



Nuffield Canada
AGRICULTURAL SCHOLARSHIPS

**Identification of Key
Success Factors from World
Leaders in Processing, Seed
and Fresh Potatoes to
Assist with Long Term
Planning of Prince Edward
Island's Potato Industry**

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Nuffield Canada Agricultural Scholarships

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SCHOLAR PROFILE

Greg Donald is the General Manager of the PEI Potato Board (for over seven years). The PEI Potato Board represents PEI potato producers working together to ensure long term profitability and sustainability through marketing, advocacy, negotiation, and activities that support quality potato production.

Greg has a BSc. degree in Agriculture with a major in Plant Protection from the Nova Scotia Agricultural College. He also attended the University of New Brunswick and obtained a Master's in Business Administration. Greg has over twenty years of experience in the potato industry, including five years with McCain Foods in New Brunswick in the area of agronomy, potato production, potato procurement, and green crop field management. He then spent over 14 years in progressively responsible management positions in the agricultural crop input business in Atlantic Canada and Maine with the Cavendish Group. Greg continues to participate in a number of industry organizations.



Greg became interested in the Nuffield Scholarship for personal and professional reasons. “I’ve always taken the “tool box” approach to learning and personal development. And because of that, I’m always looking to add new tools to my box that will complement the ones I already have, while improving my personal and professional abilities. If better equipped, I will be able to better serve the producers and the industry that I’m very passionate about. This is why I participated in the Nuffield program.”

Greg and his wife Becky, along with their daughter Abby and son Jack, live in Margate, Prince Edward Island. Greg enjoys spending time with his family, boating, volunteering with his community watershed group, and travelling.

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EXECUTIVE SUMMARY

This project enabled me to learn about some of the key success factors for the processing, seed and fresh potato sectors from the world's leading countries to assist with long term planning by the Prince Edward Island (PEI) potato industry.

Belgium is the land of the fries. An appropriate reference because it is the world's leader in processing potatoes. Belgium has achieved this title because of its strategic location, high yields, competitiveness (low cost of production), and the industry's expertise. Belgium's future success factors will include a continued focus on sustainability, research and innovation, collaborations within the sector, increasing promotion, and capitalizing on growing export markets. I believe that Belgium's most significant success factor is its strong competitiveness in the potato processing sector attributable to its high yields and low production costs.

Netherlands has become the world's leader in seed potatoes by getting better, not bigger. Generally speaking, I believe this has been the country's key success factor. More specifically, Netherlands success is the result of its strategic location, favourable soil and climate, expertise, innovation, and infrastructure. Netherlands' future success factors will include a continued focus on new market-oriented variety development, research and innovation, and pest management. It was apparent production costs are very high (in particular land costs) and the prevalence of the latest in technology. These two factors are among the reasons why it is believed the Netherlands has become, and will continue to be, the world leader in the seed sector because of the need to focus on continuous improvement.

The study tour in Great Britain provided a "fresh" perspective for this project. The key success factors that have made Great Britain a world leader in the fresh potato sector include a huge local market, a focus on new exclusive varieties, branding, promotion of healthy attributes, economies of scale, and value added products. Great Britain's future success factors will include managing supply, promoting the health benefits of potatoes, improving convenience, and increasing environmental stewardship. It was most apparent that addressing the decline in fresh consumption will be the single most important future success factor for Great Britain.

To meet the world's increasing food needs, the potato will play a critical role— in large part because of its ability to produce a great deal of food per unit of area with less water per unit of production versus the world's other major crops. Growth in both potato consumption and production area will occur in the developing countries, whereas consumption will be static or

declining in developed countries. Production area will also decline in developed countries due to increasing yield trends.

Trade of frozen processed products will follow a similar trend as fresh potatoes, however it is believed that production of processing potatoes and processed products will be provided by the most competitive suppliers. The big question globally will be whether local processing sectors in developing countries will be able to compete with the quality and price of world leaders like Washington and Belgium.

The key implications from this study for PEI's potato industry include an ever increasing need for research and extension efforts to improve marketable yields, the use of exclusive market oriented varieties, effective disease management, and environmental sustainability. Also important will be efforts to strengthen PEI's brand and the development of new products that offer greater consumer convenience. There are endless opportunities to ensure long term success by collaborating with stakeholders on PEI, across Canada, and around the world.

DISCLAIMER

This report has been prepared in good faith but is not intended to be a scientific study or an Academic paper. It is a collection of my current thoughts and findings on discussions, research and visits undertaken during my Nuffield Farming Scholarship.

It illustrates my thought process and my ongoing quest for expanding my knowledge base. It is not a manual with step-by-step instructions to implement procedures.

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1.0 INTRODUCTION

I am very passionate and driven for the success of agriculture, and in particular the PEI potato industry. The North American potato industry is relatively mature. For instance, in Canada the fresh market has been on the decline (consumption has declined 48% in the last 15 years), so have the seed markets and processing has been relatively stable (Potato Consumption 2016). Despite these challenges, I remain optimistic about the future of the potato industry. The Nuffield Scholarship has provided an opportunity to gain a broader perspective of agriculture, specifically the potato industry, in other regions that can assist in future planning for the long term success of the PEI potato industry.

