CEREAL GRAINS AND FERTILIZERS TRANSPORTATION: ANALYSIS AND FORECAST THROUGH BRITISH COLUMBA PORTS

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Introduction

This study analyzes the movement of two major commodity groups: cereal grains, and potash and fertilizers through the Canadian rail and marine system. Using national forecasts from other sources and applying econometric and suitable quantitative procedures, forecasts of exports through British Columbia (BC) ports are developed. Two additional scenarios are also developed to account for a range of factors.

Scope and Data Sources

The study covers two dry bulk commodities which belong to the two-digit classification system of the Standard Classification of Transported Goods (SCTG). The SCTG-02 group represents cereal grains[2] and SCTG-22 represents potash and fertilizers[3]. For the purpose of this study, each of these two-digit SCTG groups was divided into two separate sub-groups. The cereal grains group was divided into wheat grains and non-wheat grains, whereas, the potash and fertilizers group was divided into potash and non-potash.

The main databases considered for this study are: Statistics Canada's Marine and Rail Databases, Informetrica's macroeconomic projections and Agriculture and Agri-Food Canada's (AAFC) Medium Term Outlook.

Shipments of Cereal Grains, Potash and Fertilizers

Cereal grains are dominantly produced in the Prairie Provinces[4], whereas, potash is produced mainly in Saskatchewan[5]. These commodities are exported using surface (mainly rail) and marine modes of transportation[6]. For exports to countries other than the

USA, these commodities are first transported to Canadian ports by rail, and then exported by the marine system.

According to Statistics Canada's Rail Database (RDB), the Canadian rail system handled approximately 24 Mt of cereal grains in 2010 (Table 1). Out of the total domestic cereal grains shipments of 21 Mt in 2010, more than half (11.4 Mt) went to BC. The data indicate that these shipments were mainly from Alberta and Saskatchewan with an almost equal share.

Table 1: Rail Shipments of Cereal Grains, Potash and Fertilizers by Canadian Province 2006-2010 (Mt)

		2006	2007	2008	2009	2010	2010 Share of National Shipments (%)
Rail Shipments of Cereal Grains from Canada (Mt)		**25.0**	**25.4**	**22.5**	**24.9**	**23.9**	**100%**
Destination	**Origin Provinces (%)**						
to British Columbia (Mt)		**11.6**	**11.4**	**8.9**	**12.0**	**11.4**	**48%**
	Alberta (%)	47%	52%	58%	51%	47%	
	Saskatchewan (%)	44%	40%	31%	39%	46%	
	Manitoba (%)	7%	7%	9%	8%	6%	
	Other Provinces (%)	2%	2%	2%	1%	1%	
to Other Provinces (Mt)		**10.0**	**10.1**	**9.4**	**9.9**	**9.6**	40%
Transhipments/Exports to US/Mexico (Mt)		**3.3**	**4.0**	**4.1**	**3.0**	**2.9**	12%
Rail Shipments of Potash and Fertilizers from Canada (Mt)		**18.4**	**22.4**	**21.2**	**11.0**	**19.8**	**100%**
Destination	**Origin Provinces (%)**						
to British Columbia (Mt)		**5.0**	**6.7**	**6.7**	**2.5**	**5.7**	**29%**
	Saskatchewan (%)	94%	97%	97%	90%	97%	
	Alberta (%)	6%	3%	3%	10%	3%	
	Other Provinces (%)	0.03%	0.03%	0.05%	0.06%	0.01%	
to Other Provinces (Mt)		**3.4**	**3.6**	**3.3**	**2.3**	**3.0**	15%
Transhipments/Exports to US/Mexico (Mt)		**10.1**	**12.1**	**11.2**	**6.2**	**11.0**	56%

Source: Statistics Canada's Rail Database

In terms of rail transportation of potash and "non-potash", the RDB indicates that in 2010, Canada exported/transhipped 11 Mt (fifty six percent of the total rail shipments) directly to the USA/Mexico alone. Out of the total domestic shipments of 8.7 Mt, about two thirds (5.7 Mt) went to BC. These shipments were mainly from Saskatchewan (ninety seven percent – representing potash). The rest of the

shipments (three percent) were from Alberta, which represented non-potash freight.

A comparison of the RDB and Statistics Canada's Marine Database (MDB) indicates that over ninety five percent of these commodities shipped to BC were exported through its ports (Table 2).

