecker, Associate Professor and Chair; and Yu Na Lee, Assistant Professor, FARE*

As a follow-up to the study in the August 2020 edition of *FARE Share*, we now report on how the participants’ emotional responses to the hypothetical ‘Always Green Avocado’ are connected to their purchasing intentions, and how the impact of information on purchase intentions differed between segments.

After all participants received a statement about benefits associated with delayed browning, they were randomly assigned to one of five information statements

1. **Product parity assurance** indicated that taste and nutrition of the ‘Always Green Avocado’ was the same as conventional varieties and was hypothesized to impact purchasing intention positively.
2. **Supply chain benefits** highlighted increased profits to producers and grocery stores from the increased shelf life of the product and was hypothesized to impact purchasing intentions negatively by suggesting GM foods benefit businesses and not consumers.
3. **Significant time requirements for risk assessment and approval** was hypothesized to positively impact purchasing intentions by suggesting thorough and diligent testing.
4. **Data requirements for risk assessment and approval** described the parties involved in the process and stated the

absence of required independent testing; it was hypothesized to impact purchasing intentions negatively.

5. **Control:** No further information.

The first analysis of sample-wide information effects suggested that exposure to the ‘Product Parity Assurance’ statement would significantly increase purchase likelihood. However, the inclusion of segment-specific effects revealed that the Product Parity Assurance statement significantly increased the purchase intentions of two segments only, Technology Opposers and Conflicted Consumers (exhibiting both strong positive and strong negative affect), while purchase intentions of the Enthusiastic Consumers were not affected. Exposure to the ‘Data Requirements for Risk Assessment and Approval’ statement positively influenced the purchase intentions of the Conflicted Consumers but was not found to have a significant impact in the first analysis.

In conclusion, distinct emotional response patterns to a purchase decision situation were found to prompt a clear predisposition to either reject or accept GM food or to make consumers more receptive of information, in particular when assuring the parity of GM food quality with that of conventional food.



# Effectiveness of Nutrition Warning Labels

By: *Laura Stortz, M.Sc. Student; Yu Na Lee, Assistant Professor, FARE; and Michael von Massow, Assoc. Professor and OAC Chair in Food Systems Leadership*

Two-thirds of Canadians are overweight or obese, according to Statistics Canada. Health Canada estimates the annual cost of obesity to Canadian taxpayers is about \$6.6 billion. As part of Canada's Healthy Eating Strategy, the federal government proposed a mandatory Front-of-Package (FOP) warning label for foods with 'high' levels of saturated fat, sugar or sodium to combat obesity. The warning labels apply to pre-packaged food products that contain 15% or more of daily suggested values of saturated fat, sugar or sodium and specify which of the nutrients the product is 'high in.'

To test the effectiveness of the warning label, we ran an experiment with 202 participants at a mock grocery store on the University of Guelph campus. In addition to a broad sample, we focused on achieving representation from marginalized groups within the Guelph area. Half of our participants shopped in the store without the FOP warning labels and the other half shopped in the store with warning labels attached on the qualifying 'high in' products. To address hypothetical bias, we made each participant pay for and take home a randomly selected item from their basket out of the \$20 compensation for her/his participation. We had a total of 457 items including some refrigerated products, but most products were prepackaged.

**“The probability that a ‘high in’ product is chosen decreases by approximately 21% when the FOP warning label is applied to the ‘high in’ product, compared to the situation wherein no warning label is applied...”**

We find that the proposed labelling does have the intended effect on reducing demand for foods 'high in' sugar, sodium or saturated fat overall. Individuals in our treatment group shop in the store where the labels are added to products that qualify. The probability that a 'high in' product is chosen decreases by approximately 21% when the FOP warning label is applied to the 'high in' product, compared to the situation wherein no warning label is applied.

Higher educational attainment, higher income, interest in nutrition facts information, greater aversion to risk, and lower confidence in numeracy skills all increase the effectiveness of the label.

We do not, however, find enough evidence to support that the labels aid participants who are overweight or obese, or those who report to make efforts to reduce consumption of fat, sugar or sodium. We find that recent immigrants are less likely to buy 'high in' items in comparison to those who have spent ten or more years in Canada. This is consistent with the theory of the healthy immigrant effect present in Canada and other developed countries.



## Mixed results across product categories

The effectiveness of warning labels is not equal across all product categories. We find evidence that the 'high in' labels significantly reduce demand for 'high in' tomato sauce, popcorn, and chocolate milk among the 36 food categories in our study. The labels on yogurt and granola bars did not deter purchases despite their likely nutritional ambiguity. Previous research finds that nutritionally ambiguous products, when it is not clear whether a product is healthy or not, see greater impacts from warning labels. The dairy industry has been opposed to the labels and our findings confirm the industry's fears that the label may decrease demand for chocolate milk. However, we do not find that the demand for yogurt was affected.

FOP warning labels appear to reduce the purchase of products high in salt, sugar and/or saturated fat which meets the policy objective. Given our mixed results across product categories, further studies that focus on specific food categories are needed to better inform the food processing industry of potential consumer responses.



University of Guelph  
Department of Food, Agricultural  
and Resource Economics (FARE)  
J.D. MacLachlan Building  
Guelph, Ontario, Canada N1G 2W1  
Telephone: 519-824-4120 x53625

<https://www.uoguelph.ca/fare/>