LMC International

The Economic Impact of Canola on the Canadian Economy

Report for:

Canola Council of Canada
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Research and analysis to inform your business decisions

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Introduction

The Canola Council of Canada commissioned LMC International to undertake research and analysis to quantify the benefit of canola to the Canadian economy in terms of:

1. **Economic impact**
2. **Number of people dependent on the sector**
3. **Wages**

This study provides the results of that independent analysis.

We focused specifically on the production of canola and canola products, spanning eleven steps in the value chain: from canola seed and trait development through canola farming and processing to the delivery of value added by-products to end users or ports of export. We also included the economic impact to the livestock sector of the benefits of using canola meal.

The results capture:

1. The ***direct*** benefit from these stages.
2. The ***indirect*** benefit from the associated economic and market activities and industries.
3. The ***induced*** benefit from household spending of the income earned from the canola sector.

The objective was to develop an up-to-date assessment, using:

- Official data as much as possible.
- The latest data for 2014/15 and previous years (which are officially revised over time).
- Interviews with industry participants.
- Best practice in estimating economic benefits.

This study

The analysis aimed both to update and to enhance our previous exercises on the same subject so as to provide the most accurate and independent assessment possible. To this end, we incorporated newly-available sources of data in our latest research, we took guidance on past and current trends from industry participants, and we applied the most recent Statistics Canada multipliers to arrive at our totals.

The totals sum the indirect and induced impacts of the canola industry with the direct impacts.

We have applied the most recent multipliers to develop a consistent series of data back to 2010/11 but have incorporated the results of the previous study, back to 2005/06, to communicate the long-term trends of the sector. Our direct results for the earlier years are comparable to those in the previous study, with small changes reflecting revisions to official data, while our total results reflect the government's most recent multipliers. The new and additional aspects result in a robust, enriched examination of the benefits of canola to the Canadian economy.

- The development over the period is clear: ***canola's benefit to the Canadian economy has continued to trend upwards, even in the face of stabilizing canola acreage and the recent downturn in commodity prices.***

Note: Value throughout the study is presented in Canadian dollars, whether noted as dollars, or with the symbols $ or C$.

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Summary of Results

For the average of the three years, 2012/13-2014/15:

- The total economic impact on the Canadian economy from the canola sector averaged C$26.7 billion per year (Table 5).
- 250,000 people are supported by the canola sector, comprising 177,000 paid jobs (Table 6) and an additional 72,000 family members (beyond the growers themselves) who support and are supported by canola farming operations.
- The total wage impact of the sector averaged C$11.2 billion (Table 7).

The economic benefits from canola demonstrated a jump in 2011/12 coinciding with an increase in commodity prices. Since then, the impacts attributable to the sector have been more steady as the impact of larger crops has been partially offset by lower commodity prices. For 2014/15, the most recent year of our estimates:

- The total economic impact on the Canadian economy from the canola sector was C$26.5 billion per year.
- 254,000 people were supported by the canola sector, including 180,000 paid jobs and an additional 74,000 family members (beyond the growers themselves) who support and are supported by canola farming operations.
- The total wage impact of the sector was C$11.2 billion.

In the decade that has elapsed since 2005/06:

- The economic impact of the canola value chain has increased by C$19.3 billion or over 250%.
- The employment impact of the sector has increased by 41%.
- The total wage impact of the sector has doubled.

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Part A. National Results – Overview

In this study, we have evaluated the impact across the value chain for canola via three different metrics:

- **Economic impact** — quantifying the value added to the Canadian economy across the canola value chain.
- **Employment impact** — estimating the number of full-time equivalent (FTE) jobs contributed by canola production, processing and distribution.
- **Wage impact** — evaluating the total wages for individuals employed along the canola value chain.

For these purposes, we evaluated the canola value chain at eleven distinct steps (Tables 1A and B), tracing the impact through the value-added products of refined oil, crude oil and meal.

- For **refined canola oil**, our analysis terminates at the point where this oil either 1) is produced into margarine, shortening and salad oil within Canada, or 2) is loaded on a ship for overseas export, or 3) crosses from Canada into the United States for overland export.
- Our approach for **crude canola oil** was similar; however, the vast majority of crude oil used in Canada is not delivered to end users — typically, it is refined first, whether into edible oil or biodiesel. The refiner or biodiesel producer is then treated as the *de facto* end user.
- Canola meal is handled in the same manner as oil; however, given the important and quantifiable benefit of canola meal to the livestock sector, we extend our analysis one step further. For meal, we both: 1) evaluate the cost savings for discrete livestock sectors vis-à-vis protein meal alternatives and 2) estimate the value of additional milk yielded by Canadian cows fed a canola ration, given the unique benefits to dairy cattle.

The economic indicators for each step of the canola value chain are presented at two different levels, Direct effects only, and Total effects which is the summation of Direct, Indirect and Induced effects.

- As the name suggests, the **Direct effect** is composed of the economic, employment and wage impacts that can be directly attributed to the canola value chain. These results were calculated first hand by LMC International based on models driven by publicly and privately available data, industry knowledge, and interviews with industry stakeholders.
- **Indirect effects** are the economic, employment and wage impacts created by those industries that supply the canola value chain, or by individuals who work at the periphery of the sector.
- **Induced effects** are those economic, employment and wage impacts that stem from household spending of the income earned from the canola sector.

  Note: Both indirect and induced impacts of the canola sector are estimated based on input-output tables developed by Statistics Canada (StatCan). The use of these multipliers is discussed in greater detail later in the study.

To arrive at Canada-level results, data first needed to be collected and results tallied at the provincial level. Throughout the text of this study, our focus will be national-level results; nonetheless, we will highlight provincial-level data where interesting. The most recent three-year averages of provincial-level results are presented in Part 2 and beginning with Table 9 below.

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Table 1A: Canola economic impact assessment by value chain component

Step number	Value chain component	Description	Economic impact	Employment	Wages	Multiplier used
1	Seed development	Breeding of canola varieties, enhancement of canola genetic materials as well as the manufacture, distribution and sale of canola seed in Canada	captured in canola farming	yes	yes	yes
2a	Canola farming	Production of canola seed by farmers using land and agricultural inputs like seed, fertilizers and crop protection	yes	yes	yes	yes
2b	Farm family members	Unpaid family members who may indirectly support farm operation. Paid family members would be captured under step 2a	captured in canola farming	yes	captured in canola farming	no
3	Elevation	Primary elevation of canola seed	yes	yes	yes	yes
4	Seed delivery	Delivery of seed to crushing facility or point of export via truck, rail and barge	yes	yes	yes	yes
5	Crushing	Crushing canola seed for the manufacture of crude canola oil and canola meal	yes	yes	yes	yes
6	Refining	Refining crude canola oil for use in edible applications	yes	yes	yes	yes
7	Biodiesel production	Production of biodiesel using canola oil feedstock	yes	yes	yes	yes
8	By-product delivery	Delivery of crude oil, refined oil or meal to end user or point of export	yes	yes	yes	yes
9	Impact at ports	Loading ocean-going vessels for overseas export as well as laker vessels for shipments between Ontario and Quebec	yes	yes	yes	yes
10	Benefit to livestock sector	Cost savings associated with using canola meal relative to alternatives and the value of the dairy yield boost associated with canola meal	yes	no	no	yes
11	End users	Impact on major end use- products such as margarine, shortening and salad oil	yes	yes	yes	yes
*	International shipping	We have included estimates for international shipping for interest however these have not been included in the Canada total given that they take place outside the country on vessels that are typically foreign-owned	na	na	na	na

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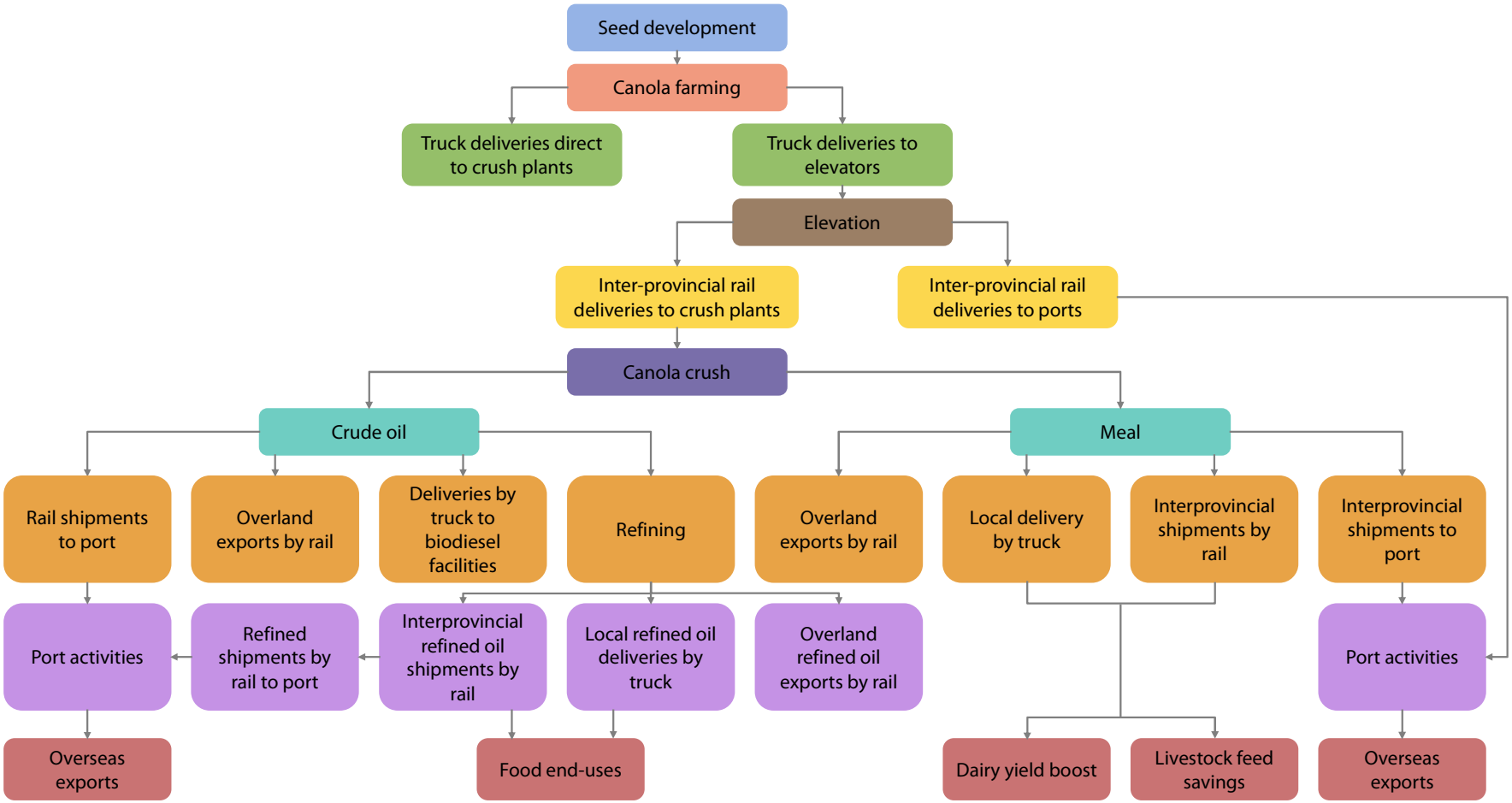
Table 1B: Flow chart of the Canadian canola value chain assessed in this study



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1. Direct-effect results

The direct-effect impacts of canola on the Canadian economy are illustrated in Diagram 1 with the economic impact, employment and wage impact delineated in Tables 2, 3, and 4, respectively.

- Between 2012/13 and 2014/15, **the direct economic impact of canola on the Canadian economy averaged 10.9 billion dollars** (Table 2). Over the past three years, direct economic impacts have deviated from this average only by ± 2.5% as acreage has leveled off (relative to heady levels of growth only a few years ago), and a drop in the value of seed and by-products has been partially offset by an increase in the value associated with transportation and logistics.

- Bucking the overall trend of fewer people employed in agriculture, the direct employment impact across the canola value chain has held steady in recent years. Between 2012/13 and 2014/15, the canola sector was directly accountable for over 74,000 paying jobs, on average (Table 3). When additional canola farm family members, who contribute to the overall success of the farming enterprise, are included, **the number of people directly supported by the canola industry over the same period rose to 147,000**.

- **Between 2012/13 and 2014/15, the direct wage impact of canola on the Canadian economy averaged 3.7 billion dollars** (Table 4). This dollar value includes the canola share of grower revenues and the slightly lower wage total in 2014/15 relative to 2012/13 was mostly a reflection of growers receiving less money for their crop.

Diagram 1: Direct effects of canola on the Canadian economy

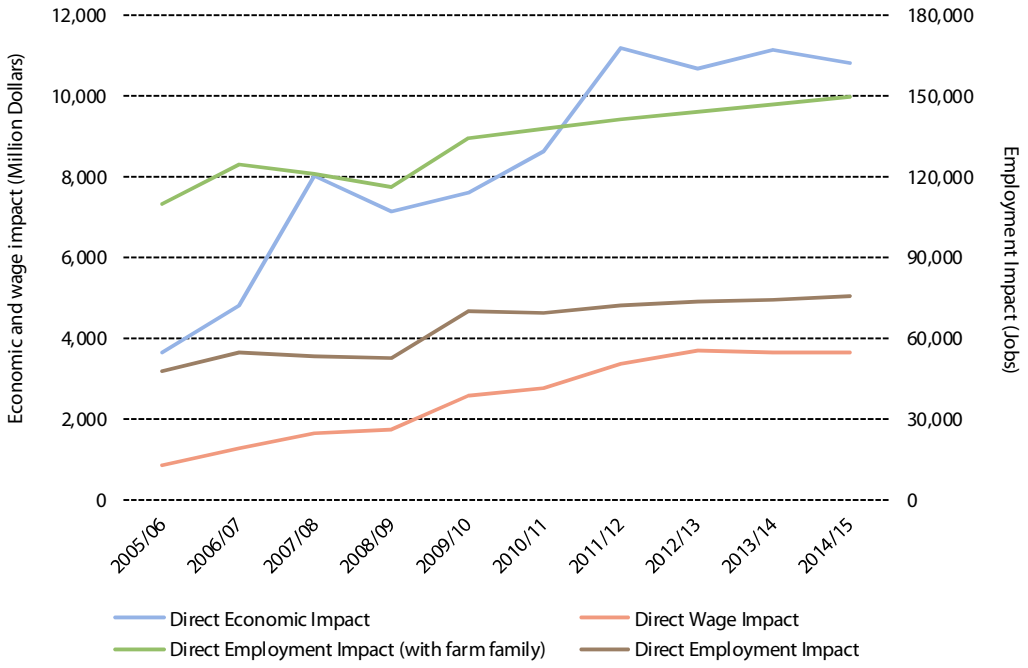

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Table 2: Direct economic impact across the canola value chain on the Canadian economy (billion C$)

Crop Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Avg. 2012-2014
Seed development	na	na	na	na	na	0.0	0.0	0.0	0.0	0.0	**0.0**
Canola farming	2.4	3.6	6.4	5.5	5.3	6.3	8.3	8.1	7.3	7.4	**7.6**
Elevation	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	**0.2**
Seed delivery	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.8	0.8	**0.7**
Crushing	0.3	0.2	0.5	0.4	0.4	0.5	0.6	0.4	1.1	0.7	**0.7**
Refining	0.1	0.1	0.2	0.1	0.0	0.1	0.1	0.2	0.4	0.3	**0.3**
Biodiesel production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
By-product delivery	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	**0.1**
Impact at ports	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	**0.1**
Benefit to livestock sector	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	**0.1**
End uses	na	na	na	na	0.7	0.7	0.9	0.8	0.9	1.0	**0.9**
Direct Economic Impact	**3.6**	**4.8**	**8.0**	**7.1**	**7.6**	**8.6**	**11.2**	**10.6**	**11.1**	**10.8**	**10.9**

Note: Economic impacts of the seed development sector are not calculated explicitly. Instead, they are captured under canola farming. A detailed explanation as to how this avoids the pitfalls of double counting is discussed in our methodology section below.

Table 3: Direct employment impact across the canola value chain on the Canadian economy (thousand jobs)

Crop Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Avg. 2012-2014
Seed development	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	**0.6**
Canola farming	44.3	50.9	49.8	48.2	49.2	48.0	49.8	52.6	52.2	53.3	**52.7**
Elevation	0.9	1.0	1.0	0.8	1.0	1.0	1.2	1.0	1.1	1.1	**1.1**
Seed delivery	0.8	0.8	0.9	1.3	1.1	1.5	1.9	1.7	2.2	2.0	**1.9**
Crushing	0.3	0.3	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	**0.5**
Refining	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	**0.3**
Biodiesel production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
By-product delivery	0.2	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	**0.3**
Impact at ports	0.2	0.2	0.3	0.4	0.5	0.6	0.8	0.6	0.7	0.7	**0.7**
Benefit to livestock sector	na	na	na	na	na	na	na	na	na	na	**na**
End uses	na	na	na	na	16.1	16.1	16.2	15.9	16.1	16.3	**16.1**
Direct Employment Impact	**47.2**	**54.1**	**53.3**	**52.2**	**69.5**	**68.9**	**71.6**	**73.5**	**73.9**	**75.2**	**74.2**
Additional canola farm family members	62.5	70.4	67.7	64.0	64.3	68.2	69.7	70.5	72.6	74.1	**72.4**
Direct Employment Impact Incl. farm family members	**109.7**	**124.5**	**121.0**	**116.1**	**133.8**	**137.1**	**141.3**	**144.1**	**146.6**	**149.3**	**146.7**

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Table 4: Direct wage impact across the canola value chain on the Canadian economy (billion C$)

Crop Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Avg. 2012-2014
Seed development	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.05	**0.05**
Canola farming	0.66	1.03	1.39	1.46	1.48	1.63	2.15	2.53	2.38	2.34	**2.41**
Elevation	0.05	0.06	0.06	0.05	0.07	0.07	0.09	0.07	0.08	0.08	**0.08**
Seed delivery	0.06	0.06	0.07	0.11	0.10	0.12	0.16	0.15	0.20	0.18	**0.18**
Crushing	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.04	**0.04**
Refining	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	**0.02**
Biodiesel production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
By-product delivery	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.03	**0.02**
Impact at ports	0.01	0.01	0.02	0.03	0.03	0.03	0.05	0.04	0.05	0.05	**0.05**
Benefit to livestock sector	na	na	na	na	na	na	na	na	na	na	**na**
End uses	na	na	na	na	0.77	0.78	0.80	0.78	0.81	0.86	**0.82**
Direct Wage Impact	**0.84**	**1.25**	**1.63**	**1.74**	**2.57**	**2.75**	**3.35**	**3.69**	**3.64**	**3.65**	**3.66**

2. Total-effect results (Direct + Indirect + Induced effects)

The total effect of canola on the Canadian economy is not limited to the people working directly in the industry. Its full effect can be best appreciated when its indirect and induced impacts are taken into account. These are illustrated in Diagram 2 and in Tables 5-7.