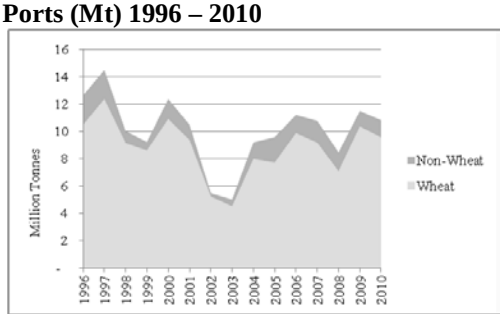
Table 2: Cereal Grains, Potash and Fertilizers Shipments to BC and Exports through BC Ports 2006-2010 (Mt)

		2006	2007	2008	2009	2010
Cereal Grains						
	Rail Shipments to BC (Mt)	11.6	11.4	8.9	12.0	11.4
	Exports from BC Ports (Mt)	11.2	10.8	8.5	11.5	10.8
	Shipments to BC (%)	97%	95%	95%	96%	95%
Potash and Fertilizers						
	Rail Shipments to BC (Mt)	5.0	6.7	6.7	2.5	5.7
	Exports from BC Ports (Mt)	4.8	6.5	6.5	2.4	5.6
	Shipments to BC (%)	96%	97%	96%	96%	97%

Source: Statistics Canada's Rail Database and Marine Database

Over the 2006-2010 period, we observe that anywhere between 95 and 97% of rail shipments of these commodities to BC are exported through its ports.

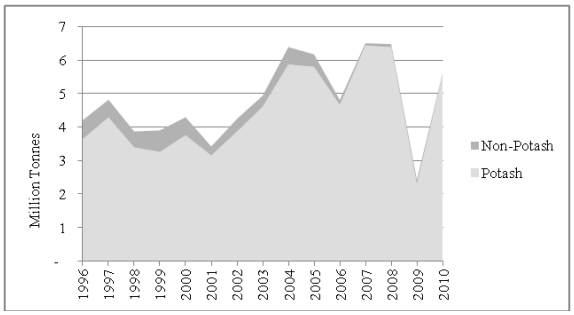
Figure 1: Wheat and Non-Wheat Grains Exports through BC Ports (Mt) 1996 – 2010



Source: Statistics Canada's Marine Database

Figures 1 and 2 illustrate that historically wheat and potash were the dominant commodities exported (in their respective groups) through BC ports.

Figure 2: Potash and Fertilizers Exports through BC Ports (Mt) 1996 – 2010

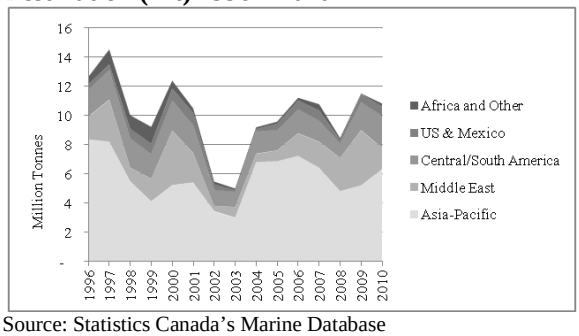


Source: Statistics Canada's Marine Database

In terms of destination region, the MDB reveals that the countries from the Asia-Pacific and Middle East regions dominate in cereal grains imports through BC ports (Figure 3). Figure 3 also indicates that export tonnage to the Asia-Pacific region was high in recent years and the share of exports to countries in the Middle East and the Central/South American region was increasing.

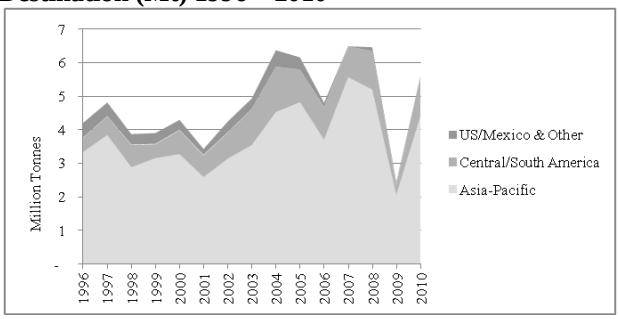
With respect to potash and non-potash exports through BC ports, the main markets are the Asia-Pacific and Central/South American regions (Figure 4).