Potato production is a significant financial engine for PEI's economy; and growers are well organized to market this important vegetable throughout Canada, North-America; and abroad. Approximately 60% of the island's potato production is marketed to the processing sector, 30% to the fresh or table market, and 10% to the seed market. There are approximately 200 potato farms on PEI and the industry contributes over a billion dollars into the economy either directly or through spin-offs. The industry, either directly or indirectly, is the largest employer on PEI with over 12% of the workforce (Canmac Economics Ltd. 2011). The PEI Potato Board is the preeminent potato marketing organization in Canada. Being well organized means that thoughtful and considered plans are developed and adjusted on a regular basis. The PEI Potato Board maintains a comprehensive long term strategic plan that has served the Board well over the last several years; but as with all plans, there will be a time to review and, if necessary, bring about changes for the success of the industry.

With the Nuffield scholarship, my goal was to gain greater knowledge and broader insight into the long term critical success factors identified in other regions that can be used to assist in the long term planning and success of the PEI potato industry. The study approached the investigation from an industry perspective encompassing all sectors, rather than focusing exclusively on a particular sector or aspect of a sector e.g., marketing of table potatoes.

This study focused on learning about the current state and key success factors that have been identified for the potato industry in Belgium (focus on processing sector), Netherlands (focus on seed sector), and the Great Britain (focus on fresh sector). These countries were selected as they are international leaders for each of the primary sectors. I also attended numerous potato industry events including the World Potato Congress in China and North American Potato Expo's in 2015 and 2016 to expand my perspective and help with this study.

2.0 Belgium – “The Land of Fries”

2.1 Introduction

Located in the center of Western Europe, Belgium has quickly become one of the regions’ main potato producing countries and is recognized as a world leader in processing potatoes (Table 1.). I conducted a study tour in Belgium to gain a better understanding of why and how the country’s processing sector has become a world leader. The study tour was designed to explore the current state of Belgium’s processing sector and to get an indication of what industry leaders believe are the key success factors for the future of their industry. Visits during the study tour included processing potato producers, farm organizations, subcontractors, subcontractor organizations, equipment manufacturers, equipment associations, research and development organizations, industry organizations, and processing companies.

Table 1. Fry Exports by Leading Countries

Fry exports by leading countries ('000 tonnes)				
	Total	Internal	External	% internal
Belgium	1,965	1,467	498	74.7
Netherlands	1,533	977	556	63.7
USA	904	178	726	19.7
Canada	922	790	132	85.7
France	339	271	68	79.9
Germany	308	244	64	79.1
Poland	158	70	88	44.2

Source: (Faulkner and Porter, Key Developments in World Frozen Product Markets 2016)

2.2 Industry Overview

Potato production in Belgium occupies a central position in the potato production region of Western Europe (Netherlands, United Kingdom, Germany, and Northern France) as shown in Figure 1.



Figure 1. Map of Northwestern Europe

The area of Belgium is only six times greater than PEI with a population of 11 million people. PEI has a population of 140,000 people and is the most densely populated province in Canada. Farming on PEI has been referred to as “farming in a sub-division” which has led to public concerns about pesticide use and environmental issues. The relatively small land area, and huge population in Belgium, gave me a new perspective on “farming in a subdivision”.

There are an estimated 37,740 farms of all types in Belgium (Eurostat 2016). Of these farms, Belgapom representatives estimate there are approximately 7,000 potato farms. The total potato area for the country is approximately 81,000 ha (200,000 Acres) and the average area of potatoes per farm is only 11.43 ha (28.23 acres) (Table 2.).

Most farms are family owned. Many have livestock (pigs making up the largest group) and their potato fields are rotated with cereals, corn, and sugar beets. Belgium has so many pigs (nearly as many as people) that getting rid of the manure is a challenge. Nitrogen and phosphorus levels are high in the environment and have resulted in regulations around application amounts.

Potatoes typically are produced one year in three, and on most farms they were not necessarily the primary source of revenue; in fact, for most it was a secondary crop. In most cases, planting and harvesting operations are contracted out to custom service providers because the farms cannot justify owning their own equipment for these operations due to their small size. Having said that, I visited one farm that grew approximately 150 ha (371 acres) of potatoes (considered a large potato farm in Belgium) and potatoes were its primary focus. Land costs

are very expensive, between €35,000 and €70,000 (EUR) / hectare (approximately \$20,000 to \$40,000 CAD / acre).

In 2014, Belgian potato farmers had a yield of over 56 tonnes per ha (almost 500 cwt per acre) for all varieties combined (Table 2.). The Belgian potato sector owes its high yields to the local soil, climate, and high yielding potato varieties (primarily yellow fleshed) used for processing such as the Bintje variety that on average accounted for 55 tonnes per ha (490 cwt per acre).

Table 2. Potato area and production in the five main European Union producing countries

Potato production in the five main EU producing countries					
	2014	% change	2013	5 year average	% change 2014 to 5 yr av
Production in tonnes					
Total	28612	+18.2	24206	24495	+16.8
Belgium	4577	+25.4	3650	3541	+29.3
Germany	8856	+30.3	6796	7336	+20.7
France	6071	+16.0	5235	4969	+22.2
Netherlands	3964	+11.9	3542	3596	+10.2
Great Britain	5145	+3.3	4982	5054	+1.8
Area					
Total in hectares	549033	+3.2	531860	530048	+3.6
Belgium	81434	+6.9	76210	72709	+12.0
Germany	167100	+3.3	161800	165273	+1.1
France	121410	+3.6	117150	111827	+8.6
Netherlands	74089	+4.8	70700	70520	+5.1
Great Britain	105000	-0.9	106000	109720	-4.3
Yield in tonnes/hectare					
Total	52.1	+14.5	45.5	46.2	+12.8
Belgium	56.2	+17.3	47.9	48.6	+15.6
Germany	53	+26.2	42	44.4	+19.4
France	50	+11.9	44.7	44.4	+12.6
Netherlands	53.5	+6.8	50.1	51	+4.9
Great Britain	49.0	+4.3	47	46	+6.5
Source: NEPG					