- In 2014/15, the total economic impact, which includes direct, indirect and induced effects, amounted to $26.5 billion. **The average economic impact of canola on the Canadian economy over three years, 2012/13 to 2014/15, was slightly higher, $26.7 billion.**
- **The total employment effect of canola between 2012/13 and 2014/15 averaged 250,000**. This includes canola farm family members.
- Over the same period, **the wage effect of canola on the Canadian economy averaged $11.3 billion.** When divided by the jobs created, excluding those jobs to canola farm family members, the implied per-capita supported wage for 2014/15 was $62,000, which compares favorably with an average 2014/15 Canadian salary of $50,000.

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Diagram 2: Total effects of canola on the Canadian economy

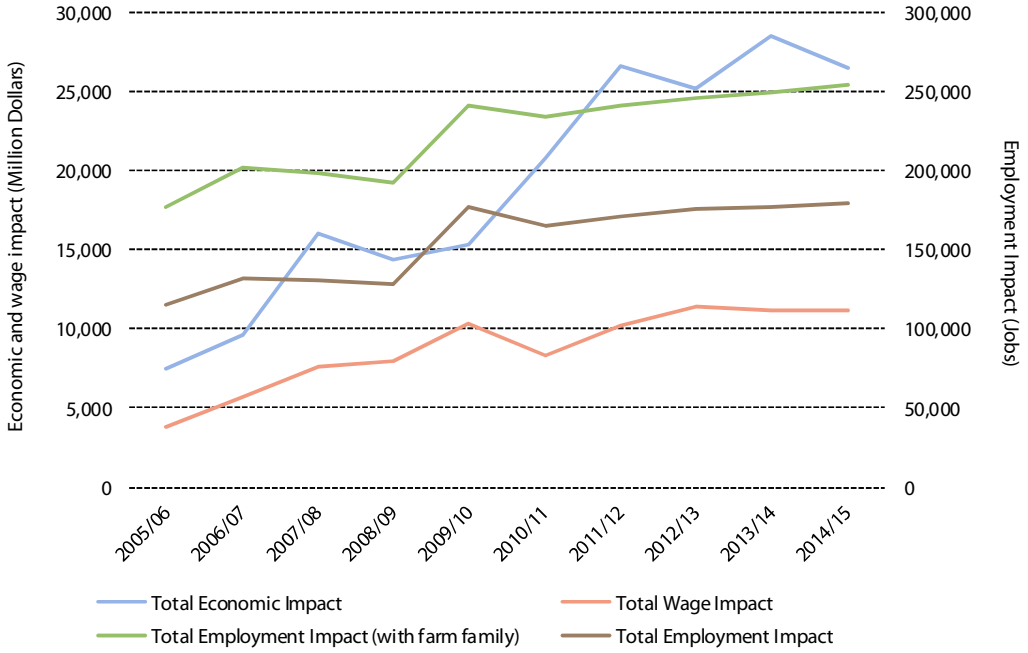

Table 5: Total economic impact across the canola value chain on the Canadian economy (billion C$)

Crop Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Avg. 2012-2014
Seed development	na	na	na	na	na	na	na	na	na	na	**na**
Canola farming	4.7	6.9	12.4	10.7	10.3	13.6	18.0	17.5	15.8	16.0	**16.4**
Elevation	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.5	0.5	**0.4**
Seed delivery	0.8	0.8	0.9	1.1	1.1	1.0	1.4	1.3	1.8	1.7	**1.6**
Crushing	0.7	0.6	1.2	0.9	0.9	2.6	2.7	1.9	5.2	3.2	**3.4**
Refining	0.3	0.4	0.4	0.3	0.1	0.3	0.4	0.7	1.7	1.5	**1.3**
Biodiesel production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	**0.1**
By-product delivery	0.1	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	**0.2**
Impact at ports	0.1	0.2	0.2	0.3	0.3	0.2	0.3	0.2	0.3	0.3	**0.3**
Benefit to livestock sector	0.4	0.4	0.5	0.5	0.6	0.9	0.9	0.8	0.7	0.6	**0.7**
End uses	na	na	na	na	1.5	1.7	2.2	2.0	2.3	2.5	**2.3**
Total Economic Impact	**7.5**	**9.7**	**16.1**	**14.3**	**15.3**	**20.8**	**26.6**	**25.1**	**28.5**	**26.5**	**26.7**

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Table 6: Total employment impact across the canola value chain on the Canadian economy (Thousand jobs)

Crop Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Avg. 2012-2014
Seed development	2	2	2	2	2	3	3	3	3	3	**3**
Canola farming	103	118	115	112	114	106	110	116	115	118	**116**
Elevation	2	2	2	2	2	2	2	2	2	2	**2**
Seed delivery	2	2	2	3	2	3	4	4	5	4	**4**
Crushing	4	4	5	5	6	4	4	4	5	5	**5**
Refining	2	2	3	3	3	2	2	2	2	3	**3**
Biodiesel production	0	0	0	0	0	0	0	0	0	0	**0**
By-product delivery	1	1	1	1	1	1	1	1	1	1	**1**
Impact at ports	0	1	1	1	1	1	1	1	1	1	**1**
Benefit to livestock sector	na	na	na	na	na	na	na	na	na	na	**na**
End uses	na	na	na	na	45	44	44	43	43	44	**43**
Total Employment Impact	**115**	**131**	**131**	**129**	**177**	**165**	**171**	**175**	**177**	**180**	**177**
Additional canola farm family members	62	70	68	64	64	68	70	71	73	74	**72**
Total Employment Impact Incl. farm family members	**177**	**202**	**198**	**193**	**241**	**233**	**241**	**246**	**249**	**254**	**250**

Table 7: Total wage impact across the canola value chain on the Canadian economy (billion C$)

Crop Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Avg. 2012-2014
Seed development	0.09	0.11	0.11	0.12	0.13	0.15	0.15	0.16	0.18	0.17	**0.17**
Canola farming	3.25	5.08	6.88	7.20	7.32	5.38	7.07	8.32	7.85	7.71	**7.96**
Elevation	0.09	0.13	0.12	0.10	0.13	0.11	0.14	0.12	0.12	0.12	**0.12**
Seed delivery	0.12	0.12	0.15	0.21	0.20	0.27	0.35	0.33	0.43	0.40	**0.39**
Crushing	0.10	0.14	0.15	0.18	0.20	0.20	0.20	0.21	0.23	0.22	**0.22**
Refining	0.05	0.07	0.08	0.09	0.11	0.10	0.11	0.11	0.11	0.12	**0.12**
Biodiesel production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	**0.01**
By-product delivery	0.03	0.04	0.04	0.05	0.05	0.05	0.04	0.04	0.05	0.05	**0.05**
Impact at ports	0.02	0.03	0.03	0.05	0.06	0.06	0.07	0.06	0.07	0.08	**0.07**
Benefit to livestock sector	na	na	na	na	na	na	na	na	na	na	**na**
End uses	na	na	na	na	2.09	2.05	2.10	2.06	2.13	2.28	**2.16**
Total Wage Impact	**3.75**	**5.71**	**7.57**	**8.01**	**10.29**	**8.36**	**10.24**	**11.41**	**11.19**	**11.17**	**11.26**

3. Methodology: Use of multipliers to evaluate indirect and induced impacts

The direct effects of canola on the Canadian economy are significant. They nonetheless fail to capture the full effect that comes via a ripple effect on supporting industries. This is known as the indirect effect. For some steps in the canola value chain, the indirect effect can be significant. This is especially true for capital-intensive aspects of the sector, like crushing. To illustrate this point, one must consider that a typical canola crushing facility in Canada, with an average capacity of 525,000 tonnes annually and directly employs between 40 and 60 people excluding the refining side of operations. However, many jobs associated with keeping that facility operational, from white collar jobs in engineering to trade professions like electricians, plumbers and pipefitters, are done on a contractual basis, making the true impact of that facility much higher.

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Similarly, direct effects fail to capture the economic activity stemming from expenditures of households drawing a salary from a given sector. While these "induced effects" are typically smaller than indirect effects, they can still constitute a sizeable economic force, particularly when the sector being evaluated is large, as is the case for canola.

While multipliers vary across subsectors of the canola value chain, the economic, employment, and wage multipliers can also vary considerably within the same category. When a wage multiplier is:

- higher than an employment multiplier, it can be interpreted as a subsector indirectly supporting higher paying jobs elsewhere in the Canadian economy.
- lower than an employment multiplier, the opposite inference can be made.

To capture indirect and induced effects, economists use multipliers, which are developed from "input-output" tables, which in turn measure the impact on the broader economy from some kind of exogenous shock to a specific sector of the economy.

Input-output tables and economic multipliers are the convention when estimating indirect and induced effects and are available for many economies globally. However, many countries offer multipliers only at the broadest level of the economy. Fortunately, ***Canada maintains industry multipliers at a detailed sectoral level.***

How StatCan multipliers have been used in this study

Statistics Canada's Industry Accounts Division has estimated as many as 282 economic multipliers for all Canadian provinces, with all categories available at the national level. Initially, it would seem reasonable to assume that *provincial*-level data would provide more detail, and hence accuracy, for the estimates of indirect and induced effects. However, after calculating estimates using provincial-level multipliers and after conversations with StatCan economists who developed the multipliers, we learned the following:

- For some industries, the number of data points at the provincial level can be insufficient to make an accurate assessment of the multiplier effect.
- Some sector designations can mean very different things when applied to different provinces. For example, the category "Crop Production" in the Prairies represents broad acre agriculture, like that of canola production. However, in Ontario or Quebec, "Crop Production" is skewed toward the smaller fruit farms more commonly found in these provinces, whereas this study is strictly focused on canola.
- Finally, *induced* effects are not estimated at the provincial level, but are available only at the national level.

For these reasons, we adopt national-level multipliers when making any estimates for the total effect of canola on the Canadian economy, including at the provincial level.

Multipliers exist for 1) economic impact, 2) employment impact, and 3) wage impact at the direct, the direct+indirect, and the direct+indirect+induced levels.

- ***The purpose of this study is to gauge, with as much accuracy as possible, the economic impact of canola on the Canadian economy.*** For this reason, direct economic, employment, and wage impacts were tallied at each step of the value chain. This approach is far more accurate than the alternative of estimating direct employment and wage effects using multipliers applied to GDP (economic impacts) and is far more accurate. Multipliers are therefore reserved for estimating indirect and induced effects.

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Multipliers change over time

One challenge associated with using multipliers for sophisticated economies, like Canada, is that multipliers can change over time to reflect not only new economic realities, but also methodological developments. Also, constructing multiplier tables is both data and labor-intensive, resulting in a significant time lag in reporting. As of the writing of this study, for example, the most recent multipliers available were from 2010 (Table 8). Using dated multiplier estimates can present difficulties when seeking to compare total impacts estimated in earlier years using earlier — different — multiplier estimates, however doing so is the most prudent and sensible course of action, as they represent the best available estimates. Therefore, we have presented our total results accordingly:

- *Total impacts from **2010/11-2014/**15 have been calculated using **StatCan's 2010 multipliers.***
- *Total impacts calculated in the previous study, **2005/06-2009/10**, were done so on the basis of **StatCan's 2008 multipliers** (Table 8).*

Table 8: National-level multipliers derived from StatCan input-output tables

	2010 Input-Output Tables				2008 Input-Output Tables			
Value-added activity	StatCan Industry Designation	Economic	Employment	Wages	Different 2008 StatCan Industry Designation?	Economic	Employment	Wages
GM Seed Development	Pesticide, fertilizer and other agricultural chemical manufacturing	1.64	3.13	2.55		1.06	3.97	2.81
Farming	Crop Production (except Greenhouse, Nursery and Floriculture Production)	1.16	1.21	2.30		0.93	1.32	3.93
Rail Transport	Rail Transportation	0.81	1.19	0.90		1.03	1.21	0.89
Truck Transport	Truck Transportation	1.66	1.03	1.14		1.36	1.05	1.22
Barge Transport	Water Transportation	2.00	2.01	1.72		1.43	1.91	1.50
Crushing	Grain and oilseed milling	3.74	8.07	4.84	Starch and Vegetable Fat and Oil Manufacturing	1.48	10.86	5.13
Refining	Grain and oilseed milling	3.74	8.07	4.84	Starch and Vegetable Fat and Oil Manufacturing	1.48	10.86	5.13
Biodiesel	Grain and oilseed milling	3.74	8.07	4.84	na	1.48	10.86	5.13
Elevation	Warehousing and storage	0.89	0.57	0.58	Farm Product Warehousing and Storage	1.00	1.27	1.02
Port Activities	Warehousing and storage	0.89	0.57	0.58	Farm Product Warehousing and Storage	1.00	1.27	1.02
Livestock	Animal production	4.42	1.41	3.55	Animal production (except Animal Aquaculture)	1.90	1.20	4.26
End uses	Other food manufacturing	1.45	1.70	1.64	Other Miscellaneous Food Manufacturing	1.13	1.79	1.69

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Part B. Provincial Results – Overview

Below we provide an overview of provincial-level results, first presenting our findings for *direct* impacts, followed by our findings for direct+ indirect+induced (or total) impacts.

1. Direct-effect results

- At the provincial level, Saskatchewan was the epicenter for the economic impact of Canadian-grown canola between 2012/13 and 2014/15, reconciling with the province's position as the leading producer of canola seed and home to most of the country's processing capacity. Saskatchewan accounted for over $5 billion in direct economic impact, roughly 46% of the Canadian total of $10.80 billion (Table 9 and Diagram 3).

- Alberta and Manitoba comprised 29% and 15% of the Canadian economic impact, respectively, meaning that collectively, Canada's Prairie Provinces accounted for 91% of the economic impact from canola.

- Similarly, the Prairies also dominate in terms of the employment and wage impacts of canola. In Saskatchewan, over 57,000 people are directly employed in the canola sector when canola farm family members are included. An additional 69,000 work in Alberta and Manitoba, meaning that 86% of canola's employment impact is felt in the Canadian prairies (Table 10 and Diagram 4).

- Finally, of the $3.7 billion in direct wages derived from canola, $2.8 billion are paid into the Prairies (Table 11 and Diagram 5).

Table 9: Direct economic impact by province (million C$), 3-year average (2012/13–2014/15)

	Maritimes	PQ	ON	MB	SK	AB	BC	Canada
Seed development	na	na	na	na	na	na	na	**na**
Canola farming	3	14	23	1,116	3,805	2,605	35	**7,600**
Elevation	0	0	0	35	96	98	3	**231**
Seed delivery	0	1	1	118	329	242	32	**723**
Crushing	0	63	84	151	356	72	0	**726**
Refining	0	24	32	58	136	25	0	**275**
Biodiesel production	0	3	11	0	1	2	2	**18**
By-product delivery	0	9	10	23	38	19	1	**100**
Impact at ports	0	0	6	1	0	0	130	**137**
Benefit to livestock sector	7	45	47	6	3	12	9	**130**
End users	30	140	222	129	267	99	34	**921**
Direct Economic Impact	**40**	**297**	**435**	**1,637**	**5,031**	**3,175**	**246**	**10,861**

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Diagram 3: Direct economic impact by province, 3-year average (2012/13–2014/15)

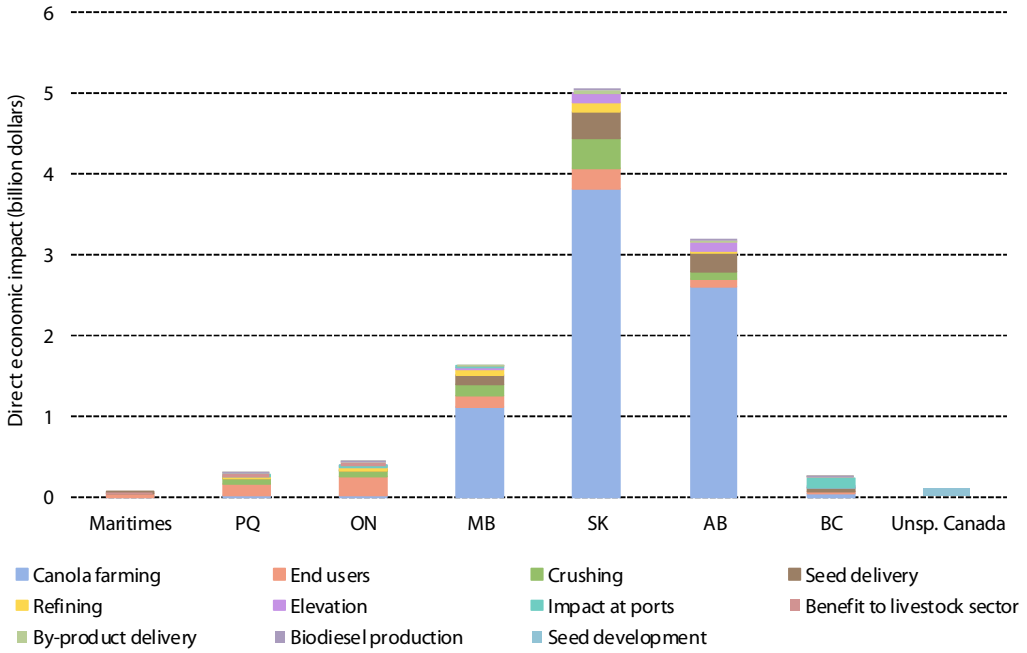

Table 10: Direct employment impact by province (including farm family members), 3-year average (2012/13–2014/15)

	Maritimes	PQ	ON	MB	SK	AB	BC	Canada
Seed development	na	na	na	na	na	na	na	**610**
Canola farming	49	61	825	8,884	24,803	17,817	280	**52,718**
Elevation	0	0	1	151	447	457	10	**1,066**
Seed delivery	1	5	8	366	936	591	39	**1,945**
Crushing	0	36	64	108	181	140	0	**529**
Refining	0	24	32	58	137	25	0	**277**
Biodiesel production	0	2	10	0	1	3	2	**19**
By-product delivery	0	51	40	58	99	49	1	**299**
Impact at ports	0	0	121	4	0	0	563	**687**
Benefit to livestock sector	na	na	na	na	na	na	na	**na**
End users	530	5,705	5,838	504	435	1,484	1,577	**16,073**
Direct Employment Impact	**580**	**5,885**	**6,939**	**10,133**	**27,039**	**20,566**	**2,472**	**74,223**
Farm Family	89	1,174	1,769	13,055	30,397	25,535	418	**72,437**
Direct Employment Impact w/ Farm Family Members	**669**	**7,060**	**8,708**	**23,188**	**57,435**	**46,101**	**2,890**	**146,660**

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Diagram 4: Direct employment impact by province (including farm family members), 3-year average (2012/13–2014/15)