Figure 3: Cereal Grains' Exports through BC Ports by Destination (Mt) 1996 – 2010



Source: Statistics Canada's Marine Database

Figure 4: Potash and Fertilizers Exports through BC Ports by Destination (Mt) 1996 – 2010



Source: Statistics Canada's Marine Database

Forecasting Procedure

Because of the nature and availability of data, two separate procedures were used to develop forecasts of exports of cereal grains on one hand, and potash and non-potash on the other. The forecast of cereal grain exports was developed by utilizing data obtained from Agriculture and Agri-food Canada (AAFC), whereas, for potash and non-potash, macroeconomic data from Informetrica Inc. were used. The forecasting procedure for each commodity group is described below.

Cereal Grains

Exports forecasts of cereal grains are based on AAFC's annual agricultural Outlook[7]. In its Outlook, AAFC has developed projections of Canadian grain production and exports (Table 3). According to their national projection, wheat and non-wheat grains production will respectively increase by 1.9 and 5.7 Mt between 2009 and 2020 (2009 being the baseline year).

After accounting for domestic use and stock level changes, AAFC indicates that exports of wheat will increase by 1.0 Mt or 5% during the 2009-2020 period and by 1.5 Mt or 35% in the same period for non-wheat grains.

To understand how AAFC's national/aggregate forecast of exports may translate at the regional level, and more precisely to develop forecasts of exports through BC ports, historical information of Canadian exports by destination region, transportation mode, and export provinces was used.

Table 3: Projected Production, Domestic Use and Exports of Wheat and Non-Wheat Cereal Grains 2010-2020 (Mt)

		2009	Forecast 2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Net Change 2009-2020 (Mt)	Percent Change (2009-2020)
Cereal Grains															
	Production (Mt)	49.3	43.9	52.3	53.4	53.2	53.5	55.2	55.0	54.5	55.4	56.2	56.9	**7.6**	**15%**
	Domestic Use (Mt)	27.4	28.6	30.1	29.6	29.8	30.1	30.3	30.6	30.8	31.0	31.3	31.7	**4.3**	**15%**
	Exports (Mt)	23.0	21.7	20.9	22.9	23.8	24.1	24.8	24.1	23.7	24.4	25.2	25.5	**2.5**	**11%**
Wheat															
	Production (Mt)	26.8	22.6	25.0	26.2	26.1	26.6	27.1	27.2	26.9	27.4	28.1	28.7	**1.9**	**7%**
	Domestic Use (Mt)	7.2	7.9	8.7	8.9	8.9	8.9	8.9	9.0	9.1	9.0	8.9	9.0	**1.8**	**25%**
	Exports (Mt)	18.5	17.5	16.2	16.8	17.3	17.7	18.1	17.9	17.7	18.4	19.1	19.5	**1.0**	**5%**
Non-Wheat															
	Production (Mt)	22.5	21.3	27.3	27.2	27.1	26.9	28.1	27.8	27.6	28.0	28.1	28.2	**5.7**	**25%**
	Domestic Use (Mt)	20.2	20.8	21.4	20.8	20.9	21.2	21.4	21.6	21.8	22.0	22.4	22.6	**2.4**	**12%**
	Exports (Mt)	4.5	4.2	4.7	6.1	6.5	6.4	6.7	6.2	6.0	6.0	6.1	6.0	**1.5**	**35%**

Source: Medium Term Baseline, February 2011, AAFC

Here is the quantitative procedure that was used:

$$Y_t = \sum_{j=1}^{n} Y_{j.t}$$

Where:

Y_t = Exports of cereal grains through BC's ports in forecast period t

$Y_{j.t}$ = Exports of cereal grains destined to region j through BC's ports in forecast period t

Where:

$$Y_{j.t} = \sum_{k=1}^{2} \alpha_{k.h} * \beta_{k.h} * \delta_{j,k.h} * AAFC_{k.t}$$

$\alpha_{k.h}$ = Share of marine based exports of commodity k for period h – the last historical year (Note: There were two commodity groups, wheat and non-wheat.)

$\beta_{k.h}$ = Share of marine based exports from BC ports for commodity k for period h – the last historical year

$\delta_{j,k.h}$ = Share of marine based exports from BC ports destined to region j for commodity k for period h – the last historical year

$AAFC_{k.t}$ = AAFC forecast for commodity k in period t

This procedure assumed that cereal grain production is determined by prices, international grains demand and key domestic factors[8], which ultimately determine export levels. Of note, these factors were already taken into account in AAFC's baseline Outlook.