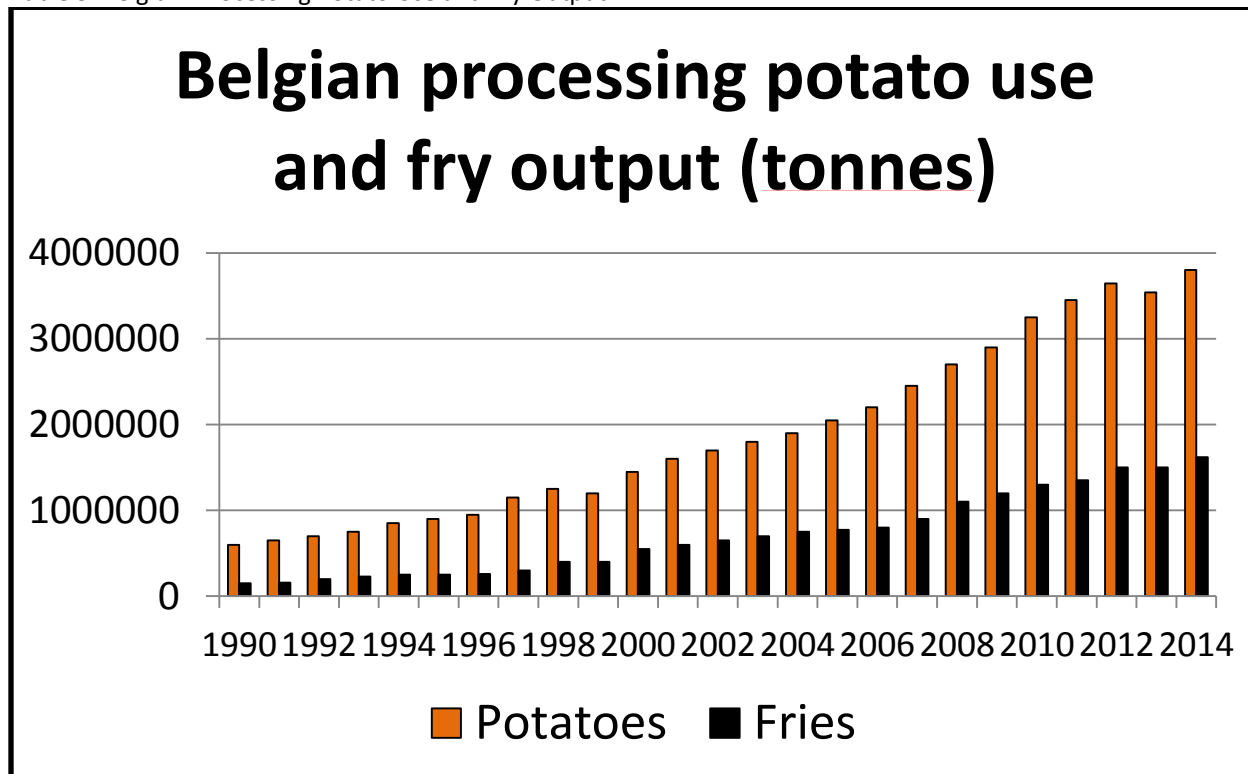
Source :
NEPG/World
potato markets

Bintje, represents about 45-50% of the planted potato area in Belgium, although this has declined in recent years. Bintje used to be sold for the fresh potato market, chip shops, and export– as well as for the processing industry. Today, however, sales of Bintje for the fresh market, and for export, are now generally in decline. Other varieties such as Fontane, Innovator, Markies, and Challenger had a yield of over 60 tonnes per ha (534 cwt per acre), and early varieties 47 tonnes per ha (419 cwt per acre). These high yields, combined with an increase in acres of production to 81,000 ha (200,000 acres) in 2014, led to a record production of 4.5 million tonnes (99 million cwt) (Van In and Demeulemeester 2015)– very similar to Canada’s annual production.

The processing industry has expanded tremendously during the last 20 years: from 500,000 tonnes in 1990, to more than 3.8 million tonnes (83.6 million cwt) in 2014, remaining the focus

of Belgian's potato industry (Table 3.). To fulfil industry requirements, the potato area has increased from 52,000 ha (128,000 acres) in 1994 to 80,000 ha (198,000 acres) in 2014.

Table 3. Belgium Processing Potato Use and Fry Output



Source: (Faulkner and Porter, Key Developments in World Frozen Product Markets 2016)

Potatoes are also imported each year from neighbouring countries (mainly the Netherlands and France but, increasingly, also Germany) to fulfil their strong processing demand, making Belgium also the largest importer of potatoes in the world (Belgapom 2014). This is not surprising considering the concentration of close to 20 processing companies (often along the borders with the Netherlands, France, and Germany), and Belgium's location in the middle of the European potato belt (Figure 2.). Many of these plants are smaller, independently family-owned operations.

Only 60% of the potatoes for processing are contracted; and the remainder are purchased on the open or spot market. The trend seems to be heading toward more contracting than open-market purchasing by processors.

The fresh market plays a much smaller part in the overall Belgian potato market. The sector is heavily dependent on imports from France and the Netherlands. For the last decade, the Belgian potato sector has used new varieties, irrigation, packaging, and marketing to increase the amount of Belgian fresh consumption potatoes sold in supermarkets.



Figure 2. Map of Belgium and potato processing plants (Belgapom 2014)

Total potato production (five-year average) in Belgium is 3.5 million tonnes (77 million cwt). The increase in Belgian processing production has been massive over the last 25 years with fry output up by nearly 1000% (Faulkner and Porter 2016).