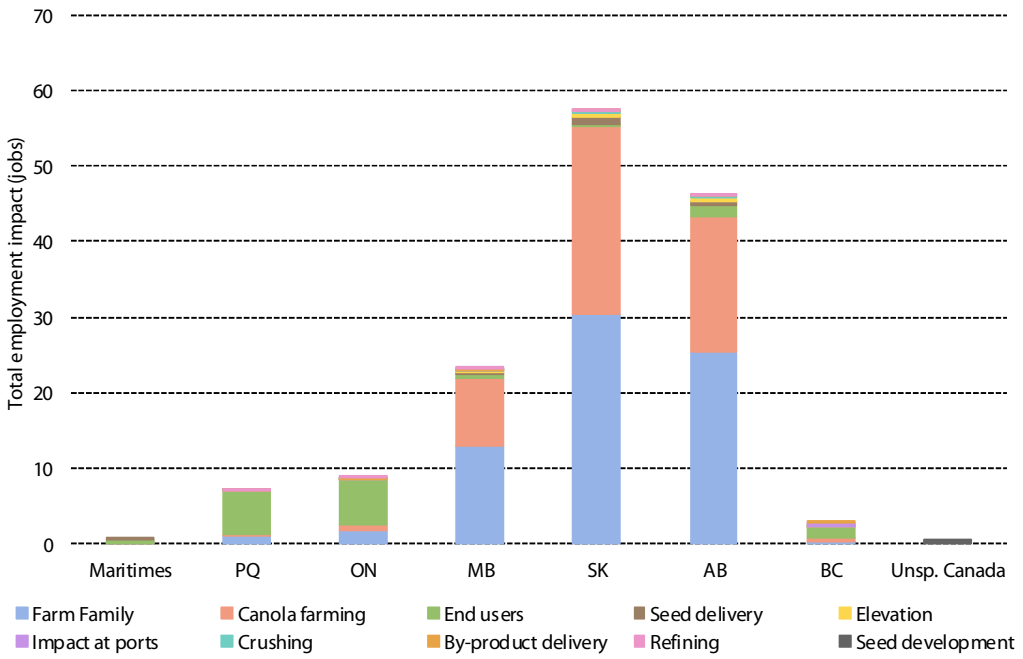

Table 11: Direct wage impact by province (million C$), 3-year average (2012/13–2014/15)

	Maritimes	PQ	ON	MB	SK	AB	BC	Canada
Seed development	na	na	na	na	na	na	na	**48**
Canola farming	2	12	14	374	1,053	941	19	**2,414**
Elevation	0	0	0	11	32	33	1	**77**
Seed delivery	0	0	1	31	85	56	4	**176**
Crushing	0	3	5	8	13	10	0	**38**
Refining	0	2	2	4	10	2	0	**20**
Biodiesel production	0	0	1	0	0	0	0	**1**
By-product delivery	0	4	2	5	9	4	0	**24**
Impact at ports	0	0	8	0	0	0	37	**45**
Benefit to livestock sector	na	na	na	na	na	na	na	**na**
End users	27	290	296	26	22	75	80	**816**
Direct Wage Impact	**29**	**310**	**329**	**459**	**1,224**	**1,121**	**141**	**3,660**

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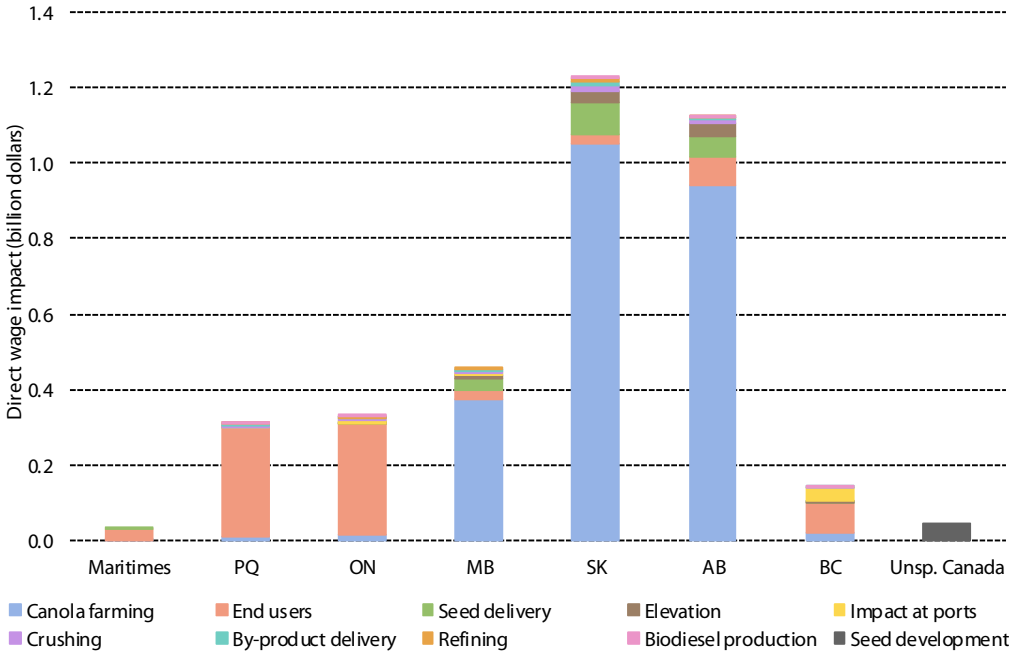
Diagram 5: Direct wage impact by province, 3-year average (2012/13–2014/15)



2. Total-effect results (Direct+ Indirect+ Induced effects)

- As mentioned above, only by including indirect and induced impacts do we capture the true magnitude of canola's impacts on the Canadian economy. That said, applying the indirect and induced multiplier effects does little to change the relative impacts of Canada's various *provinces*.

- Of the nearly $27 billion in total economic impact of canola on the Canadian economy, $12.2 billion stems from Saskatchewan, with another $11.3 billion coming out of Alberta and Manitoba (Table 12 and Diagram 6).

Table 12: Total economic impact by province (million C$), 3-year average (2012/13–2014/15)

	Maritimes	PQ	ON	MB	SK	AB	BC	Canada
Seed development	na	na	na	na	na	na	na	**na**
Canola farming	6	29	50	2,413	8,224	5,630	75	**16,428**
Elevation	0	0	0	66	182	185	5	**438**
Seed delivery	0	2	3	296	737	498	83	**1,618**
Crushing	0	297	397	716	1,687	343	0	**3,440**
Refining	0	114	152	274	644	119	0	**1,304**
Biodiesel production	0	12	50	0	4	10	10	**87**
By-product delivery	0	20	24	42	70	37	1	**193**
Impact at ports	0	0	11	2	0	0	246	**259**
Benefit to livestock sector	40	244	254	31	19	65	50	**702**
End users	74	342	543	316	654	243	84	**2,256**
Total Economic Impact	**120**	**1,061**	**1,484**	**4,155**	**12,221**	**7,130**	**554**	**26,725**

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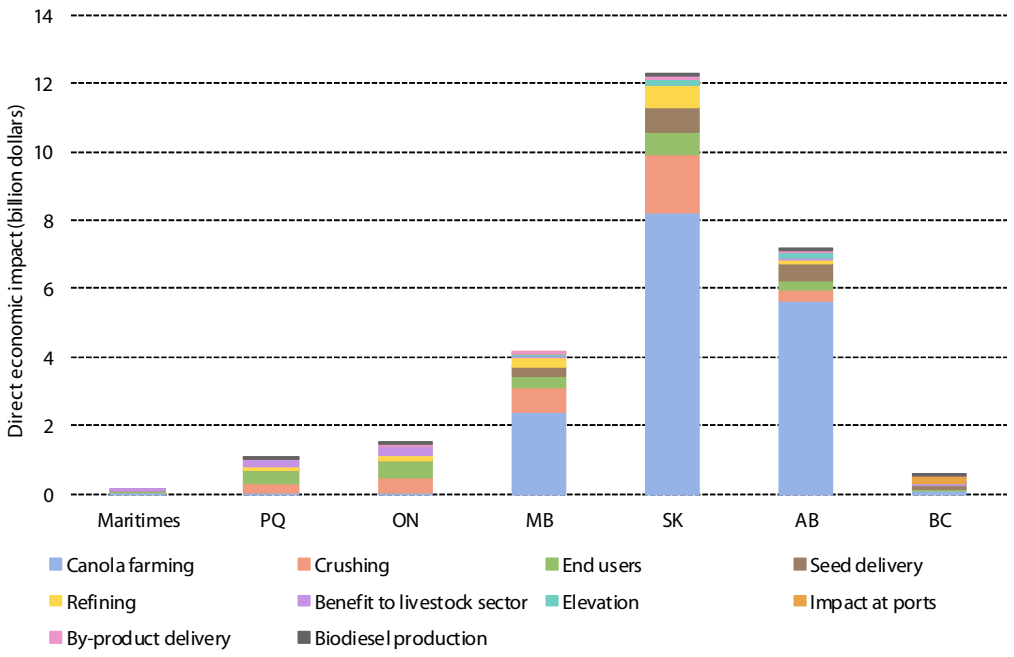
Diagram 6: Total (direct+indirect+induced) economic impact by province ('000 C$), 3-year average, (2012/13–2014/15)



- Of the 250,000 Canadian people supported by the canola sector (a figure including farm family members), roughly 201,000 are in the Canadian prairies, with 92,000 people dependent on the canola sector in Saskatchewan alone (Table 13 and Diagram 7).

Table 13: Total employment impact by province (including farm family members), 3-year average (2012/13–2014/15)

	Maritimes	PQ	ON	MB	SK	AB	BC	Canada
Seed development	na	na	na	na	na	na	na	**2,518**
Canola farming	108	135	1,820	19,609	54,743	39,325	617	**116,357**
Elevation	0	0	1	236	700	716	16	**1,670**
Seed delivery	2	10	16	798	2,010	1,252	79	**4,166**
Crushing	0	325	584	978	1,646	1,266	0	**4,799**
Refining	0	220	293	529	1,238	229	0	**2,510**
Biodiesel production	0	22	91	0	7	30	19	**169**
By-product delivery	0	108	83	126	217	106	3	**643**
Impact at ports	0	0	190	6	0	0	882	**1,077**
Benefit to livestock sector	na	na	na	na	na	na	na	**na**
End users	1,431	15,400	15,759	1,361	1,173	4,005	4,257	**43,387**
Total Employment Impact	**1,540**	**16,222**	**18,837**	**23,642**	**61,735**	**46,930**	**5,873**	**177,297**
Farm Family Members	89	1,174	1,769	13,055	30,397	25,535	418	**72,437**
Total Employment Impact w/ Farm Family Members	**1,629**	**17,397**	**20,605**	**36,698**	**92,131**	**72,465**	**6,291**	**249,734**

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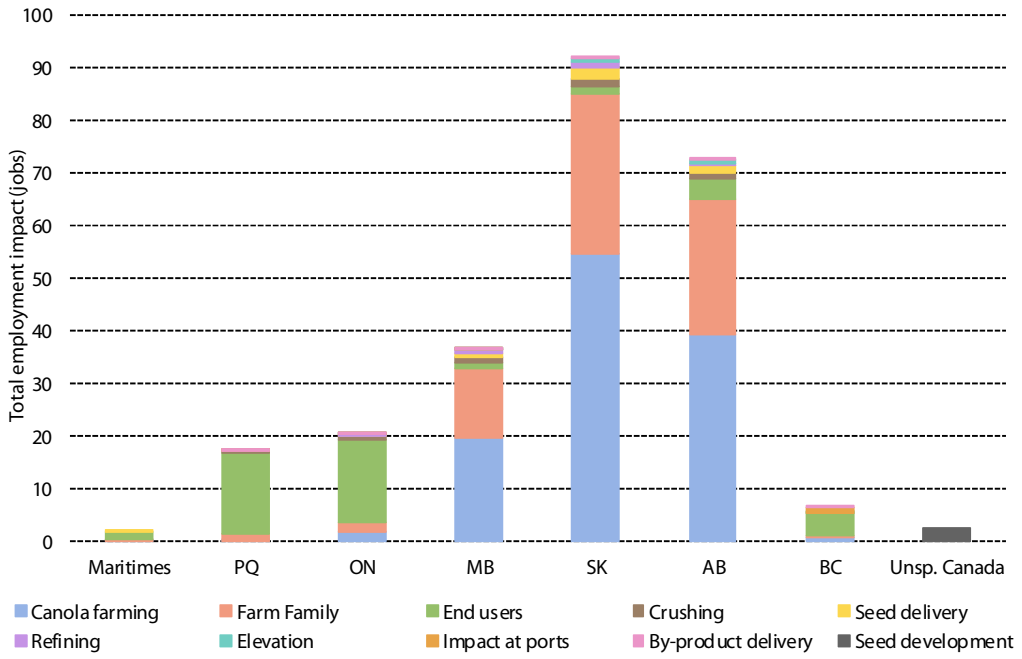
Diagram 7: Total employment impact by province (including farm family members), 3-year average (2012/13–2014/15)



- Lastly, of the $11.2 billion in wages attributable directly, indirectly, or in an induced manner to canola, on average between 2012/13 and 2014/15 $8.9 billion stem from the canola industries of the Canadian prairies, with the balance attributable to British Columbia and Canada's eastern provinces (Table 14 and Diagram 8).

Table 14: Total wage impact by province (million C$), 3-year average (2012/13–2014/15)

	Maritimes	PQ	ON	MB	SK	AB	BC	Canada
Seed development	na	na	na	na	na	na	na	169
Canola farming	7	38	46	1,232	3,471	3,101	63	7,958
Elevation	0	0	0	17	51	52	1	121
Seed delivery	0	1	2	71	185	119	9	386
Crushing	0	15	27	45	76	59	0	222
Refining	0	10	14	24	57	11	0	116
Biodiesel production	0	1	4	0	0	1	1	8
By-product delivery	0	7	5	10	17	8	0	47
Impact at ports	0	0	13	0	0	0	59	72
Benefit to livestock sector	na	na	na	na	na	na	na	na
End users	71	766	783	68	58	199	212	2,157
Farm Family	0	0	0	0	0	0	0	0
Total Wage Impact	**78**	**838**	**893**	**1,468**	**3,915**	**3,549**	**345**	**11,257**

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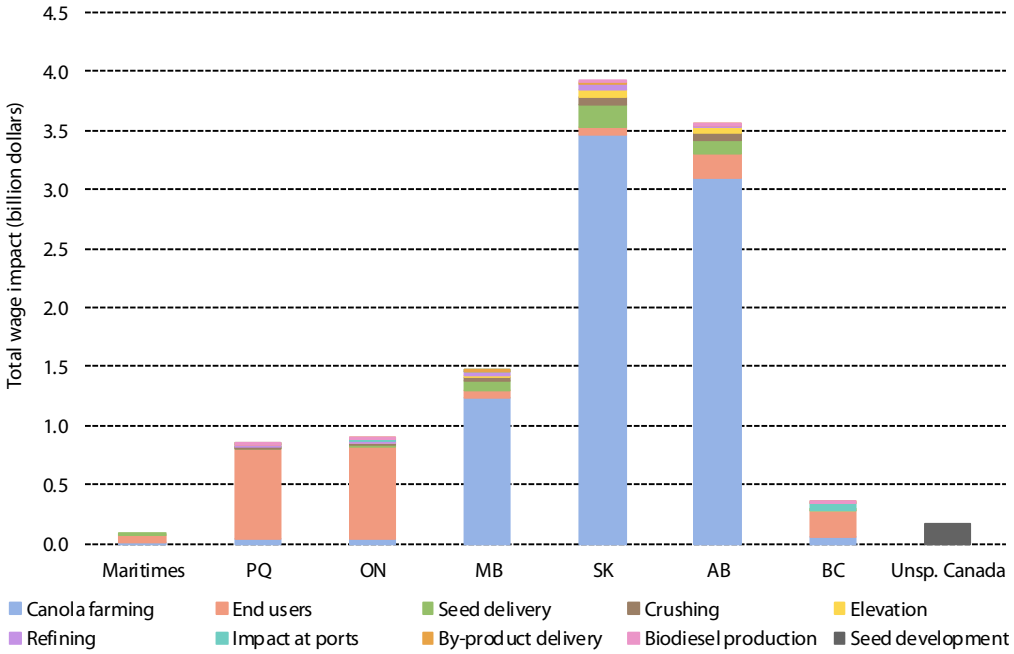
Diagram 8: Total wage impact by province (billion C$), 3-year average (2012/13-2014/15)



Part C. Detailed Results – by Step in the Canola Value Chain

Below we present our provincial-level results in further detail and discuss the methodology employed in accounting for direct economic, employment and wage impacts across the eleven distinct steps in the canola value chain.

For interest, we have also included estimates on the economic impact from international shipping. However, because this occurs outside of Canada, frequently on foreign-owned vessels, as mentioned earlier, international shipping does not count toward our Canadian total.

1. Seed development

Canola seed development is a big industry within Canada. It produces more than 70% of the seed used within Canada, with the remainder grown in the Pacific Northwest of the United States (25%) and Chile (5%). Canola *breeding* efforts are also concentrated in Canada, and the country exports a fair amount of seed for planting as well — mostly to the United States.

Impacts and methodology

Estimates of the economic, employment and wage impacts of the sector are based on first-hand discussions with industry stakeholders.

- **For the purposes of this study, we have not provided a specific line item estimate of the economic impact of the Canadian canola breeding industry in our summary of Direct and Total impacts.** Economic impacts of the canola seed sector are not listed explicitly because the impacts of the sector are captured under canola farming as improved yields and higher quality seed. **However, to provide the reader with as much detail as possible we have included an estimate of the economic impact from canola farming attributable to the seed sector in Tables 15 and 16 below.**
- Of the $7.6 billion in direct economic impacts from canola farming, it is estimated that $99 million stem specifically from the canola seed sector.[1] Of the $16.4 billion in Total economic impacts from canola farming, it is estimated that $262 million are directly attributable to the seed sector.
- The direct employment impact of the Canadian seed industry is estimated at 610 jobs, which include individuals involved in biotech, breeding, seed production and marketing. Roughly half of these individuals are involved in marketing or technical sales, with the remainder involved in R+D or seed manufacturing. When indirect and induced impacts are taken into account, the employment impact of the industry is estimated at 2,518.
- Direct wages for the sector are estimated at $48 million, while the total wage impact is estimated at $169 million.

[1] This accounts for seed company expenditures alone and does not attempt to quantify the share of canola's value (through improved yields, improved quality, etc.) attributable to the efforts of the canola sector.

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Table 15: Direct economic, employment and wage impact of the Canadian canola seed industry, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	na	na	na
Quebec	na	na	na
Ontario	na	na	na
Manitoba	na	na	na
Saskatchewan	na	na	na
Alberta	na	na	na
British Columbia	na	na	na
Canada	**99**	**610**	**48**

Table 16: Total economic, employment and wage impact of the Canadian canola seed industry, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	na	na	na
Quebec	na	na	na
Ontario	na	na	na
Manitoba	na	na	na
Saskatchewan	na	na	na
Alberta	na	na	na
British Columbia	na	na	na
Canada	**262**	**2,518**	**169**

2. a) Canola farming

Canola farming is the foundation of the canola chain within Canada and accounts for 70% of the direct *economic* impact, 36% of the direct *employment* impact, and 66% of the direct *wage* impact of the canola value chain.