In addition to the baseline forecasts, two scenarios – Optimistic and Pessimistic are also developed[9] (Table 4).

In our Optimistic scenario, it was assumed that international wheat prices will remain strong. Also, assuming that the Canadian weather would remain favourable to wheat production, therefore, wheat yield would increase by 0.1 t/ha in addition to its baseline projection. This assumption gave a twelve percent increase in wheat production instead of the seven percent increase originally projected in AAFC's baseline scenario.

Table 4: Production and Export Volumes – Wheat (only), by Scenario

Assumptions for Wheat Exports		2009	2015	2020	Percent Change 2009-2015	2015-2020	2009-2020
Optimistic Scenario							
	Area (Mha)	9.6	N.A	10.0	N.A		4%
	Yield (t/ha)	2.8		3.0			7%
	Production (Mt)	26.8		30.0			12%
	Exports (Mt)	18.5		20.8			12%
Pessimistic Scenario							
	Area (Mha)	9.6	9.2	9.7	-4%	5%	N.A
	Yield (t/ha)	2.8	2.9	2.9	2%	2%	
	Production (Mt)	26.8	26.3	28.1	-2%	7%	
	Exports (Mt)	18.5	17.3	18.9	-6%	9%	

Therefore, accounting for a given level of domestic wheat use, wheat exports would increase by 2.3 Mt in 2020 instead of 1 Mt (as in

AAFC's baseline case). In aggregate, by 2020 total cereal grain exports would reach 26.8 Mt (an increase of 3.8 Mt over the 2010-2020 period, instead of 2.5 Mt in AAFC's base case)[10].

For its part, the Pessimistic scenario assumes that due to a shift in the farmer's preferences for oilseeds and pulses, wheat production will not increase, thus reducing the level of total exports[11]. However, in the medium to long term (2015 – 2020) due to slight improvements in wheat yield, production would increase by 2020. This increase in production will allow Canada to export slightly more wheat by 2020. Overall, Canada's wheat export will marginally (0.4 Mt) be higher than 2009 level. In aggregate, cereal grain exports, in 2015 and 2020 would reach 24 and 24.9 Mt, respectively[12].

Potash and Non-Potash

The procedure to forecast potash and non-potash was a bit more challenging because of the high degree of uncertainty in potash prices and hence resulting exports[13]. The practice of developing fertilizer industry group's forecasts for only short term periods tends to support this increased challenge. This study however attempted to develop a medium to long term forecast. For this purpose, macroeconomic forecasts produced by Informetrica Inc. were used to project potash and non-potash exports through BC ports. Overall, the procedure involved three steps: the first step involved regression estimation of rail shipments, and the next two steps involved multiplication of these estimations with two different types of historical shares[14].

Table 5 provides forecast values of Canadian exports of Fertilizer and Fertilizer Materials[15]. Actual historical values of this group from 1996 to 2010 indicate an average annual growth of one percent. This growth rate was similar to the growth rate of rail shipments of potash and non-potash commodities obtained from the RDB[16]. Therefore, based on their theoretical relationship, a simple ordinary least squares (OLS) regression procedure as described below was used to estimate equation parameters.

Table 5: Value of Exports & Rail Shipments (tonnage) of Fertilizer & Fertilizer Materials/Potash & Non-Potash, 1996-2010

						Avg. Annual Growth	
	1996	2000	2005	2010	2020	1996-2010	2010-2020
Real Value of Fertilizers and Fertilizer Materials Exports, (1997 $ million)	1,881	2,210	2,041	2,123	2,886	1%	3%
Potash and Non-Potash Rail Shipments (000 t)	16,780	19,357	21,145	19,729	N.A	1%	N.A