2.3 Why is Belgium the world's leader in processing potatoes?

The success of the Belgium processing sector is likely attributed to the entire potato chain from their soil to the consumer. The key success factors (discussed below) include the country's strategic location, ability to produce high yields, competitiveness, and the industry's expertise.

- i) Location: Belgium is the most strategically located country in Europe. Bordered by France, Luxemburg, Germany, and the Netherlands, it is in the centre of the richest and most densely populated region in Europe. It has access to excellent land and sea transportation infrastructure, including access to world class seaports like Antwerp, which is the second largest seaport in Europe, and among the top 10 in the world.
- ii) High Yields: Belgium's overall yield of approximately 56 tonnes per hectare (500 cwt per acre) is second only to Washington State's yield of approximately 65

tonnes / hectare (579 cwt per acre) (Van In and Demeulemeester 2015). This is a function of excellent soil and climatic conditions, high yielding yellow fleshed varieties used for processing, and the experience/expertise of producers. High yields are obviously critical to be successful in the processing sector.

- iii) **Competitiveness:** In studies (conducted by AHDB, Andersons and Bidwells) referenced by World Potato Markets (Faulkner and Porter, Costs of Production 2015), Belgium has the lowest cost of production (COP) for potatoes in Western Europe (Table 4.). The COP in Belgium is €5401 EUR/ ha (approximately \$3126 CAD/acre). With an average yield of 45.5 tonnes/ha (approximately 405 cwt/acre), the cost is €119 EUR/tonne (\$7.73 CAD/cwt).

Table 4. Modelled full cost of processing potato production including depreciation, family labour charge, rent and finance

	€/ha	€/tonne	t/ha
Great Britain	7906	176	45
Netherlands	7800	142	55
Belgium	5401	119	45.5
France	5350	119	45

(Faulkner and Porter, Costs of Production 2015)

How can small Belgium farms have lower costs? Often it's thought that larger farms would have lower costs where there is more area over which to spread costs. But in the case of smaller, family-owned potato farms, having lower costs is often the result of being able to use family labour—outside help doesn't have to be brought in, having less expensive, smaller machinery which can be maintained from year to year, and having little-to-no land costs as most of these family farms have owned the land for a very long time—a huge advantage in a region where land is very expensive (Faulkner and Porter, Costs of Production 2015).

Most Belgian production is either sold straight from the field or from ambient stores, with less use of more expensive temperature-controlled stores used in other countries. Other cost savings are made by not using irrigation extensively and the continued significant use of Bintje—a variety that is high yielding and royalty free (Faulkner and Porter, Costs of Production 2015).

- iv. **Industry Expertise** (Belgium as a “Centre of Excellence”): Belgium is known for its extensive potato research. This includes studies conducted by organizations and institutions such as the Institute for Agricultural and Fisheries Research (ILVO),

Interprovincial Testing Centre for Potato Cultivation (PCA), and equipment manufacturing companies such as Dewulf. Support also comes from organizations like Belgapom, Federation of Agriculture, and the European Union Potato Processing Association (EUPPA) (Van In and Demeulemeester 2015).

In Flanders, PCA (based in Kruishoutem) works closely with Inagro's potato department in Beitem. They carry out joint practical research and share information with the sector. PCA and Inagro are actively supported by the potato sector and by the provinces of East and West Flanders (Van In and Demeulemeester 2015).



Figure 3. Greg Donald (left) and Karel Decramer (right) in front of self-propelled potato harvester at Dewulf factory in Roeselare, Belgium

In Wallonia, there are two organizations: Centre for Agronomy and Agro-industry of the Province of Hainaut (CARAH); and Walloon potato chain (FIWAP) in Gembloux. CARAH focuses on practical research and information dissemination, while FIWAP primarily focuses on information provision—with particular emphasis on the market and the economic conditions of the sector (Van In and Demeulemeester 2015).

Potato farmers can get assistance from these independent organizations, but they can also access expertise provided by traders and processors, as well as technicians from the plant industry and trade.

As previously mentioned, the Belgium potato industry also has support from organizations such as Belgapom (www.belgapom.ba) and EUPPA (www.euppo.ed). These organizations provide significant value to the potato trade and processing industry.

For instance, Belgapom is actively involved with initiatives that focus on the environment, training, innovation, agricultural advice, quality and food safety, plant health, market information, contracts, promotion, social items, and sustainability. The organization also plays a proactive role in a number of issues including food safety, EU trade policy, and sustainability. Belgapom's membership represents five national organizations and 11 processing companies—accounting for more than 90% of the European market. EU policies that are favourable to the processing industry are critical to the success of the industry.

The faculties of agriculture at the universities of Ghent, Louvain, Gembloux, and Liege are also active in the field of agricultural research. The main research institutions that focus on potatoes are: ILVO in Merelbeke; Walloon Agricultural Research Centre CRA-W in Gembloux and Libramont; and the Flemish institute for Technological Research (VTA) in Mol (Van In and Demeulemeester 2015).

2.4 Future success factors for the Belgium processing sector

Belgium may be a small country, but when it comes to the processing sector they have grown to be the biggest! The previous sections examined why the country has been so successful. In this section, I will discuss future success factors that were identified during the study tour, as well offer insight on what Belgium is doing to capitalize on them.

The future success factors include: a continued focus on sustainability; research and innovation; collaborations within the sector; increasing promotion; and capitalizing on growing export markets.