Impacts

- The direct economic impact of canola farming over the observed timeframe is $7.6 billion, with **the total economic impact estimated at $16.4 billion**. As mentioned earlier in the study, this impact is concentrated in the Prairie Provinces.
- Canola farming directly employs an estimated 53,000 paid individuals.. This figure does not include canola farm family members, who will be discussed in the next section. When the indirect and induced multipliers are applied, **the total employment impact of canola farming is estimated at just over 116,000**.
- $2.4 billion in wages are directly attributable to canola farming. For growers, this includes profits from the canola share of their farm, while for hired labor it comprises wages paid out by growers. Including indirect and induced effects, **the total wage impact of canola farming is $7.9 billion**.

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Table 17: Direct economic, employment and wage impact of Canadian canola farming and production, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	3	49	2
Quebec	14	61	12
Ontario	23	825	14
Manitoba	1,116	8,884	374
Saskatchewan	3,805	24,803	1,053
Alberta	2,605	17,817	941
British Columbia	35	280	19
Canada	**7,600**	**52,718**	**2,414**

Table 18: Total economic employment and wage impact of Canadian canola farming and production, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	6	108	7
Quebec	29	135	38
Ontario	50	1,820	46
Manitoba	2,413	19,609	1,232
Saskatchewan	8,224	54,743	3,471
Alberta	5,630	39,325	3,101
British Columbia	75	617	63
Canada	**16,428**	**116,357**	**7,958**

Methodology

For this study, **the economic impact of canola farming is determined by canola revenues earned by farmers – a proxy for volumes produced and prices received.** While one could argue that the value added to canola farming would be better captured by subtracting canola farming costs from canola farming revenues this approach would fail to capture the economic impact of the wide array of inputs used in canola farming such as seed, fertilizers and crop protection, hence our approach.

While not used directly in our value-added calculation, crop-district production figures were obtained from provincial ministries of agriculture across Canada – which when combined with local price information serve as a useful guide to the accuracy of the revenue figures reported by StatCan. The results are presented in Tables 19A and B.

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Table 19A: Canola production by Ag. District, eastern Canada ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Maritimes	**0**	**0**	**0**	**8**	**0**
Quebec	**25**	**36**	**33**	**34**	**28**
Bas-Saint-Laurent and Gaspésie-Îles-de-la-Madeleine	9	11	15	7	7
Saguenay-Lac-Saint-Jean and Côte-Nord	13	15	11	17	16
Abitibi-Témiscamingue and Nord-du-Québec	0	6	4	6	2
Chaudières-Appalaches	3	4	3	4	3
Ontario	**76**	**74**	**61**	**50**	**31**
Southern	2	1	0	5	0
Western	43	45	27	24	15
Central	6	11	20	8	9
Eastern	2	1	2	3	2
Northern	23	16	12	10	5
Manitoba	**2,227**	**1,760**	**2,087**	**2,998**	**2,526**
Ag. District 1	259	76	308	323	244
Ag. District 2	275	126	253	339	248
Ag. District 3	301	160	302	475	425
Ag. District 4	139	137	109	224	174
Ag. District 5	165	211	90	205	202
Ag. District 6	87	122	128	168	108
Ag. District 7	299	235	285	460	360
Ag. District 8	517	471	371	520	491
Ag. District 9	72	99	101	122	98
Ag. District 10	5	6	9	10	13
Ag. District 11	59	51	68	88	76
Ag. District 12	48	64	65	63	88

Table 19B: Canola production by Ag. District, western Canada ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Saskatchewan	**5,693**	**7,348**	**6,486**	**9,178**	**7,972**
Ag. District 1A	312	55	336	421	319
Ag. District 1B	266	71	301	508	337
Ag. District 2A	187	62	207	231	259
Ag. District 2B	390	284	351	673	528
Ag. District 3AN	68	107	130	202	128
Ag. District 3AS	126	109	126	175	150
Ag. District 3BN	107	198	167	251	277
Ag. District 3BS	8	29	34	50	63
Ag. District 4A	4	8	20	48	38
Ag. District 4B	49	61	60	69	109
Ag. District 5A	465	429	471	756	611
Ag. District 5B	420	1,074	584	990	823
Ag. District 6A	523	886	731	883	595
Ag. District 6B	408	480	387	472	429
Ag. District 7A	199	379	272	386	322
Ag. District 7B	398	497	413	560	508
Ag. District 8A	288	718	380	613	520
Ag. District 8B	281	738	498	607	565
Ag. District 9A	635	619	539	677	687
Ag. District 9B	560	545	478	606	704
Alberta	**4,740**	**5,348**	**5,097**	**6,169**	**5,797**
Ag. District 1	145	219	235	220	192
Ag. District 2	830	1,159	947	1,089	991
Ag. District 3	325	432	353	553	477
Ag. District 4A	499	549	518	625	656
Ag. District 4B	950	872	849	1,141	1,017
Ag. District 5	672	654	693	793	729
Ag. District 6	583	564	554	607	585
Ag. District 7	735	899	949	1,140	1,150
British Columbia	**40**	**56**	**83**	**89**	**72**
Non-Peace River	2	3	5	9	6
Peace River	38	53	78	80	66
CANADA	**12,800**	**14,622**	**13,848**	**18,525**	**16,425**

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While Vancouver prices or the Winnipeg futures are the most widely quoted when referring to prices for canola, the provincial ministries also report spot canola prices at various stages of distribution from farm gate to elevator to crusher (Table 20).

Table 20: Provincial-level spot canola prices (C$ per MT)

	2010/11	2011/12	2012/13	2013/14	2014/15
Quebec	454	514	548	549	510
Ontario	455	529	581	547	533
Manitoba	410	544	595	545	406
Saskatchewan	369	542	520	613	377
Alberta	435	539	591	549	410
Peace Valley	498	541	587	549	407
Pacific Coast	566	599	666	552	538
Canada	**402**	**541**	**558**	**580**	**394**

While the prices in table 20 are useful from the standpoint of helping to understand provincial differences, they are subject to the shortcoming that relatively little canola is actually bought and sold on the spot market. Instead, canola is usually sold on the futures market plus or minus a basis for a given geography. While some crush plants advertise their basis levels openly, many do not. Fortunately, StatCan eliminates the need to collect this information by publishing data on canola revenues received by farmers, which provide the basis for the economic impacts of canola production. The prices as implied by these revenues are reported in Table 21.

Table 21: Provincial-level prices as implied by grower revenues (C$ per MT)

	2010/11	2011/12	2012/13	2013/14	2014/15
Quebec	425	395	498	380	415
Ontario	385	394	475	582	928
Manitoba	468	563	536	389	422
Saskatchewan	519	586	605	394	487
Alberta	472	557	581	395	417
British Columbia	342	318	450	440	387
Canada	**491**	**571**	**584**	**394**	**451**

For this study, we took paid canola employment to be a combination of growers and paid labor. While many growers may hire an immediate family member (like a son or daughter) we assumed that hired labor was primarily found outside the immediate family. The employment effect on unpaid immediate family members is captured in the next subsection "Canola farm-family members."

Estimating grower employment in canola farming was straightforward and done on the basis of the number of farms in Canada that grow canola (Table 22).

Table 22: Number of farms growing canola in Canada

	2010/11	2011/12	2012/13	2013/14	2014/15
Maritimes	29	35	39	47	53
Quebec	402	447	482	536	581
Ontario	540	624	671	792	875
Manitoba	6,093	6,151	6,161	6,267	6,325
Saskatchewan	15,576	15,736	15,737	16,056	16,215
Alberta	11,523	11,889	12,202	12,621	12,988
British Columbia	170	178	182	194	203
Canada	**34,345**	**35,073**	**35,473**	**36,513**	**37,240**

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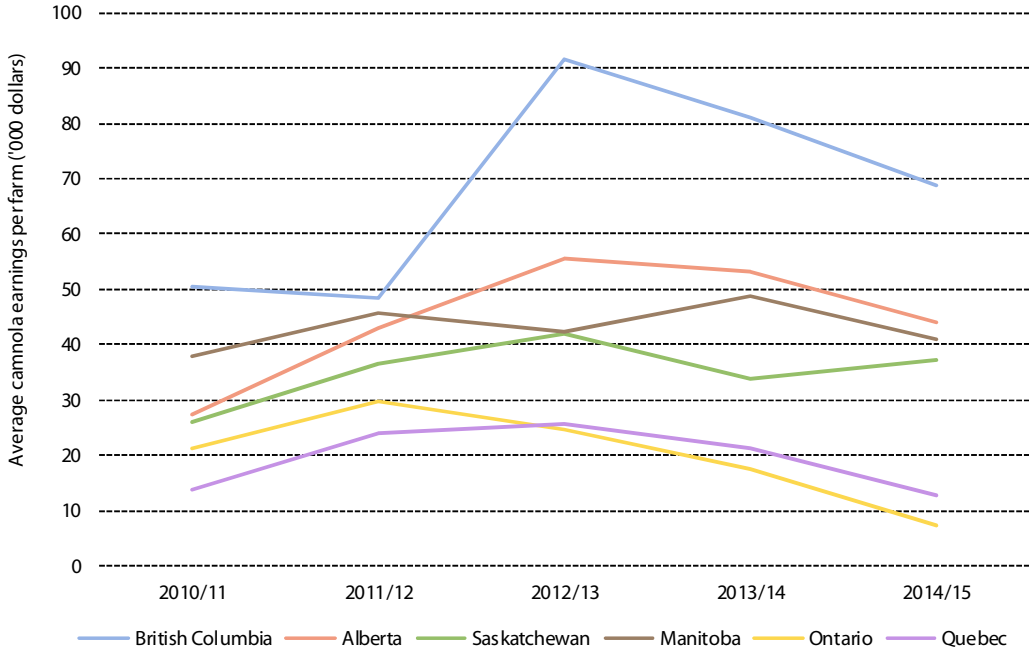
Canola was assumed to provide a canola job regardless of the fact that canola may make up only a portion of a farm's acreage (given that it is grown on rotation). Had we accounted for the fact that canola farming may make up ½ to 1/3 of a grain and oilseed grower's time, presenting the employment number in terms of "Full-time Equivalent," the number would have been lower.

Canola share of farm earnings was used to represent a grower's canola wage. Canola earnings were based on the average farm earnings for grain and oilseed farmers, from a data series available from StatCan. To account for the canola share of those earnings, we divided average canola acreage per farm by the average farm size. We then multiplied this ratio by the StatCan series on profitability. Canola earnings per farmer have increased along with prices through 2012/13 but have fallen since along with commodity prices in general (Diagram 9).

Diagram 9: Canola earnings per farm by province (per farm growing canola)



Estimates for hired labor were based on crop budgets developed by agricultural ministry extension specialists from across the Prairie Provinces. While there was some variability in these budgets in terms of labor requirements, the data was fairly tightly clustered at around 1.6 man-hours per acre of canola. By multiplying the number of canola acres by 1.6 and dividing by 2000 (50 weeks x 40 hours/week), we arrived at the number of hired hands working on canola farms on a full-time basis annually (Table 23).

Table 23: Number of hired workers dedicated to canola acreage

	2010/11	2011/12	2012/13	2013/14	2014/15
Maritimes	2	2	2	2	2
Quebec	25	33	34	31	28
Ontario	64	71	60	48	28
Manitoba	2,660	2,240	2,860	2,560	2,480
Saskatchewan	6,800	7,920	9,280	8,520	8,600
Alberta	4,440	4,857	5,280	4,960	5,400
British Columbia	80	71	96	80	84
Canada	**14,070**	**15,194**	**17,612**	**16,201**	**16,622**

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Wages for hired labor were also taken from StatCan with total wages paid being the product of the number of hired workers and the prevailing wage. For reference, the average wage for a hired farm hand, including those individuals in supervisory roles, was taken to be approximately $20 per hour for Canada, on average, for the 2014/15 crop year.

2. b) Canola farm family members

Estimating the employment impact of an agricultural commodity presents the added challenge of how to account for farm family members other than the growers themselves. In some families, spouses and children may provide just a supporting role in farm operations, be it through keeping the books, buying supplies, or providing labor on an occasional basis. For other families, however, spouses and grown children may work on a nearly full-time basis, supported by farm revenues and, in the case of grown children, possibly working as a means ultimately to acquire the farm from their parents.

Impacts and methodology

To account for this impact, we have included a sub-category in our employment estimates for canola farm family members. As labor that is unpaid in the traditional sense, this category is differentiated from the rest of our employment estimates across the canola value chain, which represent workers who draw a cash wage from working in the canola sector. Consequently, the total employment impacts given at the beginning of this study are presented with and without this number.

A number of data sets exist detailing the average size of Canadian families over time, both maintained by StatCan. One series estimates the number of farm families by size, ranging from two members to more than 7 members and suggest an average Canadian farm family size of 3.1 persons. Using this series would, therefore, imply that for every grower, there are just over two additional canola farm family members (Table 24). Because these family members are assumed to be uncompensated through wages, no indirect or induced multiplier has been applied toward this group and totals are the same whether looking at direct or total impacts. Lastly, the economic impact associated with these workers has been captured under the previous heading "canola farming."

Table 24: Direct/total economic, employment and wage impact of canola farm family members, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	na	89	na
Quebec	na	1,174	na
Ontario	na	1,769	na
Manitoba	na	13,055	na
Saskatchewan	na	30,397	na
Alberta	na	25,535	na
British Columbia	na	418	na
Canada	**na**	**72,437**	**na**

3. Primary elevation

In recent years, between 25% and 40% of the canola produced in Canada has been delivered directly from growers' farms to processing facilities, with the balance being delivered to primary elevation facilities. At these facilities, canola (and other grains) are stored until needed 1) by domestic crushing facilities, 2) for overland export to the US or Mexico, or 3) for delivery to Canadian ports for overseas export.

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Impacts

- The direct economic impact of canola elevation in Canada averaged $230 million between 2012/13 and 2014/15. The total economic impact, meanwhile, is estimated at $440 million.
- An estimated 1,066 individuals are directly employed in primary canola elevation. When indirect and induced effects are included, the total effect is estimated at just under 1,700 jobs.
- Lastly, wages directly attributable to primary canola elevation are quantified at $77 million over the observed time frame, with the total wage effect estimated at $120 million.

Table 25: Direct economic, employment and wage impact of primary canola elevation, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	1	0
Manitoba	35	151	11
Saskatchewan	96	447	32
Alberta	98	457	33
British Columbia	3	10	1
Canada	**231**	**1,066**	**77**

Table 26: Total economic, employment and wage impact of primary canola elevation, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	1	0
Manitoba	66	236	17
Saskatchewan	182	700	51
Alberta	185	716	52
British Columbia	5	16	1
Canada	**438**	**1,670**	**121**

Methodology

The **economic impact of canola elevation was determined by the product of volumes of canola being elevated and fees incurred for primary elevation**. For the Prairie Provinces, elevated canola volumes were determined by data available through the Canadian Grain Commission, with the numbers modified slightly to reconcile with information on internal canola trade flows within the country (Table 27). For Quebec, Ontario, and British Columbia, the volumes of canola passing through elevators (versus being delivered directly to processing facilities) were derived based on conversations with industry stakeholders.

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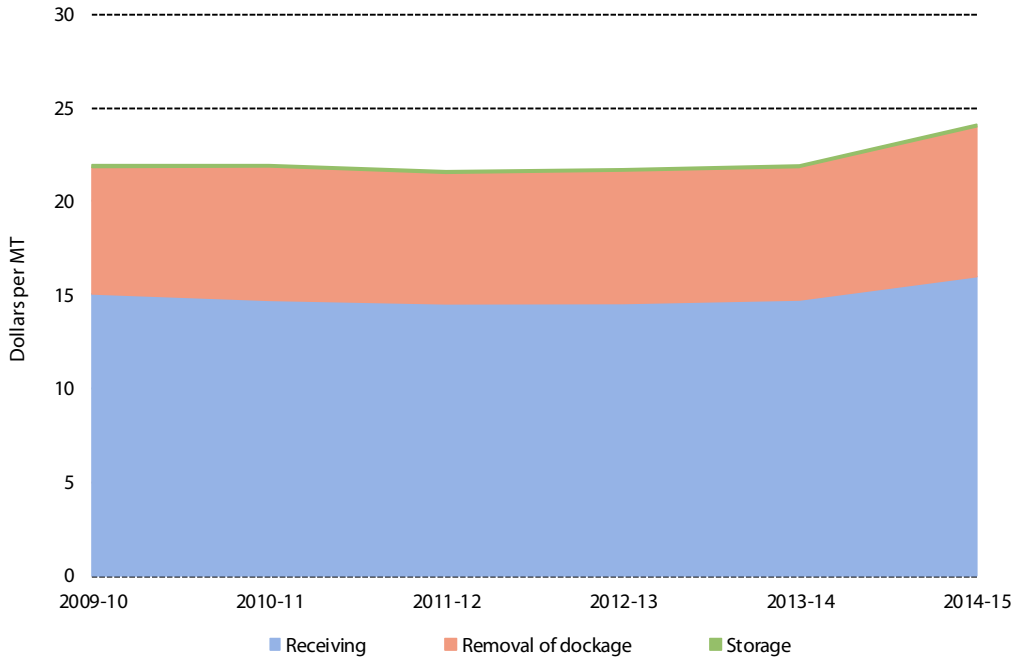
- For 2014/15, an estimated 10.6 million tonnes of canola passed through primary elevation facilities in Canada, 65% of the country's total production down from the peak of 74% set in 2011/12 and a reflection of increased processing capacity in the country.

- Primary elevation fees were also obtained from the Canadian Grain Commission based on annual surveys they conduct on the costs of moving grain to point of export. In Diagram 10, we illustrate how these fees approached the $25 mark, after holding steady for the past five years.

Table 27: Volumes of canola elevated ('000 MT)

	2010/11	2011/12	2012/13	2013/14	2014/15
Maritimes	0	0	0	0	0
Quebec	0	0	0	0	0
Ontario	19	11	9	7	5
Manitoba	1,675	1,289	1,355	1,680	1,573
Saskatchewan	3,672	4,721	3,613	4,611	4,481
Alberta	3,721	4,704	4,076	4,414	4,458
British Columbia	12	80	90	127	130
Total Volume Elevated	**9,100**	**10,805**	**9,143**	**10,840**	**10,647**
Total Production	12,800	14,622	13,848	18,525	16,425
% of crop elevated	**71%**	**74%**	**66%**	**59%**	**65%**

Diagram 10: Primary elevation fees for Canadian canola



To understand the employment impact of primary canola elevation, we began with a "Working in Canada" report developed by the Canadian government. It states that, in 2010, there were 6,234 individuals employed in the direct elevation of all agricultural commodities in Canada. The canola share of this total was calculated by multiplying the total jobs figure by the ratio of canola in commercial positions over all grains in commercial positions. Salaries for these positions were based on a StatCan series for jobs in grain processing and handling.