Source: Informetrica Inc. and Statistics Canada's Rail Database

$$Y_t = \alpha \ + \beta \ * X_t + \mu_t$$

Where

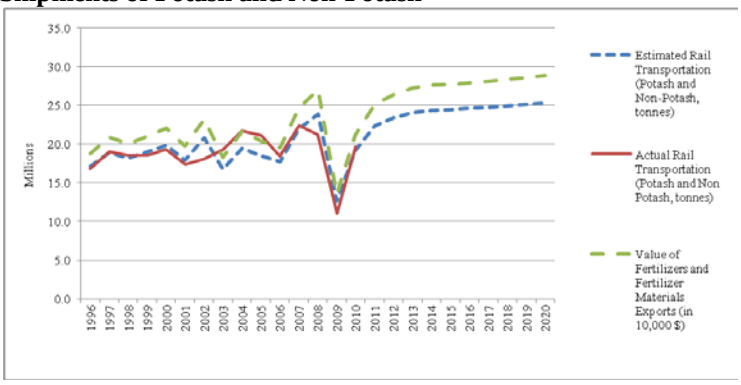
Y_t = Potash and non-potash freight movement through the Canadian rail system in period t, from the RDB

X_t = Value of fertilizer and fertilizer materials' exports in period t, from Informetrica, Inc.

The regression results indicated that the parameters (α and β) were significant at 95% level of significance[17]. Therefore, these parameters were used to estimate rail shipments in the future period. Figure 5 provides a plot of the estimated and actual rail shipments. This regression procedure indicates that rail shipments may increase to 26.1 Mt by 2020 from the 2010 level of 19.7 Mt.

In the second step, these estimated rail shipments were divided between potash and non-potash freight by multiplying them with their historical shares. Historical data indicates that non-potash shipments ranged between 4.2 and 5.1 Mt during 1996 and 2010 showing a relatively steady trend. Therefore, it was assumed that non-potash shipments will not increase in future as well. Consequently, by taking the difference of total estimated (potash plus non-potash) shipments and non-potash shipments (assumed to be at the 4.8 Mt level), estimated potash shipments were obtained. The results indicate that estimated potash shipments may increase from 15.4 Mt in 2010 to 21.4 Mt in 2020.

Figure 5: Estimated and Actual Volume and Value of Rail Shipments of Potash and Non-Potash



In the final (third) step, estimated national shipments (of potash and non-potash) were again multiplied with the historical five-year average shares of these two commodities moving to BC[18].

Similar to the cereal grains forecast, two scenarios (Optimistic and Pessimistic) were also developed for potash and non potash exports. The Optimistic scenario assumes a faster increase in prices as compared to the prices projected by Informetrica Inc. On the other hand, the Pessimistic scenario considers that the recent spike in potash prices was a temporary phenomenon and in the medium to long run, potash prices would stabilize around the average level of the five previous years' prices[19].

Using an export price elasticity of 1.28 along with the assumptions of both scenarios, two new series of future export values were developed[20]. These new series of future export values (representing each scenario) were regressed against the rail data and multiplied with the shares similar to the procedure used for the baseline forecast.

Results

Cereal Grains

The results from this study show that exports of wheat and non-wheat through BC ports will increase within a range of 1.1 to 2.1 Mt by 2020 (Table 6).

Specifically, according to the baseline forecast, cereal grains exports through BC ports will increase by 1.4 Mt from the 2009 level of 11.5 Mt. Exports to the Asia-Pacific countries will increase by 1.3 Mt; whereas, exports to rest of the world regions combined (including the USA/Mexico) will increase by 0.3 Mt. Exports to the Middle East will decrease slightly, by 0.1 Mt, from 2009. This is because in 2009, exports to the Middle East were exceptionally high and given the historic trend based on the usual exports of around 2 Mt; exports were expected to increase by 1.4 Mt from the 2008 level[21].

Table 6: Projected Exports of Cereal Grains, Potash and Non-Potash through BC Ports[22] (Mt)