- i.) Sustainability: The Belgium potato sector recently launched a campaign titled “Samen voor een duurzame groei” (Let’s join forces for sustainable growth). The campaign is centred around the following keywords: commercial relations, promotion, and research projects. Vegaplan, with its food safety certificate, plays a central role in this messaging. Not only does this program ensure food safety, but it also certifies sustainability and integrated pest management.

Another important element is Belgapom’s Gids Autocontrole AGF handel en verwerking (Self-check Guide: potatoes, vegetables, fruit – trade and processing) which guarantees sustainability in the trade and processing of potatoes. These initiatives have been put in place to ensure the future success of the sector (Van In and Demeulemeester 2015).

- ii.) Research and Innovation: The Belgian processing potato sector has experienced rapid and dynamic growth. In order to continue with this growth, and ensure long-term success, the sector has identified the need for constant investment into research and innovation. It was evident that future research will be needed to continue to identify new varieties, as well as address various issues such as crop protection, nematodes, storage, and fertilization. The soil and available space are what they are, so sustainability from a production point of view can only be achieved if all the risks are permanently monitored, and improvements are made through research and innovation.

A few examples of research projects that are being done to ensure their future success include (Belgapom 2014):

- a.) The sector wants to gradually switch to the use of low residue sprout inhibitors (use of fewer crop protection products following harvest, which is very important to consumers) via the Resikia project.
- b.) The iPot project monitors potato fields via satellite imaging and UAVs (drones). Through this project, the sector aims to increase its yield per hectare while respecting crop rotation and other parameters.
- c.) Bintje Plus is a project which aims to use cisgenesis to make the Bintje variety resistant to *phytophthora infestans* (potato late blight disease) so as to significantly reduce the use of crop protection products.

- iii.) The Importance of Collaborations: With ever-increasing challenges and limited resources, the Belgian potato sector has embraced the need for stakeholders to work together collaboratively for their future success. The need for a coordinated approach to addressing challenges and capitalizing on opportunities was very apparent. There are numerous examples that have already been discussed in this report from organizations such as Belgapom, VLAM, Interpom-Primeurs, Fedagrim, and knowledge centres like PCA, FIWAP, and ILVO.
- iv.) Increasing Promotion: The Belgian processing sector is increasing its marketing efforts to promote their potato products both in Belgium and abroad. There are two Belgian organizations that promote potato products on behalf of the entire sector: VLAM and APAQ-W. They are competing against local countries like Germany, the Netherlands, and France. An example of a recent promotional initiative is Belgapom's James Bint (Belgapom 2014).
- v.) Growing Export Markets: Belgium's primary market (Western Europe) is reaching maturity, and future success will depend on growth in export markets that include the Middle East, North Africa, and South America. Belgium's main processing potato competitor is North America. North American ports (specifically the Pacific Northwest) are much closer to China than ports in Europe.



Figure 4. Romain Cools (Secretary General, Belgapom), in front of the Fry Museum in Brugge, Belgium

3.0 Netherlands – “Better not Bigger”

3.1 Introduction

The Netherlands is, by far, the world’s largest exporter of seed potatoes. In an effort to better understand why the Netherlands’ seed sector has become a world leader, I conducted a study tour in this country. The study tour was focused on gaining a better understanding of the current state of the Netherlands’ seed sector and determining what leaders believe are the key success factors for the future of their industry. Visits during the study included seed potato producers, industry organizations, research and development organizations, an equipment manufacturer, and private seed companies.

The most significant observations in this country were the high costs of production, in particular land and the prevalence of the latest in technology. These two factors are believed to be among the top reasons why the seed potato sector in the Netherlands has become the world leader– driven by the need to focus on getting better and not necessarily bigger.

3.2 Industry Overview

The Netherlands occupies the northeastern area in the potato production region of Western Europe (Netherlands, United Kingdom, Germany, and Northern France), as shown in Figure 1. Like Belgium, the area of the Netherlands is relatively small (only seven times greater than PEI), but has a population of 17 million people.

The total potato area for the country is around 74,000 ha (183,000 Acres) (Table 2.). Most farms are family owned and primarily located in the coastal areas. Despite trends toward larger farms to achieve economies of scale in place like Great Britain and Northern France, the farms in the Netherlands are still relatively small. Land for growing potatoes is more expensive than in other north-western potato growing countries. Land is between €80,000 and €100,000 EUR/hectare (approximately \$46,000 to \$57,000 CAD/acre). This is a significant challenge to gaining economies of scale that has led to greater focus on getting better.

Potato fields are rotated with cereals, corn, flowers, and sugar beets. There is a government regulated minimum three-year rotation with potatoes. In addition, there are a considerable number of livestock operations in the country and disposing of the manure is a problem. To help with this problem, livestock producers pay potato farmers to take away the manure. In fact, many of the potato farms visited during the study tour had manure bunkers and holding tanks.

In 2014, total production was approximately four million tonnes (88 million cwt)(Table 2.). Of that production, approximately 26% is sold for seed, 47% for the fresh or table market, and 28%

for the processing market. The Netherlands' potato yields are over 53 tonnes per ha (472 cwt per acre) for all varieties combined. The Netherlands' potato sector owes its high yields to the country's moderate climate, good water supply, and excellent soil. Bintje variety, once the most popular variety grown, has been overtaken by processing varieties such as Fontane, Markies, and Agria (Loon and Hammink 2013).

There were 40,000 ha (98,800 acres) of seed produced in 2014 on approximately 1,650 farms in the Netherlands. Total production was one million tonnes (22 million cwt). The main seed variety grown is early Spunta (Dutch General Inspection Service for Agricultural Seed and Seed Potatoes 2015). The Dutch variety list counts more than 250 varieties.