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4. Seed delivery

Seed delivery comprises delivery of seed from the farm to its point of processing within Canada or departure from Canada. As mentioned above, the majority of seed will be delivered first to elevators for rail shipment to 1) Canadian ports, 2) the US border, or 3) processing facilities within Canada, while an increasing share will be delivered by farmers directly to processing facilities within Canada. Within Canada, seed is transported across provinces by rail, although seed delivered directly to processing facilities is transported by truck. A small share is also delivered by laker vessel, making up a portion of the canola seed crushed by processing facilities within Ontario and Quebec.

Impacts

The economic impact of seed deliveries is presented individually for rail, truck, and barge. Because transportation networks span nation-wide rather than being isolated to a single point, transportation impacts are presented on the basis of where the seed originates, rather than being allocated across the path in which the seed travels or where the seed might be delivered.

- The direct economic impact of rail transportation of seed in Canada is quantified at an average of $396 million between 2012/13 and 2014/15, while the total impact, including indirect and induced impacts, is estimated at $719 million.
- Roughly 867 individuals are *directly* employed in the rail transportation of canola seed, which has a *total* employment impact of more than 1,896 jobs.
- Wages directly attributable to rail transportation of canola seed amount to $80 million, with the *total* wage impact estimated at nearly $152 million.

Table 28: Direct economic, employment and wage impact of canola seed transportation by rail, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	0	0
Manitoba	39	95	9
Saskatchewan	179	423	39
Alberta	173	344	32
British Columbia	5	6	1
Canada	**396**	**867**	**80**

Table 29: Total economic, employment and wage impact of canola seed transportation by rail, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	0	0
Manitoba	71	207	17
Saskatchewan	325	924	74
Alberta	315	751	60
British Columbia	8	14	1
Canada	**719**	**1,896**	**152**

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- The direct economic impact of seed transportation by truck, which includes trucking to elevators in addition to trucking directly to crushing facilities, averaged $245 million annually between 2012/13 and 2014/15. The total impact, meanwhile, is estimated at $653 million.

- The direct employment impact of seed transportation by truck averaged 991 jobs over the observed timeframe. When indirect and induced multipliers are applied, we calculate the total impact to equal 2010 jobs supported.

- $48 million in annual wages were earned directly through canola seed trucking over the observed three-year time frame. At the same time, the total wage impact from canola seed trucking was calculated to be $103 million.

Table 30: Direct economic, employment and wage impact of canola seed transportation by truck, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	1	0
Quebec	1	5	0
Ontario	1	8	0
Manitoba	40	230	11
Saskatchewan	107	469	23
Alberta	69	247	12
British Columbia	28	32	2
Canada	**245**	**991**	**48**

Table 31: Total economic, employment and wage impact of canola seed transportation by truck, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	2	0
Quebec	2	10	1
Ontario	2	16	1
Manitoba	107	466	24
Saskatchewan	284	950	49
Alberta	183	501	26
British Columbia	74	65	3
Canada	**653**	**2,010**	**103**

- Given the relatively small share of canola seed traffic that takes place in laker vessels, the economic impact of seed transported by laker vessel is small in comparison to that of canola transported by rail or truck. Direct economic impact between 2012/13 and 2014/15 averaged $82 million annually, with the total impact estimated at $247 million. Port fees for Great Lakes and St. Lawrence ports are included in the section dedicated to ports later in the study.

- Jobs directly associated with laker transportation of canola seed and associated port activities averaged 87 over the observed time frame, whereas the total employment impact is estimated at 260 jobs.

- Direct wages attributable to laker transportation of canola seed meanwhile averaged $48 million, with the total wage impact equating to $131 million.

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Table 32: Direct economic, employment and wage impacts of canola seed transportation by laker vessel, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	0	0
Manitoba	40	41	11
Saskatchewan	43	45	23
Alberta	0	0	12
British Columbia	0	0	2
Canada	**82**	**87**	**48**

Table 33: Total economic, employment and wage impact of canola seed transportation by laker vessel, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	1
Ontario	0	0	1
Manitoba	119	125	30
Saskatchewan	128	136	62
Alberta	0	0	33
British Columbia	0	0	4
Canada	**247**	**260**	**131**

Methodology

Given the infinite combinations of farm origin and end-use destination, determining the economic impact of canola seed transportation proved to be the most complicated aspect of our economic impact model.

The first step in estimating expenditures associated with canola seed transportation was to determine inter-provincial trade flows of canola seed. To do this, we began by constructing provincial-level supply/demand tables. This was done in part with our knowledge of provincial-level canola production and estimates of factory level crush (see Diagram 14 in the next section on Crushing). Our results, reviewed by experts in the Canadian canola trade, are presented below.

Note: Overseas exports are assigned to a province only if the seed left from a port located in that province. Hence, the overseas exports category is zero for Alberta and Saskatchewan where no port facilities exist. For seed that originates within a province and is ultimately exported we track it through inter-provincial trade which will be discussed in greater detail below.

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Table 34: Quebec — supply/demand ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Beginning Stocks	**4**	**3**	**24**	**17**	**44**
Beginning stocks on farms	3	2	0	0	3
Beginning stocks in commercial positions	0	1	24	17	40
Production	**25**	**36**	**33**	**34**	**28**
Net Inter-Canadian Trade	**-11**	**697**	**536**	**585**	**639**
Net barge trade	-8	523	402	439	479
Net rail trade	-3	174	134	146	160
Imports	**0**	**1**	**0**	**0**	**0**
International Exports	**14**	**72**	**0**	**0**	**0**
Overseas Exports	14	72	0	0	0
Overland Exports to US/MX	0	0	0	0	0
Seed, Feed and Losses	**0**	**1**	**0**	**0**	**1**
Seed	0	0	0	0	0
Feed	0	1	0	0	1
Losses	0	0	0	0	0
Crush within province	**0**	**640**	**576**	**592**	**658**
Ending stocks	**3**	**24**	**17**	**44**	**52**
Ending stocks on farms	2	0	0	3	2
Ending stocks in commercial positions	1	24	17	40	50

Table 35: Ontario — supply/demand ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Beginning Stocks	**83**	**91**	**38**	**33**	**94**
Beginning stocks on farms	6	7	1	1	5
Beginning stocks in commercial positions	77	84	38	33	89
Production	**76**	**74**	**61**	**50**	**31**
Net Inter-Canadian Trade	**960**	**999**	**992**	**1,304**	**1,260**
Net barge trade	768	799	793	1,043	1,008
Net rail trade	192	200	198	261	252
Imports	**44**	**6**	**39**	**6**	**0**
International Exports	**182**	**253**	**312**	**492**	**443**
Overseas Exports	182	253	312	489	442
Overland Exports to US/MX	0	0	0	3	1
Seed, Feed and Losses	**1**	**2**	**0**	**0**	**1**
Seed	0	0	0	0	0
Feed	1	2	0	0	1
Losses	0	0	0	0	0
Crush within province	**890**	**875**	**785**	**806**	**842**
Ending stocks	**91**	**38**	**33**	**94**	**99**
Ending stocks on farms	7	1	1	5	2
Ending stocks in commercial positions	84	38	33	89	97

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Table 36: Manitoba — supply/demand ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Beginning Stocks	**494**	**317**	**68**	**73**	**427**
Beginning stocks on farms	373	199	20	27	309
Beginning stocks in commercial positions	121	117	48	45	117
Production	**2,216**	**1,746**	**2,100**	**3,026**	**2,511**
Net Inter-Canadian Trade	**-1,116**	**-663**	**-622**	**-1,030**	**-906**
Net barge trade	0	0	0	0	0
Net rail trade	-1,116	-663	-622	-1,030	-906
Imports	**144**	**65**	**55**	**37**	**53**
International Exports	**131**	**61**	**99**	**205**	**172**
Overseas Exports	44	0	39	39	80
Overland Exports to US/MX	87	61	60	166	92
Seed, Feed and Losses	**28**	**58**	**15**	**20**	**99**
Seed	10	8	9	10	9
Feed	18	50	5	10	90
Losses	0	0	0	0	0
Crush within province	**1,263**	**1,277**	**1,415**	**1,454**	**1,517**
Ending stocks	**317**	**69**	**73**	**427**	**295**
Ending stocks on farms	199	20	27	310	156
Ending stocks in commercial positions	117	48	45	117	140

Table 37: Saskatchewan — supply/demand ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Beginning Stocks	**1,070**	**802**	**219**	**187**	**1,218**
Beginning stocks on farms	808	512	85	84	938
Beginning stocks in commercial positions	262	290	134	102	280
Production	5,693	7,348	6,486	9,178	7,972
Net Inter-Canadian Trade	**-2,118**	**-3,878**	**-2,952**	**-4,063**	**-4,275**
Net barge trade	0	0	0	0	0
Net rail trade	-2,118	-3,878	-2,952	-4,063	-4,275
Imports	**11**	**2**	**3**	**3**	**4**
International Exports	**245**	**274**	**198**	**528**	**338**
Overseas Exports	0	0	0	0	0
Overland Exports to US/MX	245	274	198	528	338
Seed, Feed and Losses	**71**	**243**	**45**	**60**	**315**
Seed	25	32	28	30	28
Feed	46	211	17	30	287
Losses	0	0	0	0	0
Crush within province	**3,538**	**3,538**	**3,326**	**3,498**	**3,459**
Ending stocks	**802**	**219**	**187**	**1,219**	**806**
Ending stocks on farms	512	85	85	939	494
Ending stocks in commercial positions	290	134	102	280	312

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Table 38: Alberta — supply/demand ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Beginning Stocks	**535**	**492**	**96**	**90**	**702**
Beginning stocks on farms	468	426	62	66	630
Beginning stocks in commercial positions	67	66	35	24	72
Production	4,740	5,348	5,097	6,169	5,797
Net Inter-Canadian Trade	**-3,928**	**-4,718**	**-4,318**	**-4,528**	**-4,716**
Net barge trade	0	0	0	0	0
Net rail trade	-3,928	-4,718	-4,318	-4,528	-4,716
Imports	**11**	**11**	**21**	**9**	**13**
International Exports	**187**	**189**	**156**	**367**	**221**
Overseas Exports	0	0	0	0	0
Overland Exports to US/MX	187	189	156	367	221
Seed, Feed and Losses	**59**	**177**	**35**	**40**	**229**
Seed	20	23	22	20	21
Feed	39	154	13	20	209
Losses	0	0	0	0	0
Crush within province	**620**	**670**	**614**	**629**	**884**
Ending stocks	**492**	**96**	**90**	**703**	**461**
Ending stocks on farms	427	62	66	631	359
Ending stocks in commercial positions	66	35	24	72	102

Table 39: British Columbia — supply/demand ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Beginning Stocks	**562**	**481**	**261**	**189**	**523**
Beginning stocks on farms	6	4	1	1	9
Beginning stocks in commercial positions	556	478	261	188	514
Production	40	56	83	89	72
Net Inter-Canadian Trade	**6,213**	**7,562**	**6,372**	**7,737**	**7,998**
Net barge trade	0	0	0	0	0
Net rail trade	6,213	7,562	6,372	7,737	7,998
Imports	**14**	**12**	**10**	**11**	**7**
International Exports	**6,347**	**7,849**	**6,537**	**7,501**	**7,987**
Overseas Exports	6,346	7,847	6,535	7,496	7,984
Overland Exports to US/MX	1	1	2	5	3
Seed, Feed and Losses	**0**	**2**	**1**	**1**	**3**
Seed	0	0	0	0	0
Feed	0	2	0	0	3
Losses	0	0	0	0	0
Crush within province	**0**	**0**	**0**	**0**	**0**
Ending stocks	**481**	**261**	**189**	**523**	**610**
Ending stocks on farms	4	1	1	9	4
Ending stocks in commercial positions	478	261	188	514	606

The next step in determining transportation expenses was to compile a distance matrix between the centers of canola production, canola processing and points of export (port facilities). These distances are presented in Table 40.

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Table 40: Distances between geographic centers of canola production (by province) and port facilities, the US border and processing facilities (miles)

		Center of provincial canola production					
		Bécancours, QC	Hornepayne, ON	Gladstone, MB	Kenaston, SK	Red Deer, AB	Fort St. John, BC
Port	Bécancours, QC	x	823	1,589	2,038	2,459	x
Port	Thunder Bay, ON	x	308	539	911	1,284	x
Port	Churchill, MB	x	x	1,063	x	x	x
Port	Prince Rupert, BC	x	x	x	x	934	717
Port	Vancouver, BC	3,206	2,157	1,360	985	687	x
US Border	Grand Portage, MN	x	345	x	x	x	x
US Border	Crystal City, ND	x	x	93	x	x	x
US Border	Estevan, SK	x	x	x	250	x	x
US Border	Crescent Lake, WA	x	x	x	x	444	x
Processing Facility	Fort Saskatchewan, AB	x	x	x	x	116	x
Processing Facility	Lethbridge, AB	x	x	x	x	218	x
Processing Facility	Lloydminster, AB	x	x	x	x	242	x
Processing Facility	Camrose, AB	x	x	x	x	85	x
Processing Facility	Yorkton, SK	x	x	x	204	x	x
Processing Facility	Nipawin, SK	x	x	x	212	x	x
Processing Facility	Clavet, SK	x	x	x	43	x	x
Processing Facility	Harrowby, MB	x	x	135	261	x	x
Processing Facility	Altona, MB	x	x	133	506	x	x
Processing Facility	Ste. Agathe, MB	x	x	115	487	x	x
Processing Facility	Hamilton, ON	469	690	1,452	1,824	x	x
Processing Facility	Windsor, ON	x	953	1,404	1,547	x	x
Processing Facility	Bécancours, QC	x	828	1,590	1,945	x	x

Trucking

With an understanding of provincial-level supply/demand balances and estimates of the annual crush of each processing facility in Canada we began our transportation estimates with trucking. Trucking canola seed was then divided up into two categories.

- **Volumes trucked from farm to elevator** were based on the volumes of seed passing through elevators, data that was obtained in part from the Canadian Grain Commission and was presented in (Table 27).

- Canola that did not pass through a primary elevator was credited toward **volumes trucked directly to crushing facilities**.

For the Prairie Provinces, where canola production is relatively evenly distributed across the province, the distance trucked from farm to elevator was determined by dividing the number of square miles of canola planted by the number of canola harvested. For Quebec, Ontario and British Columbia, where canola production is smaller and more isolated, the average distance to elevator was determined through conversations with individuals with local canola expertise.

Distances for canola seed trucked directly from farm to processing facility were determined using the distance between the geographic centers of canola production in a province and processing facilities situated within that province. In all cases, canola trucked directly to processing facilities was done at a distance of less than 205 miles, which would be at the high end of actual observed trucking distances.

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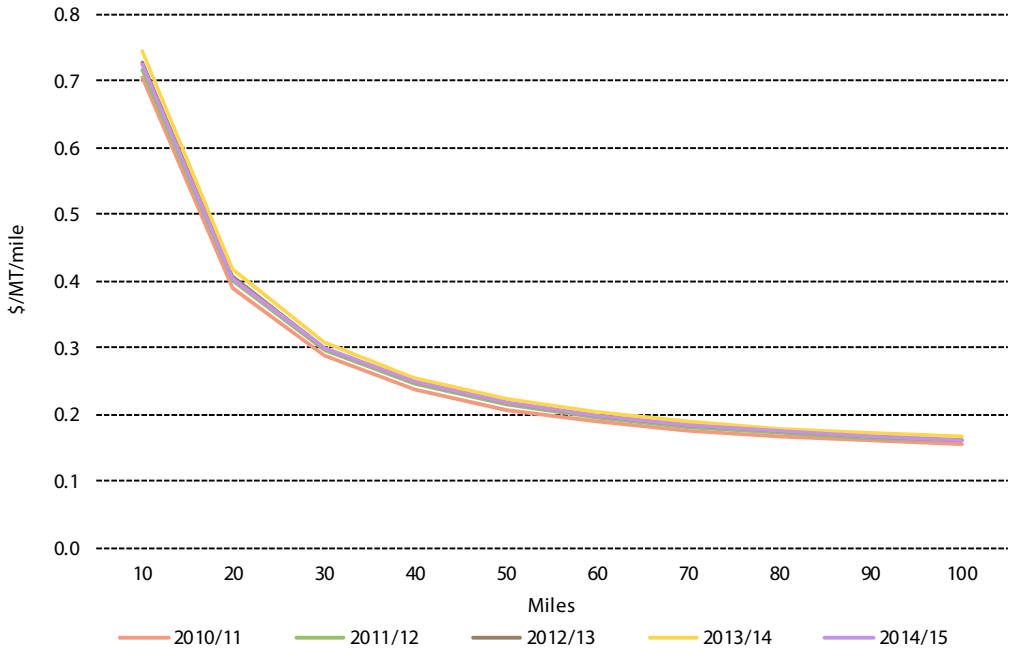
Volumes were multiplied by distances to arrive at a figure in tonne-miles. This, in turn, was multiplied by a tonne-mile trucking rate sourced from StatCan (Diagram 11) to arrive at a trucking expenditures number.

Diagram 11: Canadian trucking rate (CD dollars per tonne-mile)



The direct employment impact of canola seed trucking was calculated on the basis of the tonne-miles of canola seed delivered by truck. This was converted to a full-time employment impact by assuming that a typical truck (with one driver) can transport 18 tonnes of cargo and averages 40 miles per hour and that a full-time trucker drives 2000 hours per year. Trucking wages were obtained from StatCan data.

Rail

Our calculations on rail expenditures also begin with the provincial supply/demand balances shown in Tables 34 through 39 above, where we included estimates on rail trade with the US and net inter-provincial rail trade. In Tables 41 to 46 below, we provide a more detailed look at our inter-provincial canola rail trade estimates.

Note: There is a fair amount of canola moved by laker vessel between Ontario and Quebec. A large volume of canola crushed in Bécancours, QC that originates from the Prairie Provinces is delivered by rail to Ontario (captured in Table 42) and then delivered by laker vessel from Ontario to Quebec. These laker movements are not included in Tables 41 or 42, but there is some discussion of lakers below, on page 39.