Cereal Grains Exports	2009	2015	2020	Change (2009-2020) Mt	Potash and Non-Potash Exports	2010	2015	2020	Change (2010-2020) Mt
Baseline									
Asia-Pacific	5.2	6.5	6.5	**1.3**	**Potash**	**5.6**	**7.4**	**7.7**	**2.1**
Middle East	3.8	3.5	3.7	**- 0.1**	Asia-Pacific	4.6	6.1	6.3	1.7
Central/South America	1.9	2.1	2.1	**0.2**	Mexico/Central/South America	1.0	1.3	1.4	0.4
US & Mexico	0.5	0.5	0.5	**- 0.0**	USA[1]	0.0	0.0	0.0	0.0
Africa and Other	0.0	0.1	0.1	**0.1**	**Non-Potash**	**0.2**	**0.2**	**0.2**	0.0
Baseline Exports	**11.5**	**12.6**	**12.9**	**1.4**	**Baseline Exports**	**5.8**	**7.6**	**7.9**	**2.1**
Optimistic Scenario									
Asia-Pacific	5.2	6.8	6.8	**1.6**	**Potash**	**5.6**	**7.7**	**8.3**	**2.7**
Middle East	3.8	3.7	3.9	**0.1**	Asia-Pacific	4.6	6.3	6.8	2.2
Central/South America	1.9	0.0	2.2	**0.3**	Mexico/Central/South America	1.0	1.4	1.5	0.5
US & Mexico	0.5	0.5	0.5	**- 0.0**	USA[1]	0.0	0.0	0.0	0.0
Africa and Other	0.0	0.1	0.1	**0.1**	**Non-Potash**	**0.2**	**0.2**	**0.2**	0.0
Optimistic Exports	**11.5**	**13.4**	**13.6**	**2.1**	**Optimistic Exports**	**5.8**	**7.9**	**8.5**	**2.7**
Pessimistic Scenario									
Asia-Pacific	5.2	6.4	6.4	**1.2**	**Potash**	**5.6**	**6.2**	**6.2**	**0.6**
Middle East	3.8	3.4	3.6	**- 0.2**	Asia-Pacific	4.6	5.1	5.1	0.5
Central/South America	1.9	2.0	2.1	**0.2**	Mexico/Central/South America	1.0	1.1	1.1	0.1
US & Mexico	0.5	0.4	0.5	**- 0.0**	USA[1]	0.0	0.0	0.0	0.0
Africa and Other	0.0	0.1	0.1	**0.1**	**Non-Potash**	**0.2**	**0.2**	**0.2**	0.0
Pessimistic Exports	**11.5**	**12.4**	**12.6**	**1.1**	**Pessimistic Exports**	**5.8**	**6.4**	**6.4**	**0.6**

The Optimistic scenario indicates that the total exports of cereal grains through BC ports could reach up to 13.6 Mt. In this scenario, the net increase in exports will be approximately 2.1 Mt with 1.6 Mt

alone going to the Asian markets. Under this scenario, exports to all regions will increase slightly except exports to the USA and Mexico. Finally, the Pessimistic scenario would see a 1.1 Mt net increase in exports through BC ports by 2020. In this scenario, exports to the Asia-Pacific region will increase by 1.2 Mt whereas; exports to the Middle East will decrease by about 0.2 Mt[23].

Potash and Fertilizers

In the case of potash and non-potash, total exports will be 7.6 Mt by 2015 and 7.9 Mt by 2020 in the baseline case (Table 6). This includes 6.1 Mt of exports of potash to the Asia-Pacific region by 2015. During the same time, potash exports to Latin America will increase to 1.3 Mt – an increase of 0.3 Mt from the 2010 level.

The other two scenarios indicate that total exports of potash and fertilizers through BC's marine system will be between 6.4 and 8.5 Mt; this includes 5.1 to 6.8 Mt of potash to the Asia-Pacific region. Overall, the Optimistic and Pessimistic scenarios indicate that in the 2011-2020 period potash exports will increase anywhere from 0.6 Mt to 2.1 Mt. However, during the 2015-2020 period, exports may increase by 0.6 Mt, only, under the optimistic scenario.

Summary and Conclusion

Forecasting commodity exports through a specific gateway can prove challenging due to demand fluctuations from various countries and the numerous factors at play.

The results from this study indicate that cereal grains exports via BC ports will range between 12.6 to 13.6 Mt. whereas, exports of potash and non potash will range between 6.4 and 8.5 Mt by 2020. This increased level of exports will have implications for Canadian railways and port terminal operations. Reports suggest that there will be some increased port capacity to handle this level of exports. However, capacity related to rail shipments needs to be investigated. This is also important because two other dry bulk commodities

(oilseeds and sulphur)[24], not part of this study, are bound to add pressure to a highly solicited transportation system.

In conclusion, the study results were dependent on AAFC's and Informetrica Inc.'s projections which are subject to revisions each year. Changes in the grain marketing system, potash prices, overall demand and economic growth in the Asian countries are examples of factors that should be closely monitored as they can significantly impact the forecast results derived in this study.