Dutch farmers have a long history of producing seed potatoes. A wealth of knowledge and expertise has been passed along from generation to generation. So too has the industry's resources and expertise that support the industry. Along with the farmers there is also a long history of potato breeders—breeding companies and traders that have contributed to the success of the seed sector in the country.

I was surprised at how many serious pest challenges are faced by the Netherlands' potato industry including wart, potato cyst nematode, brown rot, etc. On their own, each of these pests can be very challenging for potato production and marketability of the crop. Farmers cannot irrigate from surface water because of brown rot. Farmers must use small whole potato seed because of the risk of transmitting bacterial ring rot disease. It was obvious over the last few decades much attention has been given to monitoring and managing these pests. Among management strategies, variety resistance to pests like nematodes, wart disease and major virus diseases, but also to the vital quality aspect, were keys to their success. Despite these pest challenges, the Netherlands has managed to maintain itself as a world leader in the seed sector.

3.3 Why is the Netherlands the world leader in seed potatoes?

The key success factors that have made the Netherlands the world leader in seed potatoes include: the country's strategic location; favourable soil and climate; expertise; innovation; infrastructure; an independent inspection and seed certification system; and breeder's rights.

- i) Strategic location: The Netherlands is strategically located close to major international seaports and has favourable logistics to growing markets. The Port

of Rotterdam, for example, is the largest in Europe and among the top ten in the world.

- ii) Favourable soil and climate: The Netherlands has excellent soil for potato production as well as a moderate climate with an appropriate water supply (Loon and Hammink 2013).
- iii) Expertise: The country has many specialized farmers with a long history of seed production. Private activity from companies like HZPC and Agrico, as well as research and technical expertise at places like Wageningen University and Research Centre, contribute to the pool of expertise. Farmer groups that share technical information such as the one I observed that was coordinated by Lamb Weston agronomy staff. The Dutch Potato organization (NAO) and the Netherlands Consultative Potato Network (IVLAP) are also excellent examples of organizations providing technical expertise.



Figure 5. HZPC Research Station in Roptawei, Netherlands



Figure 6. Dr. Jeroen D. Bakker, sector breeder retail fresh potatoes, HZPC

- iv) Innovation: It was evident that the potato industry embraces new technology and innovation from production practices, to farm equipment used in the fields, to seed handling equipment and storages. Among the many examples observed were the use of ethylene to manage sprouts, highly automated grading equipment, greensprouting, and Tolsma (www.tolsma.nl) ventilation systems. As well, quality seed storage management with automated ventilation and humidification systems were prevalent. Solar panels on potato storages to make them self-sufficient for power were also common.



Figure 7. Ethylene injection unit to manage seed sprouting

- v) Infrastructure: The Netherlands has over 100 seed companies that are either private or cooperatives (Dutch General Inspection Service for Agricultural Seed and Seed Potatoes 2015). Most seed companies are involved in breeding and trading. Most of the seed trade is through these companies. Among the leading seed companies are HZPC and Agrico.

HZPC is a private company that is a world leader in the marketing of seed potatoes for various applications (www.hzpc.com) and have ten branch offices abroad. They have well over 200 employees, 800 growers, and 55 breeders that work on the introduction and commercialization of new, specific varieties. Their clients are active in five different sectors: traditional; retail fresh; and the peeled, crisps, and french fry processing sectors.

HZPC, with corporate headquarters in Joure, has a market/consumer oriented approach to variety development that is focused on engaging the entire value chain.

Agrico is also a leading potato seed breeding and trading company that is a producer-owned cooperative (www.agrico.nl). This company also markets seed potatoes worldwide.

- vi.) Independent inspection and seed certification system: - NAK is the Dutch General Inspection Services. It is 100% funded by producer user fees. NAK's primary function is to provide field and warehouse inspection services for seed potato production. The company also provides entire laboratory testing services (i.e. virus, potato cyst nematode, other nematodes, bacteria), performs field trials, training services, and services for cereals and grasses on germination, purity, moisture, and health. NAK also plays a role in regulations. For example, if a seed grower does not comply with the rotation rules, NAK will not allow the seed to be certified.
- vi.) Breeder's rights: Improved varieties are the result of extensive breeding programmes. It can take up to 15 years for a new variety to come to market. The potato industry is aware that, without modern varieties, progress cannot be made and even the best technology is useless. To recover the costs of breeding, the development and trading of new varieties require a sound legal basis and an effective system for protecting plant breeder's rights. Plant breeder's rights in the Netherlands are protected by the Seed and Planting Material Act (Loon and Hammink 2013).

3.4 Future success factors for the Dutch seed sector

The Netherlands is recognized as the world leader in the seed potato sector. The previous sections discussed reasons why the country has been so successful. In this section, I will discuss some of the future success factors that were identified during the study tour, as well as some insight into what the Netherlands is doing to capitalize on them. The future success factors include: a continued focus on new market-oriented variety development; research and innovation; and pest management.