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Table 41: Quebec inter-provincial canola rail trade ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Maritimes	0	0	0	0	0
Quebec	0	0	0	0	0
Ontario	-11	0	0	0	0
Manitoba	0	272	218	319	305
Saskatchewan	0	418	318	266	332
Alberta	0	7	0	0	2
British Columbia	0	0	0	0	0
TOTAL	**-11**	**697**	**536**	**585**	**639**

Table 42: Ontario inter-provincial canola rail trade ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Maritimes	0	0	0	0	0
Quebec	11	0	0	0	0
Ontario	0	0	0	0	0
Manitoba	740	354	386	688	629
Saskatchewan	117	635	606	615	628
Alberta	92	10	0	1	4
British Columbia	0	0	0	0	0
TOTAL	**960**	**999**	**992**	**1,304**	**1,260**

Table 43: Manitoba inter-provincial canola rail trade ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Maritimes	0	0	0	0	0
Quebec	0	-272	-218	-319	-305
Ontario	-740	-354	-386	-688	-629
Manitoba	0	0	0	0	0
Saskatchewan	25	0	42	40	77
Alberta	0	0	0	0	0
British Columbia	-401	-36	-60	-63	-50
TOTAL	**-1,116**	**-663**	**-622**	**-1,030**	**-906**

Table 44: Saskatchewan inter-provincial canola rail trade ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Maritimes	0	0	0	0	0
Quebec	0	-418	-318	-266	-332
Ontario	-117	-635	-606	-615	-628
Manitoba	-25	0	-42	-40	-77
Saskatchewan	0	0	0	0	0
Alberta	0	0	0	0	0
British Columbia	-1,975	-2,824	-1,986	-3,141	-3,237
TOTAL	**-2,118**	**-3,878**	**-2,952**	**-4,063**	**-4,275**

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Table 45: Alberta inter-provincial canola rail trade ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Maritimes	0	0	0	0	0
Quebec	0	-7	0	0	-2
Ontario	-92	-10	0	-1	-4
Manitoba	0	0	0	0	0
Saskatchewan	0	0	0	0	0
Alberta	0	0	0	0	0
British Columbia	-3,836	-4,701	-4,318	-4,527	-4,710
TOTAL	**-3,928**	**-4,718**	**-4,318**	**-4,528**	**-4,716**

Table 46: British Columbia inter-provincial canola rail trade ('000 tonnes)

	2010/11	2011/12	2012/13	2013/14	2014/15
Maritimes	0	0	0	0	0
Quebec	0	0	0	0	0
Ontario	0	0	0	0	0
Manitoba	401	36	60	63	50
Saskatchewan	1,975	2,824	1,986	3,141	3,237
Alberta	3,836	4,701	4,318	4,527	4,710
British Columbia	0	0	0	0	0
TOTAL	**6,213**	**7,562**	**6,372**	**7,737**	**7,998**

Based on the volumes of inter-provincial trade shown in Tables 41 through 46 and the distances delineated in Table 40, we arrive at a figure for tonne-miles of canola seed transported. The tonne-mile figure is then multiplied by a range of rail freight rates (which tend to be higher for shorter distances and lower for longer distances) (Diagram 12) to arrive at an estimate of rail freight expenditures.

According to the Railway Association of Canada, roughly 34,000 individuals are employed in freight rail in Canada, a number that has fallen only slightly over the last decade. Additionally, the Association states that over 320 billion tonne-miles of cargo are transported in Canada annually. To estimate the number of individuals directly employed in the rail transportation of canola seed, we multiplied total freight rail employment by the ratio of canola tonne-miles to total freight tonne-miles (Diagram 13). Rail wages were also obtained from the Railway Association of Canada and multiplied by jobs to determine the direct wage impact.

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Diagram 12: Trended range in Canadian rail rates

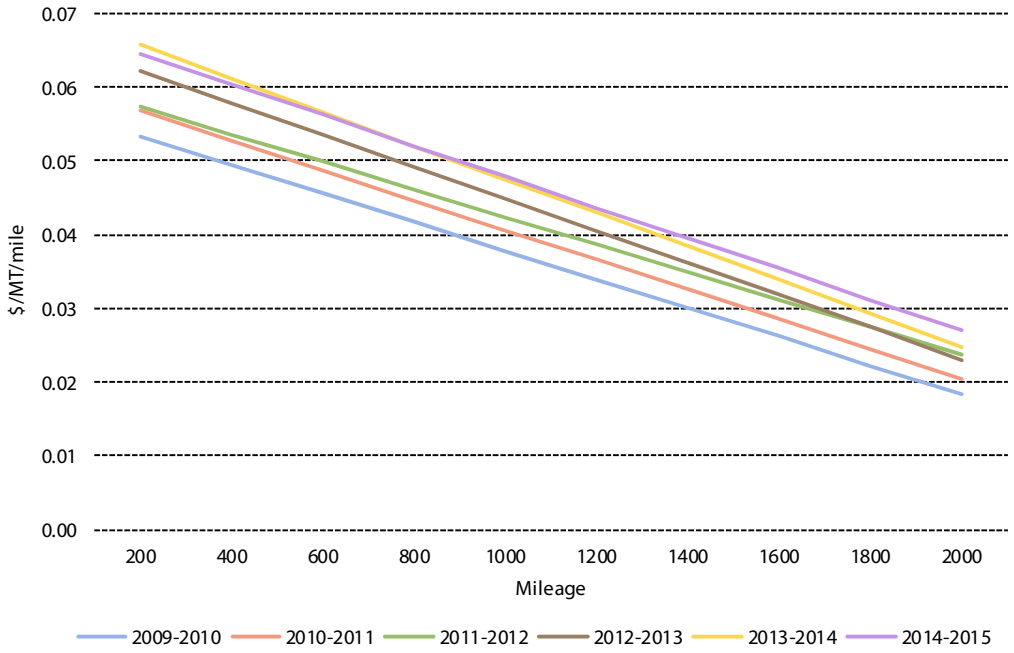
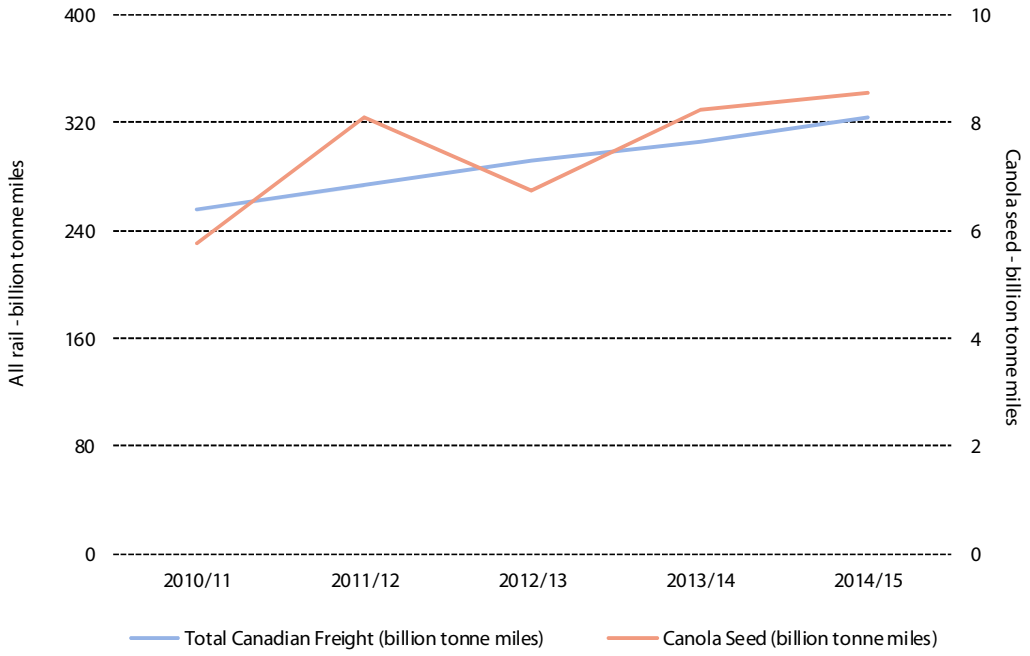


Diagram 13: Total rail freight and canola tonne-miles in Canada



Lakers

Estimates of the expenditures incurred through canola shipment by laker begin with the assumption that roughly 75-80% of the canola delivered to the two processing facilities in Ontario and one in Quebec is delivered by laker vessel. Most of this barge traffic originates around Thunder Bay, ON, based on rail shipments delivered from the Prairies. Laker shipping rates were obtained from the Canadian Grain Commission and have ranged between $24 and $26 per tonne in recent years.

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Employment and wages on both laker vessels themselves and at ports was based on conversations with experts in shipping in the Great Lakes and on a report entitled "Ocean Shipping in the Great Lakes: an Analysis of Issues" by Dr. John Taylor of Grand Valley State University. http://www.lakeinvaders.com/Learn_More_files/OceanShippingPhaseII.pdf

5. Crushing

Canada's crushing sector adds value to roughly 7.4 million tonnes of canola seed annually. With the completion of the Cargill facility in Camrose, AB, there are now 14 operational canola crush plants in the country.

Impacts

- The direct economic impact of canola crushing on the Canadian economy is just under $730 million. The total economic impact, including indirect and induced impacts is $3.4 billion.
- Roughly 530 individuals are directly employed in canola crushing. However as a capital intensive sector that relies heavily on contracted workers, the total employment impact of canola is estimated to be much higher, supporting 4,800 jobs.
- $38 million in wages are paid out to individuals directly employed in canola crushing. Like the employment impact, however, the total wage impact of canola crushing is much higher, in excess of $220 million.

Table 47: Direct economic, employment and wage impact of canola crushing, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	63	36	3
Ontario	84	64	5
Manitoba	151	108	8
Saskatchewan	356	181	13
Alberta	72	140	10
British Columbia	0	0	0
Canada	**726**	**529**	**38**

Table 48: Total economic, employment and wage impact of canola crushing, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	297	325	15
Ontario	397	584	27
Manitoba	716	978	45
Saskatchewan	1,687	1,646	76
Alberta	343	1,266	59
British Columbia	0	0	0
Canada	**3,440**	**4,799**	**222**

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Methodology

The economic impact of the canola crushing sector is determined based on the value it adds from processing seed into its crude oil and meal by-products. This is done on a provincial level by estimating the crush at each canola processing facility in Canada (Diagram14), which in turn is estimated on the basis of each facility's processing capacity, while taking into account that the Ontario and Quebec facilities devote a significant share of their capacity to soybeans. Once seed volumes were estimated, we had to make a choice about what set of canola seed and by-product prices are most representative of the crush margin. After consulting with crushers, it was decided that spot prairie prices may exceed the actual margin received by crushers by overstating the value of by-products and understating the value of seed, while using Vancouver prices may cause the opposite problem. Instead, we opted for the board crush margin (which actually relies on soybeans for by-product prices), as a midpoint between the two (Diagram 15). The total economic impact of the crushing sector was then taken to be the product of volumes crushed and the board crush margin.

The employment impact of the canola crushing sector was determined through discussions with employees of the major crushers in Canada as well as through press releases citing the number of individuals employed in a given facility. The average salary for employees of crushing facilities was obtained from StatCan data.

Diagram 14: Estimated volume of canola seed crushed by facility, 2005/06-2014/15

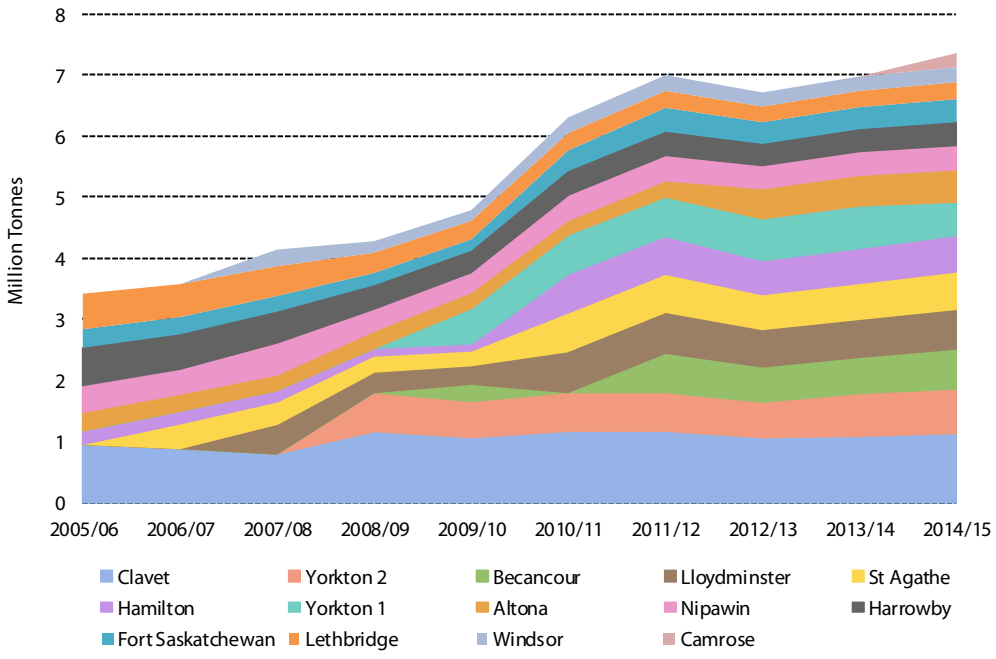

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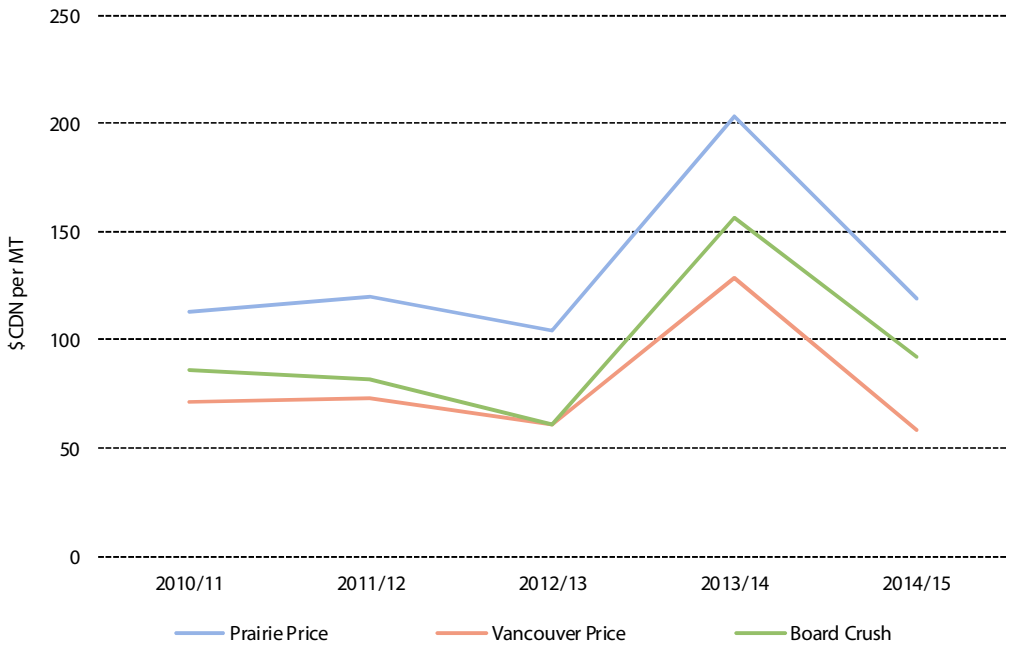
Diagram 15: Crush margins calculated using different bases



6. Refining

Most crushing facilities in Canada refine a portion of the crude oil they produce on site. The notable exception is the Cargill facility in Camrose, AB, which does not currently refine oil, instead exporting the bulk of its crude oil to the US and overseas markets.

Impacts

- The direct economic impact on the Canadian economy from refining crude canola oil averaged $275 million annually between 2012/13 and 2014/15. The total economic impact, meanwhile, is estimated at $1.3 billion annually.
- Approximately 277 people are directly employed by canola refining in Canada. Like crushing, however, the multiplier effect of refining is high, with the total employment impact estimated at over 2,500 jobs.
- $20 million in wages are directly attributable to canola refining while the total wage impact is in the vicinity of $116 million.

Table 49: Direct economic, employment and wage impact of canola refining, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	24	24	2
Ontario	32	32	2
Manitoba	58	58	4
Saskatchewan	136	137	10
Alberta	25	25	2
British Columbia	0	0	0
Canada	**275**	**277**	**20**

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Table 50: Total economic, employment and wage impact of canola refining, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	114	220	10
Ontario	152	293	14
Manitoba	274	529	24
Saskatchewan	644	1,238	57
Alberta	119	229	11
British Columbia	0	0	0
Canada	**1,304**	**2,510**	**116**

Methodology

The value added to the Canadian economy through canola refining has been determined on the basis of volumes produced multiplied by the refining margin. Total canola oil refined was estimated as crude canola oil production minus crude oil exports. This total was then allocated across Canada's processing facilities based on crude canola oil production, adjusting for the fact that Camrose, AB does not refine crude canola oil (Diagram 16).

The refining margin for canola oil was based on the spread between unit export values for crude and refined canola oil, obtained from Canadian trade data (Diagram 17).

Diagram 16: Estimated volume of canola oil refined by facility, 2005/06-2014/15

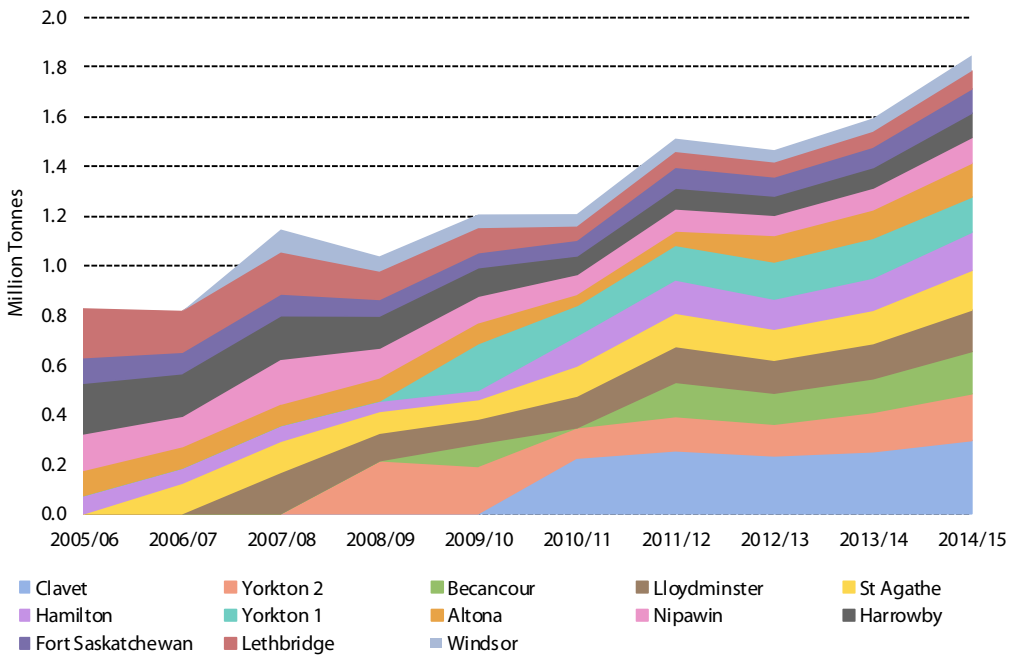

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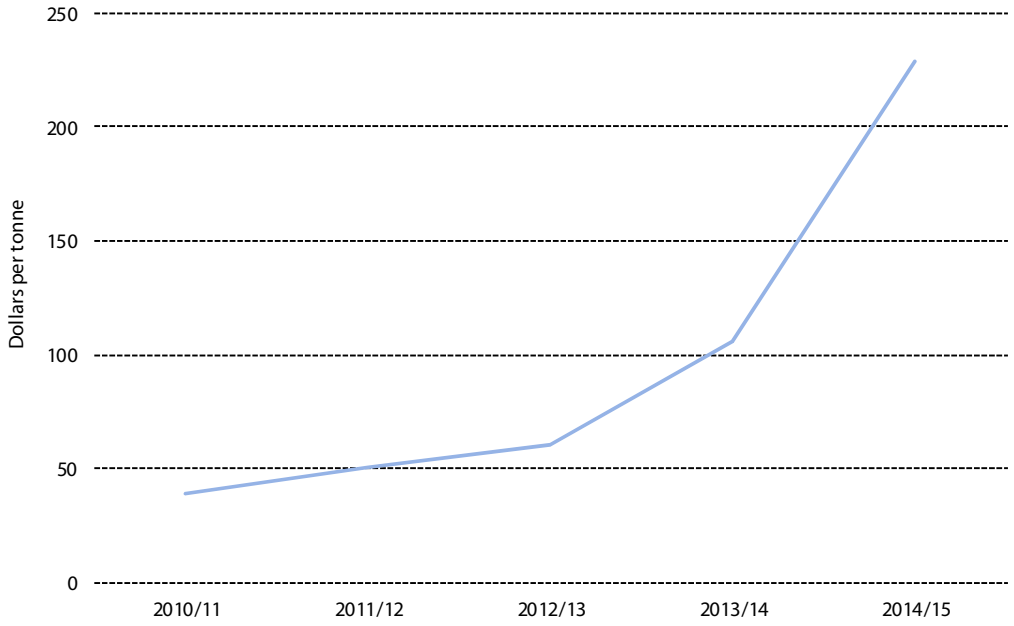
Diagram 17: Canola oil refining margin



7. Biodiesel production

In the not-too distant past Canadian biodiesel production generally, and canola oil used for biodiesel production in Canada specifically, have been negligible. That said, canola oil used in production of the biofuel has ramped up in recent years and now constitutes a significant value-added activity.