Bibliography

- Agriculture and Agri-Food Canada, (2011) *Medium Term Outlook, February, 2011*
- Agriculture and Agri-Food Canada (1998), *Fertilizer Pricing in Canada*
- The Informetrica Inc. (2011), *National Forecasts to Clients*
- Statistics Canada, (2011) *Marine Database and Rail Database*
- Natural Resources Canada, (2011), Personal Communication

APPENDIX

Table A.1: Rail Shipments of Potash (Mt) 1996-2010

Year	Total (Mt)	From Saskatchewan (Mt)					From the Rest of Canada (Mt)					Total (Mt)
		Total from Saskatchewan	In Canada only			to the United States/ Mexico	Total from the Rest of Canada	In Canada only			to the United States	
			Total - to BC and other Province	to BC	to the Rest of Canadian Provinces			Total - to BC and other Provinces	to BC	to the Rest of Canadian Provinces		
1996	**12.2**	10.3	4.8	3.8	0.9	5.6	1.8	1.8	-	1.8	0.0	**12.2**
1997	**14.2**	13.0	5.5	4.3	1.2	7.5	1.2	1.2	0.0	1.2	0.0	**14.2**
1998	**13.8**	12.9	4.9	3.4	1.5	8.0	0.9	0.9	0.0	0.9	0.0	**13.8**
1999	**13.4**	12.5	5.0	3.4	1.5	7.5	0.9	0.9	0.0	0.9	0.0	**13.4**
2000	**14.2**	13.3	5.2	3.9	1.3	8.1	1.0	0.9	0.0	0.9	0.0	**14.2**
2001	**12.8**	12.1	4.5	3.3	1.2	7.6	0.8	0.7	-	0.7	0.0	**12.8**
2002	**13.1**	12.3	5.0	3.8	1.2	7.3	0.8	0.7	-	0.7	0.1	**13.1**
2003	**14.7**	13.5	5.9	4.6	1.3	7.6	1.2	0.9	-	0.9	0.3	**14.7**
2004	**16.6**	15.5	7.5	6.1	1.4	7.9	1.1	0.8	-	0.8	0.3	**16.6**
2005	**16.2**	15.2	7.1	5.9	1.2	8.1	1.0	0.8	0.0	0.8	0.2	**16.2**
2006	**13.6**	12.8	5.4	4.7	0.8	7.4	0.7	0.7	-	0.7	0.0	**13.6**
2007	**17.6**	16.8	7.3	6.5	0.9	9.5	0.8	0.8	-	0.8	0.0	**17.6**
2008	**16.5**	15.8	7.1	6.5	0.6	8.8	0.7	0.7	0.0	0.7	0.0	**16.5**
2009	**6.8**	6.6	2.6	2.3	0.3	4.0	0.2	0.2	-	0.2	0.0	**6.8**
2010	**15.4**	14.7	6.1	5.6	0.6	8.6	0.7	0.6	-	0.6	0.0	**15.4**

Source: Statistics Canada's Rail Database

Table A.2: Rail Shipments of Non-Potash (Mt) 1996-2010

Year	Total (Mt)	From All Canadian Provinces (Mt)			
		In Canada only			to the United States/ Mexico
		Total - to BC and other Provinces	to BC	to the Rest of Canadian Provinces	
1996	**4.6**	2.3	0.5	1.8	2.3
1997	**4.9**	2.2	0.3	1.9	2.6
1998	**4.7**	2.3	0.4	2.0	2.4
1999	**5.1**	2.4	0.5	1.9	2.7
2000	**5.1**	2.6	0.5	2.1	2.6
2001	**4.6**	2.5	0.2	2.3	2.1
2002	**5.0**	2.6	0.3	2.3	2.4
2003	**4.6**	2.4	0.2	2.2	2.2
2004	**5.1**	2.5	0.4	2.1	2.6
2005	**4.9**	2.3	0.2	2.1	2.6
2006	**4.8**	2.2	0.3	1.9	2.7
2007	**4.8**	2.2	0.2	1.9	2.7
2008	**4.7**	2.3	0.2	2.0	2.4
2009	**4.2**	2.1	0.3	1.8	2.1
2010	**4.4**	2.0	0.2	1.8	2.4

Source: Statistics Canada's Rail Database

Table A.3: Export Price Index – Fertilizer and Fertilizer Materials

	Export Price Index					
	2006	**2007**	**2008**	**2009**	**2010**	**2020**
Baseline	1.7	1.6	2.8	3.4	2.7	2.9
Optimistic Scenario	1.7	1.6	2.8	3.4	2.7	3.0
Pessimistic Scenario	1.7	1.6	2.8	3.4	2.7	2.4

Source: Informetrica Inc. and Calculations

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[1] Views expressed in this paper benefited from exchanges between the authors and colleagues from Transport Canada, Natural Resources Canada, and Agriculture Canada. The authors thank all reviewers of this article for their comments. However, the views expressed herein do not necessarily reflect those of Transport Canada.