- i.) Market-oriented Variety Development: The main principle when selecting a variety is the presence of a stable sales market (Loon and Hammink 2013). This applies to all potato sectors. Regularly consulting with buyers (whether consumers, retailers, or processors) to determine future sales developments is essential. Just as important is the net yield of a variety. In addition, soil and quality requirements, resistances, and storage quality play an important role in variety selection. The challenge/ opportunity is to replace dominant varieties like Russet Burbank and Bintje. Variety development needs to be market driven. New varieties need to be environmentally sustainable and have an outstanding and consistent taste profile. Tolerance to abiotic stress is also desirable.
- ii.) Research and Innovation: The Netherlands' seed potato sector has experienced international success. In order to ensure long-term success, the sector has identified the need for constant investment into research and innovation. It was evident that future research will be needed to continue to identify new varieties, as well as to address various issues such as crop protection, nematodes, storage, and fertilization. Environmental sustainability will be a key factor from a production point.
- iii.) Pest Management: With ever-increasing pest challenges and limited resources, the Netherlands' potato sector has embraced the need for stakeholders to work together collaboratively for their future success. The need for a coordinated approach to addressing pest challenges and capitalizing on opportunities was very apparent. There are numerous examples that have already been discussed in this report, such as those with private companies, universities, NAO and IVLAP. Unfortunately, with potatoes there will always be plant health issues and as such, inspection services and testing facilities like NAK will be essential for the future success of the potato industry.

4.0 Great Britain – A “Fresh” Outlook

4.1 Introduction

Great Britain (England, Scotland, and Wales) is a leader in the fresh potato sector. I believe marketing of potatoes in Great Britain is at least ten years ahead of Canada. In an effort to better understand why its fresh sector has become a world leader, I conducted a study tour in this region (England and Scotland). The study tour was focused on gaining a better

understanding of the current state of Great Britain's fresh sector and an indication of what leaders believe are the key success factors for the future of their industry. Visits during the study tour included fresh potato producers, industry organizations, fresh potato packing companies, and retail stores.

4.2 Industry Overview

Great Britain is located within the northwestern area in the potato production region of Western Europe (Netherlands, United Kingdom, Germany and Northern France) as shown in Figure 1 and has a population of over 60 million people.

The total potato area for this region is approximately 105,000 ha (260,000 acres) (Table 2.). Most farms are family owned and are widespread across Great Britain. The trend is towards fewer and larger farms to achieve economies of scale. Although not as expensive as Belgium and the Netherlands, land for growing potatoes in Great Britain is expensive compared to Prince Edward Island. Land can be as high as £8,415 GBP/hectare (approximately \$14,025 CAD/acre).



Figure 8. Adrian Kew (Farm Manager, Waldersey Farms) and Cedric Porter (World Potato Markets) in Norfolk, England

In 2014, total production was 5.1 million tons (113 million cwt). Of that production, approximately 14% was sold for seed, 44% for the fresh or table market, and 42% for the processing market. In recent years, production has remained around the six million tonne mark (132 million cwt). Overall, the long-term yield trend has been increasing. Yields in 2014 were approximately 49 tonnes per ha (436 cwt per acre). The trend for increasing yields has been

driven largely by improved agronomy, crop protection, fertilizer regimes, change in varieties, and irrigation (AHDB Potatoes 2016).

In 2014, there were 2160 registered potato producers. The area per grower has been steadily increasing since the 1960's. The largest proportion of planted area is intended for use in the fresh market (fresh bags, pre-pack, and other ware). There were 56,330 ha (139,135 acres) of fresh potatoes planted in 2014. Maris Piper remains the most popular variety in terms of planted area, accounting for almost 15% (AHDB Potatoes 2016).

Farmers in Great Britain have a long history of producing potatoes. A wealth of knowledge and expertise has been passed along from generation to generation—so too has the industry's resources and expertise that support the industry.

A significant portion of Great Britain's fresh potatoes are consumed within the region. Similar to Canada, fresh potato consumption has been on the decline. According to Defra's Family Food Survey (AHDB Potatoes 2016), Great Britain's household purchases of fresh potatoes in 2013 were 27% lower than ten years ago, at an average of 439 grams per person per week. Processed potato products, however, have remained steady over recent years with purchases at around 240-250 grams per person per week. These figures did not include eating-out purchases.

On average, food prices overall rose by 4.1% in 2013, with the highest price increases recorded against potatoes, along with fruit, beef, bacon and pork. Defra's survey indicated that consumers reacted to these higher prices by purchasing fewer fresh potatoes. A concern for the long-term decline in fresh potato consumption was expressed by many during the study tour and addressing this was highlighted as a major factor for future success. The issue of declining potato consumption in Great Britain is of particular concern to me, considering the leadership role this country has shown in the fresh sector.

Significant consolidation of fresh potato packing operations was evident. It was apparent that most packing was done by a few major packers. These include Bartletts, Greenvale, Branstons, Manorfresh, and Produce World. In comparison to packing operations on Prince Edward Island (and Canada), they were significantly larger. Of significant importance to these fresh potato businesses, was a consumer focus, as well as strong social and environmental commitments. Although individual business strategies for these packers differed, some of the key success



Figure 9. Albert Bartlett's administration and production facility Airdrie, Scotland

factors included: quality raw potatoes (most often contracted); proprietary varieties; economies of scale; the use of state-of-the-art production equipment; and progressive packaging.

Fresh potatoes sold in Great Britain retail markets were worth £1.1billion GBP (\$2.0 billion CAD) in the year ending September 2015 (AHDB Potatoes 2016). The primary retailers include Tesco, Sainsbury, ALDI, Marks and Spencer, ASDA, and Waitrose stores. Clearly there are different approaches at these banners. Regardless of the approach (premium or low price) the retail packaging is excellent (mostly poly) and easy to segregate various types/uses of potatoes. There are a very high percentage of the retailers that own private label packaging—in contrast to Canada, where the split between the retailers' private label packaging and others is approximately 60/40. The price point for most 2.5 kg bags was approximately £2.00 GBP (\$3.33 CAD) and as high as £2.50 GBP (\$4.17 CAD) at high-end stores. Maris Piper is the most prevalent variety (Great Britain's Russet Burbank). In my opinion, merchandising of fresh potatoes was very well done.