Impacts

- The direct economic impact on the Canadian economy of producing biodiesel from crude canola oil averaged $18 million annually between 2012/13 and 2014/15 while the economic impact from the activity is estimated at $87 million annually.
- Approximately 19 people are directly employed by canola refining in Canada. The total attributable employment impact is estimated at 169 individuals.
- $1.3 million in wages are directly attributable to canola refining while the total wage impact is in the vicinity of $8 million.

Table 51: Direct economic, employment and wage impact of biodiesel production from canola oil, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	3	2	0
Ontario	11	10	1
Manitoba	0	0	0
Saskatchewan	1	1	0
Alberta	2	3	0
British Columbia	2	2	0
Canada	**18**	**19**	**1**

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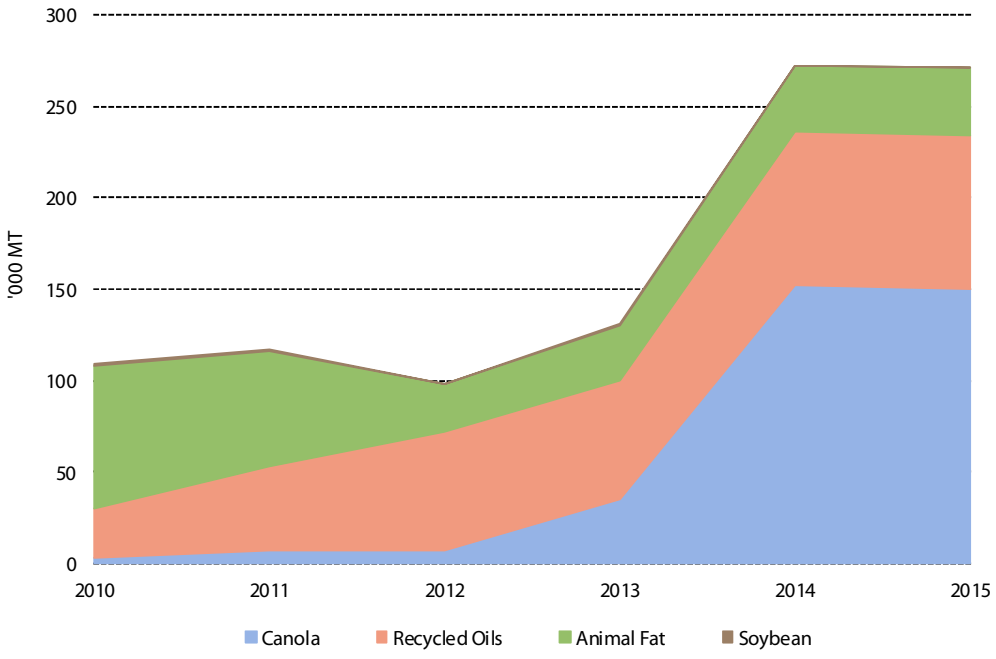
Table 52: Total economic, employment and wage impact of biodiesel production from canola, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	12	22	1
Ontario	50	91	4
Manitoba	0	0	0
Saskatchewan	4	7	0
Alberta	10	30	1
British Columbia	10	19	1
Canada	**87**	**169**	**8**

Methodology

The economic impact of the sector was taken to be a function of canola oil used in biodiesel production, as reported by the USDA (Diagram 18) and the premium of diesel fuel over crude canola oil, which is less than zero most years. We opted to use the petroleum price because no wholesale biodiesel price series exists for Canada and the production incentives enacted by the government are more a reflection of policy than value added.

Diagram 18: Feedstocks used in Canadian biodiesel production



8. By-product delivery

Most Canola crushing facilities produce and distribute three different by-products of considerable size, crude oil, refined oil and canola meal. In this section we track the distribution of these products across Canada, by truck or by rail, to domestic users, including biodiesel producers, port facilities for overseas export or up the US border in the event the product is being shipped to the US or Mexico. Deliveries of biodiesel from production facility to blending facility are not included.

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Impacts

We present our results for the economic impact of canola by-product delivery separately for 1) crude oil, 2) refined oil and 3) meal. For all three by-products results are broken out for both rail and truck transportation.

- The direct economic impact of crude oil shipped by rail is $15 million with the total impact estimated at $27 million. For truck shipments (mostly for biodiesel production) the numbers are $1 million and $3 million, respectively.
- 35 jobs are directly attributable to the rail shipment of crude canola oil while the total employment impact is 77 jobs. For truck shipments, these figures are 3 and 6.
- The direct and total wage impact, meanwhile, averaged $3 million and $6 million respectively over the observed time frame. For truck shipments of canola oil wages paid amount to less than $1 million dollars annually.

Table 53: Direct economic, employment and wage impact of crude canola oil distribution by rail, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	0	0
Manitoba	0	0	0
Saskatchewan	8	18	2
Alberta	7	15	1
British Columbia	0	1	0
Canada	**15**	**35**	**3**

Table 54: Total economic, employment and wage impact of crude canola oil distribution by rail, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	1	0
Manitoba	0	0	0
Saskatchewan	14	40	3
Alberta	12	33	3
British Columbia	1	2	0
Canada	**27**	**77**	**6**

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Table 55: Direct economic, employment and wage impact of crude canola oil distribution by truck, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	1	0
Ontario	1	2	0
Manitoba	0	0	0
Saskatchewan	0	0	0
Alberta	0	0	0
British Columbia	0	0	0
Canada	**1**	**3**	**0**

Table 56: Total economic, employment and wage impact of crude canola oil distribution by truck, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	1	2	0
Ontario	2	4	0
Manitoba	0	0	0
Saskatchewan	0	0	0
Alberta	0	0	0
British Columbia	0	0	0
Canada	**3**	**6**	**0**

- The direct economic impact of refined canola oil shipped averaged $25 million for rail and $6 million for truck. Total impacts were $45 million and $17 million respectively.
- 67 jobs were directly dependent on refined canola oil shipped by rail with another 29 jobs linked to trucking. The total employment impacts for these categories are 147 jobs and 58 jobs, respectively.
- The total wage impact of refined oil transportation averaged $12 million for rail and around $4 million for trucking.

Table 57: Direct economic, employment and wage impact of refined canola oil distribution by rail, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	1	3	0
Manitoba	3	8	1
Saskatchewan	18	50	5
Alberta	3	6	1
British Columbia	0	0	0
Canada	**25**	**67**	**6**

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Table 58: Total economic, employment and wage impact of refined canola oil distribution by rail, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	1	0
Ontario	2	6	0
Manitoba	5	18	1
Saskatchewan	32	109	9
Alberta	5	12	1
British Columbia	0	0	0
Canada	**45**	**147**	**12**

Table 59: Direct economic, employment and wage impact of refined canola oil distribution by truck, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	2	9	0
Ontario	3	13	1
Manitoba	0	1	0
Saskatchewan	0	1	0
Alberta	1	4	0
British Columbia	0	0	0
Canada	**6**	**29**	**1**

Table 60: Total economic, employment and wage impact of refined canola oil distribution by truck, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	5	18	1
Ontario	8	27	1
Manitoba	1	3	0
Saskatchewan	1	2	0
Alberta	2	9	0
British Columbia	0	0	0
Canada	**17**	**58**	**3**

- The total economic impact of meal transportation is $83 million for rail and $19 million for trucking.
- Meal transportation via rail and truck supports a total of 277 jobs and 78 jobs respectively.
- Collectively, the total wage impact of canola meal transportation is estimated at $16 million.

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Table 61: Direct economic, employment and wage impact of canola meal distribution by rail, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	4	27	2
Ontario	3	7	1
Manitoba	19	45	4
Saskatchewan	12	28	3
Alberta	8	20	2
British Columbia	0	0	0
Canada	**46**	**127**	**12**

Table 62: Total economic, employment and wage impact of canola meal distribution by rail, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	7	58	5
Ontario	5	16	1
Manitoba	34	98	8
Saskatchewan	22	61	5
Alberta	15	43	3
British Columbia	0	1	0
Canada	**83**	**277**	**22**

Table 63: Direct economic, employment and wage impact of canola meal distribution by truck, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	3	15	1
Ontario	3	15	1
Manitoba	1	3	0
Saskatchewan	0	2	0
Alberta	1	4	0
British Columbia	0	0	0
Canada	**7**	**39**	**2**

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Table 64: Total economic, employment and wage impact of canola meal distribution by truck, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	7	30	2
Ontario	7	30	2
Manitoba	2	7	0
Saskatchewan	1	3	0
Alberta	2	8	0
British Columbia	0	0	0
Canada	**19**	**78**	**4**

Methodology

We began our calculations of expenditures from crude oil shipments by determining surplus quantities of crude oil by crushing facility and the likely point of export for these surpluses. The likely point of export was determined based on the importing trade partner, with the majority of US shipments being made overland, shipments to Asia generally being channeled through BC ports, and western European and some of the Middle Eastern demand being fulfilled by shipments out of the St. Lawrence. Once tonne-miles were determined, we applied a range of rail rates similar to those used in seed transportation.

The economic impact of refined oil shipments was determined by first constructing a provincial-level refined oil balance, with supply being our production estimates (shown in Diagram 16) and demand being a function of a given province's population. For demand that is met by production in a province, it was assumed that delivery was made by truck at a distance averaging 100 miles. For demand that is met by production outside of a province, or for any delivery to a port or the US border, it was assumed that delivery was made by rail. The distance matrix shown in Table 40 was also used in this exercise. With tonne-miles determined, a rail or trucking rate was applied to determine expenditures.

Similarly, the calculations behind meal transportation began with building provincial-level supply/demand tables. Meal demand in each province was based on a meal allocation by livestock species, reflecting the particular benefit of canola meal to dairy cattle (Diagram 19), and the population of livestock in a given province (Diagrams 20-22).

Diagram 19: Canola meal consumption by sector

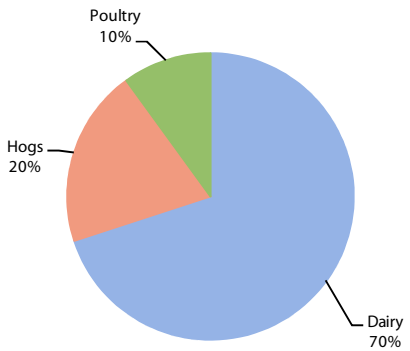

Diagram 20: Dairy cow population by province

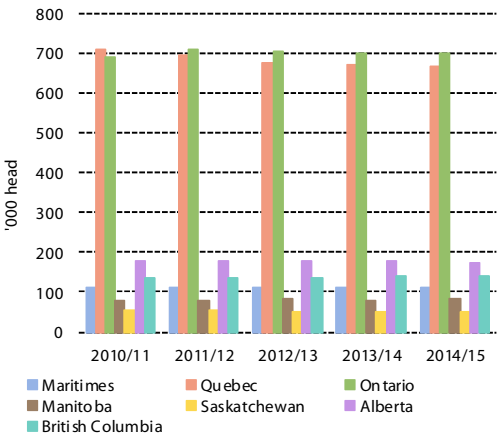

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Diagram 21: Hog population by province

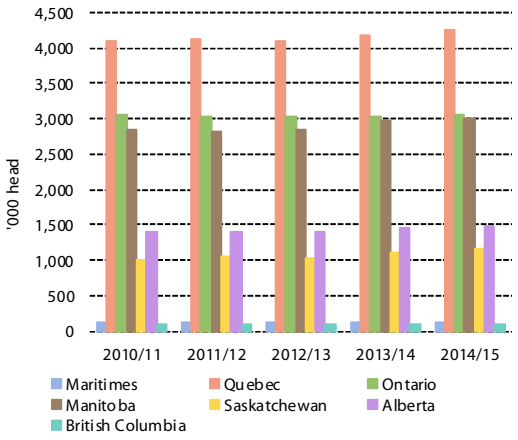
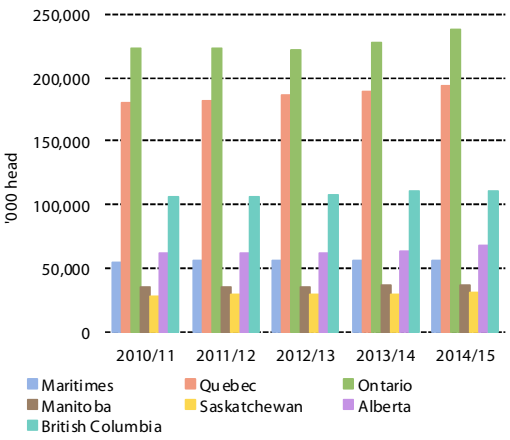


Diagram 22: Poultry (Broilers, Layers and Turkeys) population by province



After developing provincial-level supply/demand balances, the distances and modes of delivery were determined in the same manner as for refined oil, with local deliveries made by truck and long-distance deliveries made by rail. For by-product transportation, employment and wage impacts were calculated in the same manner as for the transportation of seed.

9. Impacts at ports

Exports

In 2014/15, Canada exported over 15 million tonnes of canola products, including seed, meal, crude oil, and refined oil. While the majority of meal exports takes place overland to the US and Mexico, roughly 10 million tonnes of canola products leave Canada via its ports. Although most shipments of overseas exports of canola products leave Canada via ports in British Columbia, canola also represents a sizeable share of exports out of Ontario and Quebec ports. A small amount of canola seed has even been exported out of Churchill, MB in recent years, although the facility appears set to close in 2016.

Impacts

In our model, we calculated the economic impact of canola products on Canadian ports separately for seed, meal, crude, and refined canola oil.

- The direct effects of canola seed exports on Canadian ports are an economic impact of $121 million, 617 direct jobs, and a wage impact of $41 million (Table 65).
- The total effects of canola seed exports on Canadian ports are an economic impact of $228 million, an employment impact of 967 jobs, and a wage impact of $65 million (Table 66).

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Table 65: Direct economic, employment and wage impact of canola seed at Canadian ports, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	6	121	8
Manitoba	1	4	0
Saskatchewan	0	0	0
Alberta	0	0	0
British Columbia	114	493	33
Canada	**121**	**617**	**41**

Table 66: Total economic, employment and wage impact of canola seed at Canadian ports, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	11	190	13
Manitoba	2	6	0
Saskatchewan	0	0	0
Alberta	0	0	0
British Columbia	216	772	51
Canada	**228**	**967**	**65**

Because the bulk of Canadian meal exports takes place overland to the US and Mexico, the impacts of meal exports on Canadian ports are significantly smaller than they are for seed.

- The direct economic impact of meal exports on Canadian ports is $2 million, with 8 jobs and total wages of roughly $1 million directly attributable to this activity (Table 67).
- Total effects include an economic impact of $4 million, an employment impact of 13 jobs, and a wage impact of $1 million (Table 68).

Table 67: Direct economic, employment and wage impact of canola meal at Canadian ports, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	0	0
Manitoba	0	0	0
Saskatchewan	0	0	0
Alberta	0	0	0
British Columbia	2	8	1
Canada	**2**	**8**	**1**

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Table 68: Total economic, employment and wage impact of canola meal at Canadian ports, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	0	0
Manitoba	0	0	0
Saskatchewan	0	0	0
Alberta	0	0	0
British Columbia	4	13	1
Canada	**4**	**13**	**1**

- Direct effects of crude canola oil exports include an economic impact of $13 million, an employment impact of 56 jobs, and a wage impact of $4 million (Table 69).
- Total effects of crude canola oil exports on Canadian ports meanwhile are estimated at an economic impact of $24 million, an employment impact of 87 jobs, and a wage impact of $6 million (Table 70).

Table 69: Direct economic, employment and wage impact of canola crude oil at Canadian ports, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	0	0
Manitoba	0	0	0
Saskatchewan	0	0	0
Alberta	0	0	0
British Columbia	13	56	4
Canada	**13**	**56**	**4**

Table 70: Total economic, employment and wage impact of canola crude oil at Canadian ports, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	0	0
Manitoba	0	0	0
Saskatchewan	0	0	0
Alberta	0	0	0
British Columbia	24	87	6
Canada	**24**	**87**	**6**

- Refined canola oil exports by Canada are small in comparison with crude oil exports and have a direct economic impact of $1 million and directly provide 6 jobs, with a wage impact of less than a million dollars (Table 71).
- The total economic impact is estimated at $3 million, with a total employment impact of around 10 jobs and wages estimated at roughly $1 million (Table 72).

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Table 71: Direct economic, employment and wage impact of refined canola oil at Canadian ports, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	0	0
Manitoba	0	0	0
Saskatchewan	0	0	0
Alberta	0	0	0
British Columbia	1	6	0
Canada	**1**	**6**	**0**

Table 72: Total economic, employment and wage impact of refined canola oil at Canadian ports, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact Jobs	Wage Impact (Million Dollars)
Maritimes	0	0	0
Quebec	0	0	0
Ontario	0	0	0
Manitoba	0	0	0
Saskatchewan	0	0	0
Alberta	0	0	0
British Columbia	3	9	1
Canada	**3**	**10**	**1**

Methodology

The economic impact of canola products on Canadian ports was determined to be the product of volumes multiplied by port fees.

- Canadian seed volumes by port and direct prairie exports (overland) were obtained from data provided by the Canadian Grain Commission (Diagram 23).
- Export volumes by port for meal, crude, and refined oils were obtained from Canadian trade data (Diagrams 24-26).