[2] The group 'cereal grains' includes wheat, barley, corn, oat, rye and mixed grains.

[3] This group includes potash, potash salts and all other non-potash fertilizers.

[4] According to Agriculture and Agri-food Canada, the Prairie Provinces account for ninety percent of Canada's grain production (based on a 2005-2009 average) with Saskatchewan, Alberta and Manitoba being responsible for fifty one, thirty three and sixteen percent of that total, respectively.

[5] There are eleven potash mines in Canada – ten of them are in Saskatchewan. The only mine located outside Saskatchewan is in New Brunswick.

[6] Exports using rail as the transportation mode are primarily destined to the USA. In addition, Canadian transhipments of these commodities (particularly, potash) through the USA also use railways.

[7] AAFC develops baseline forecasts of major agricultural products each year using Canadian macroeconomic forecasts.

[8] Weather, crop harvest area, yield etc

[9] The key consideration in both scenarios was that the crop harvest area and the yields determine the total production of cereal grains, which ultimately along with a given level of domestic use, determines the 'excess capacity'. This excess capacity is available for export. Applying these theoretical underpinnings, appropriate quantitative estimations were made separately to reflect changes in yields and crop area to obtain modified levels of national exports under each of the two scenarios.
[10] 19.5 Mt – wheat and 6 Mt – non-wheat as indicated in the baseline (Table 3)
[11] This assumption was based on historical information obtained from AAFC. Their data indicated that from 2005 to 2009, wheat area increased by 0.2 million hectares only, whereas, during the same period, harvest area of oilseeds and special crops increased by one and 0.3 million hectares, respectively.
[12] In 2015, wheat – 17.3 Mt and non-wheat – 6.7 Mt; in 2020, wheat – 18.9 Mt and non-wheat – 6 Mt
[13] The last few years' data on international potash prices and the level of world trade reflect this uncertainty.
[14] Historical shares of potash vs. non-potash shipments were calculated from the data provided in Appendix Tables A1 and A2.
[15] The forecast is based on four digit level of classification using NAICS (North American Industrial Classification System) system of coding. The group NAICS 2123 includes industrial activity based on potash mining, which closely resembles the SCTG 22 group.
[16] The annual growth rates during 1996-2010 for both variables were around one percent (Table 5).
[17] The log-estimated values of α and β were 9.76 and 0.91 respectively.
[18] These shares represented the tonnage of potash and non-potash moving only to BC.
[19] Although during 2008 and 2009, potash prices increased to historic high levels and in response, due to lack of willingness by major buyer countries to negotiate trade at these higher prices, global production was decreased. Nevertheless, due to an expectation of strong prices in future these years are included. However, from a pessimistic stand point, these new prices will stay at the same level for a longer period of time – at least until 2020. See Appendix Table A.3 for export price indices for each scenario.
[20] Export price elasticity was estimated separately from Informetrica's data.
[21] Exports to the Middle East were 0.7, 1.5, 1.8 and 2.3 Mt in 2005, 2006, 2007 and 2008, respectively.
[22] Totals may vary because of rounding.
[23] It is important to note that exports to the Middle East in all three forecasts would show an increase if compared to the export level of 2008.
[24] Oilseeds and sulphur were two commodities not considered in this study, although their tonnage share (among all bulk commodities leaving the BC ports) has been significant in 2010 (ten and six percent, respectively). Particularly, the exports of oilseed grains has been on the rise at an annual rate of eight percent (7.3 Mt in 2005 vs. 10.1 Mt in 2009), according to the AAFC's Outlook and their exports will increase by an average rate of 2.3 percent annually in the next decade as well (from 2009 level of total Canadian exports of 10.1 to 10.9 Mt by 2020).