Diagram 23: Seed exports by port and overland

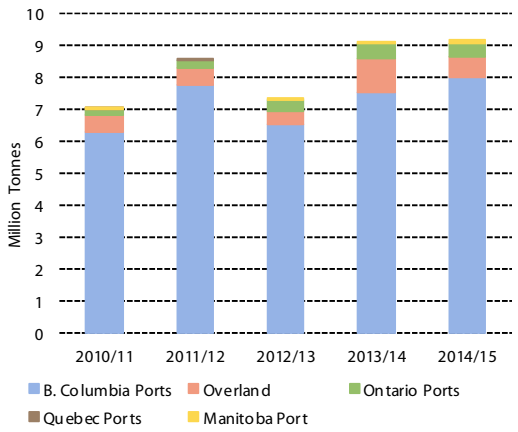

Diagram 24: Meal exports by port and overland

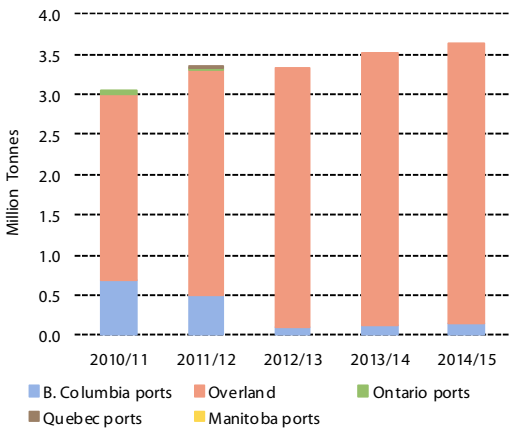

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Diagram 25: Crude oil exports by port and overland

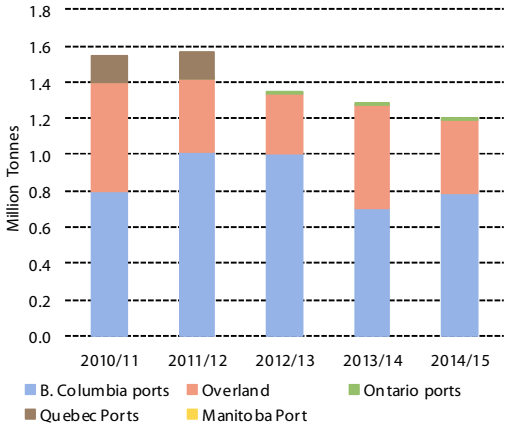
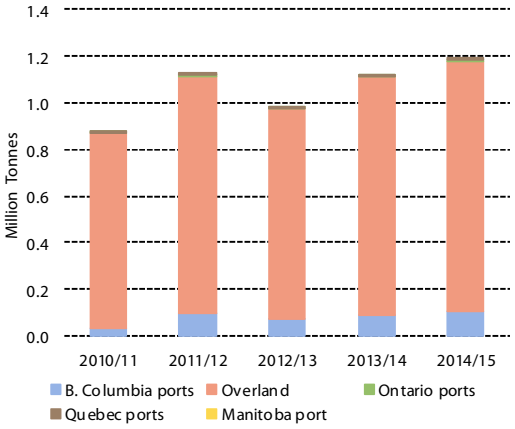
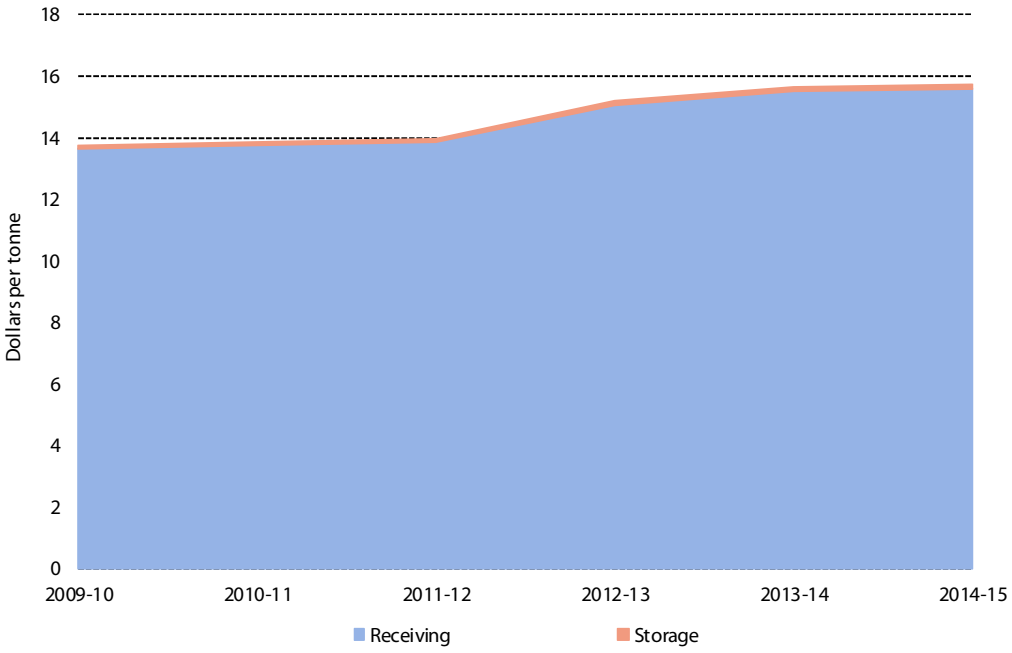


Diagram 26: Refined oil exports by port and overland



Port fees for canola seed were also obtained from the Canadian Grain Commission and are illustrated in Diagram 27. The employment impact at the ports was based on canola products' share of total port movements, combined with an understanding of the total number of individuals employed at Canadian ports. Wages, meanwhile, were based on a study detailing the economic impact of Vancouver ports: www.portmetrovancouver.com

Diagram 27: Grain charges at Canadian ports



10. Benefits to livestock sector

The Canadian livestock sector is benefited by the availability of canola meal in a number of ways. For all livestock, canola represents a lower cost protein alternative compared to soybean, even when adjusted for a lower protein content and an inferior set of amino acids for some species. This advantaged has diminished somewhat in recent years, however, as soybean prices have fallen more profoundly than those of canola. For the dairy sector, canola imparts an added advantage given the amino acid profile of canola meal is superior to most other protein meals and has been shown to increase milk yields by 1 liter of milk per cow per day.

Impacts

For the livestock sector, it is assumed that the effects of canola consumption are confined to economic impact. No jobs or wages in the livestock sector are attributed to canola meal, given that there would likely be little difference in the size of the sector in a world with or without canola meal. Canola meal does, however, have significant positive implications for the profitability of the sector (Tables 73 and 74).

Table 73: Direct economic impact of canola meal by livestock sector, 3-year average (2012/13–2014/15)

	Economic Impact Dairy Cost Savings (Million Dollars)	Economic Impact Poultry Cost Savings (Million Dollars)	Economic Impact Hog Cost Savings (Million Dollars)	Economic Impact Dairy Yield Boost (Million Dollars)
Maritimes	1	0	0	6
Quebec	6	0	1	39
Ontario	6	0	0	40
Manitoba	1	0	0	5
Saskatchewan	0	0	0	3
Alberta	2	0	0	10
British Columbia	1	0	0	8
Canada	**16**	**0**	**2**	**111**

Table 74: Total economic impact of canola meal by livestock sector, 3-year average (2012/13 – 2014/15)

	Economic Impact Dairy Cost Savings (Million Dollars)	Economic Impact Poultry Cost Savings (Million Dollars)	Economic Impact Hog Cost Savings (Million Dollars)	Economic Impact Dairy Yield Boost (Million Dollars)
Maritimes	5	0	0	34
Quebec	31	0	3	210
Ontario	32	0	2	220
Manitoba	4	0	2	25
Saskatchewan	2	0	1	16
Alberta	8	0	1	55
British Columbia	6	0	0	43
Canada	**88**	**0**	**10**	**604**

Methodology

The economic impact from canola meal cost savings was calculated based on the price of canola relative to soy, adjusted for useable protein. For the dairy sector, it was assumed canola provided 80% as much protein as soy on a per-weight basis. For hogs and poultry, the percentages were 75% and 70%, respectively, accounting for the digestibility issues of high

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fiber meals for monogastric animals. The relative cost savings (Diagram 28) were then multiplied by quantities consumed by livestock sector to determine the total savings of canola meal consumption.

The calculation for the dairy yield boost was made on the basis of research showing that cattle that are fed canola experienced a yield boost averaging 1 liter per cow per day. To achieve this boost, it was assumed that a cow needed to consume 2.7 kilograms of canola meal per day while it was lactating, and that a cow lactated an average of 300 days per year. The total number of cows being fed a "full" meal ration was determined, using these annual per-cow canola consumption figures divided by the total amount of canola thought to go into the dairy sector (around 70% of the total). Multiplying the number of canola fed cows by 300 liters per year by the Canadian wholesale milk price (Diagram 29) gave us the economic value of the canola dairy boost.

Diagram 28: Canola meal savings relative to soy meal

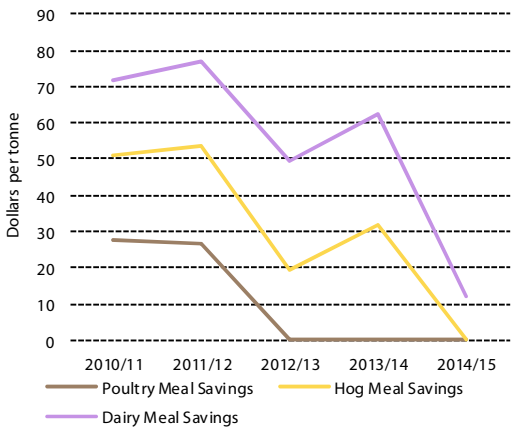
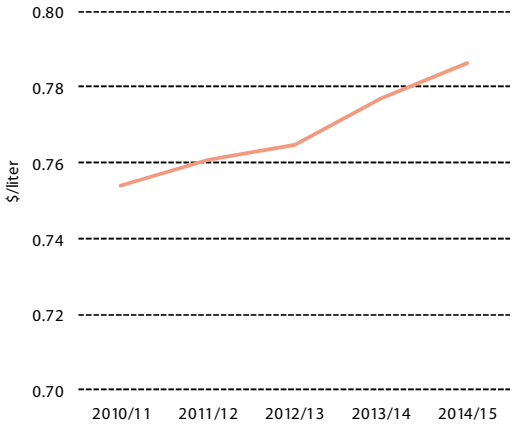


Diagram 29: Canadian wholesale milk price



11. Adding value to canola oil in food end uses

The food processing sector adds value to canola after the refining stage by incorporating refined oil into industrial food applications. In this section, we explore some of the downstream benefits derived from canola products in a selection of end-use sectors—margarine, shortening, and salad oil for human consumption.

We include the estimates from these end uses in our grand totals of the benefits to Canada of the canola industry; however, we remind readers that they do *not* represent an exhaustive assessment of the end-use benefits of canola. Thus, ***our final total for the benefit of canola to Canada necessarily represents an under-estimation of the true figure***.

Note: The further processing of refined canola oil into food end uses makes some significant contributions to the Canadian economy, but they are difficult to quantify due to the following factors:

- First, ingredient use and product formulations of processed foods are sensitive information from the perspective of industrial food manufacturers.
- Second, branding and marketing add a large part of the value to consumer products. This is the difference between consumer products at this stage of the chain and the commodity products at earlier stages. Branding and marketing make it very difficult to quantify the value that canola can claim in the further processing chain, as the large

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mark-ups are not attached typically to canola oil — if canola were not available, many products could switch to an alternative oil and often without a price effect. The growing healthy oil market may be more closely associated with canola, but again the difficulty lies in stripping out the part of the large value-added in consumer and wholesale prices that is attributable to canola rather than branding and marketing.

Impacts

As an illustration of the scale of the potential value derived in the lucrative food processing sector, we present estimates of the value added to canola oil through processing into the food products of margarine, shortening, and salad & cooking (frying) oil.

- Among the three selected end products, canola oil demand for salad oil accounts for over 60% in volume (Table 75); hence, it represents the highest impact.
- Direct effects through processing canola oil into the three end products have created an economic impact of $920 million. Meanwhile, the direct employment impact is estimated at over 16,000 jobs, creating a direct wage impact of $816 million during the period between 2012/13 to 2014/15 (Table 77).
- Total economic impact of end uses is estimated at $2.26 billion. Total jobs created stood at over 43,000 with a total wage impact of $2.2 billion (Table 78).

Table 75: Volume of refined and processed canola oil products, '000 tonnes

	2010/11	2011/12	2012/13	2013/14	2014/15
Margarine	44	55	50	60	65
Shortening	119	150	137	165	177
Veg Oil	283	355	325	391	419
Total	**446**	**559**	**512**	**616**	**661**

Table 76: Prices for refined and processed oil products, based on unit value export prices to the US from Canada ($/tonne)

	2010/11	2011/12	2012/13	2013/14	2014/15
Margarine	2,178	2,360	2,512	2,452	2,365
Shortening	1,754	1,794	1,774	1,641	1,752
Veg Oil	1,420	1,429	1,431	1,292	1,288

Table 77: Direct economic, employment and wage impact of canola oil end uses, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact (Jobs)	Wage Impact (Million Dollars)
Maritimes	30	530	27
Quebec	140	5,705	290
Ontario	222	5,838	296
Manitoba	129	504	26
Saskatchewan	267	435	22
Alberta	99	1,484	75
British Columbia	34	1,577	80
Canada	**921**	**16,073**	**816**

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Table 78: Total economic, employment and wage impact of canola oil end uses, 3-year average (2012/13–2014/15)

	Economic Impact (Million Dollars)	Employment Impact (Jobs)	Wage Impact (Million Dollars)
Maritimes	74	1,431	71
Quebec	342	15,400	766
Ontario	543	15,759	783
Manitoba	316	1,361	68
Saskatchewan	654	1,173	58
Alberta	243	4,005	199
British Columbia	84	4,257	212
Canada	**2,256**	**43,387**	**2,157**

Methodology

The economic impact of end uses is calculated based on the estimated volume of canola oil uses in each of the products: margarine, shortening and salad oil (Table 75). We then apply the volume to the unit prices of the three end products (Table 76) to derive the direct economic impact.

The total number of people employed in the food end use sector attributable to canola was based on a 2009 report on the economic impacts of canola written by Mark Goodwin Consulting. Provincial level employment was then taken to be a function of provincial canola oil refining capacity and food manufacturing revenues.

One problem with including this analysis into the main value-added calculations is that the quantification methodology employed here is necessarily less robust than in the rest of the analysis in this study, because we cannot obtain firm data from the refining sector, which regards such information as proprietary, nor from Statistics Canada, which does not report this level of detail in its Canada Food Statistics data. Taking these caveats into consideration, the analysis presented here can still be taken as indicative.

We relied on Canadian Oilseed Processors Association data to inform our statistics on total refined canola oil disappearance in Canada. For the share of each type of oil used in margarine, shortening, and salad oil, we relied on 1998-2001 data from Statistics Canada. This is the only data available that offers a snapshot of the breakdown of these processed oils by type of oil.

To calculate the value of these processed products, shown in Tables 77 and 78, we used the unit value export price of each of these products for export to the US, as reported by Statistics Canada.

* International ocean-going shipping estimates

Because international shipping of canola products takes place outside of Canada and on vessels and by crews that are generally not Canadian, we have not included international shipping in our final Economic Impact calculations. Instead, these have been included for reader interest only. Wage and employment impacts of international shipping have not been modeled – only the economic impact has been calculated and only at the direct level.

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Global impacts

Impacts are presented by province based on the province of export for the canola product.

- Expenditures on international shipping of canola seed have fallen in conjunction with lower shipping rates and averaged roughly $163 million between 2012/13 and 2014/15. For meal, crude oil, and refined oil, expenditures were $4 million, $21 million, and $2 million, respectively with overseas shipments of these by-products flat or down, in some instances. (Table 79)

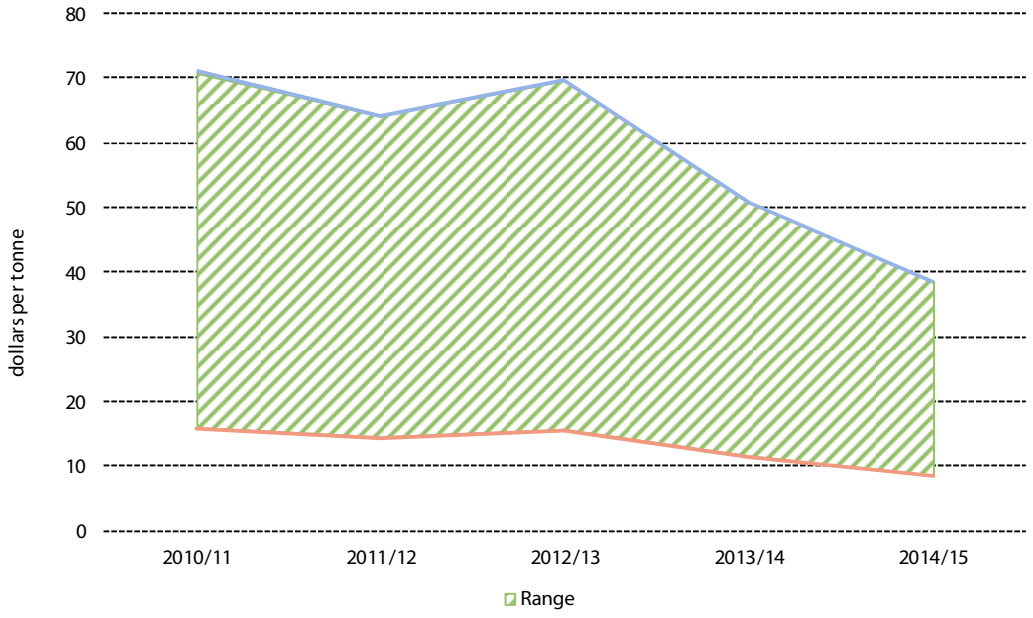
Table 79: Direct economic impact of international ocean-going shipments of canola seed, canola meal, crude canola oil and refined canola oil, 3-year average (2012/13–2014/15)

	Economic Impact Seed Shipping (million dollars)	Economic Impact Meal Shipping (million dollars)	Economic Impact Crude Oil Shipping (million dollars)	Economic Impact Refined Oil Shipping (million dollars)
Maritimes	0	0	0	0
Quebec	0	0	0	0
Ontario	10	0	0	0
Manitoba	2	0	0	0
Saskatchewan	0	0	0	0
Alberta	0	0	0	0
British Columbia	151	4	21	2
Canada	**163**	**4**	**21**	**2**

Methodology

Expenditures were determined based on canola product volumes, destinations, and prevailing shipping rates. Shipping rates from Vancouver are presented in Diagram 30 and were obtained from Canadian Grain Commission reports. Origins, destinations, and volumes of canola products shipped were sourced from the same data that informed our views on port impacts (Diagrams 23-26 above).

Diagram 30: Canola seed shipping rates from Vancouver



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