Figure 10. An example of fresh potato merchandising in grocery store in England

4.3 Why is Great Britain a world leader in fresh potatoes?

The key success factors that have made Great Britain a world leader in fresh potatoes include: a large local market; new and exclusive proprietary varieties; branding; promotion of healthy attributes; economies of scale; and value-added products.

- i) Local Market: The local market that is over 60 million people strong, provides a significant opportunity for Great Britain's fresh potato sector.
- ii) New and Exclusive Proprietary Varieties: Some of Great Britain's fresh potato businesses have invested in the development of new and exclusive proprietary varieties. The use of new and exclusive proprietary varieties is an excellent differentiation strategy (ideally to secure business and get a premium price) that although requires a lot of investment, risk, and long term vision, can be very rewarding. Good examples of this are at Greenvale and Bartlett's:
 - a. Greenvale is particularly focused on the value chain from grower to the customer and selecting varieties that best meet their respective needs. Greenvale's innovative, and specialty selected range of unique

varieties produced in partnership with The James Hutton Institute and through partnerships with European breeders, have resulted in a portfolio that boasts several exclusive varieties including Sylvana, Perline, Venezia, Flair, Lady Balfour, Safari, and Jelly.

- b. Bartletts works in partnership with leading breeders; their development programme includes the testing and evaluation of new and exclusive varieties that include Anya (fingerling variety), Marabel, Osprey, Vivaldi, Apache, Purple Majesty, Elfe, Pink Gipsy, Ilse of Jura, and Rooster.
- iii) Branding: Although there are many examples of branding in Great Britain, there are two examples that have been particularly successful. These are the Jersey Royal variety and the efforts of Albert Bartlett.
- a. Jersey Royal – The Jersey Royal is a variety of potato grown primarily as a new potato. Only those grown on the Island of Jersey can be referred to as Jersey Royal. Although very small (118 square km), the Island of Jersey is the largest of the Channel Islands (English Channel) off the coast of Normandy, France. Production of this variety is limited because of the limited area to produce it on the small island. Ninety-nine percent of the production is sold into the Great Britain market and they are traditionally the earliest new season potatoes available each year. There is high demand for this variety of new potatoes and that commands a premium price. Its strong brand recognition in the Great Britain market, combined with limited production and high demand are a winning combination. Maybe this is a model for PEI? A unique variety exclusively produced on PEI?
 - b. Albert Bartlett – Albert Bartlett has done an excellent job of developing their brand in the marketplace. Albert Bartlett's Rooster is Great Britain's leading fresh vegetable brand and Europe's fastest growing. The company has made significant investment in quality potatoes, innovative packaging, and extensive marketing and promotion to strengthen their brand in the marketplace. Bartlett's began advertising the Rooster on television in 2005 with a series of 30

recipe tips on a number of satellite channels. Since this, they have had others—including a successful advertising campaign with Hollywood actress Marcia Cross (particularly known from the TV series *Desperate Housewives*). Other marketing efforts have included promotional partnerships with Disney and world class chefs.

As previously indicated, the Great Britain potato market is dominated by generic retail store brands. Despite this, Bartlett has strengthened its brand recognition to the point where it seems to be able to leverage the distribution of its brands to the major retailers, in return for the opportunity to pack the retailers generic products, thus gaining economies of scale and efficiencies at their packing facilities.

- iv) Promotion of healthy attributes: AHDB Potatoes (2016) have made significant investments into a three-year, €3.6 million EUR (\$5.2m CAD) co-financed joint venture campaign with Board Bia that aims to change consumer attitudes toward potatoes being “**More than a Bit on the Side**”. The three-year program aims to inform and educate consumers through key opinion influencers and with highly targeted activities demonstrating that potatoes are nutritious, convenient, versatile, and can be used in innovative ways suitable for a busy, modern lifestyle.

The campaign, which is aimed at females aged 22-44 with a key focus on 25-34 year olds, aims to: increase frequency of purchase; re-engage consumers emotionally; inform consumers of the great taste and versatility; improve perception that potatoes are convenient; and build awareness of the added health and nutritional benefits of potatoes, in comparison to competitor carbohydrates. They are advertising in high profile consumer magazines as well as using impactful online banners to drive traffic to the **newly developed [Love Potatoes website](#)**, which boasts a much improved user experience and more visually appealing use of photography. There is also a large presence on social media, encouraging consumers to share recipes and nutritional information through familiar channels such as [Twitter](#), [Facebook](#) and [Instagram](#).

Promotional campaigns like this will ensure potatoes are an honest, healthy and interesting part of our food again. The ultimate goal is to curb the decline in fresh potato consumption and ensure the success of the industry.

- v) Economies of Scale: The size and scale of the fresh pack facilities were very notable in comparison to PEI facilities. The five major packers in Great Britain were significantly larger than PEI facilities. At Bartlett's, for example, it was apparent they are obtaining significant economies of scale—leveraging their own brand strength to gain generic packing opportunities and overall volume and throughout with their packing facilities to gain efficiencies and economies of scale.

Another interesting example was the approach by Manor Fresh. They are a premium supplier of fresh potatoes. Much of their business is exclusively with a high end retailer allowing them to secure contracts with producers and secure a consistent critical volume to run through its state-of-the-art production equipment.

- vi) Innovative and Value Added Products: I had limited opportunity to explore opportunities for new or innovative value added potato products, however, there were numerous examples observed when touring retail stores in Great Britain. There were many examples of products targeted to consumers' increasing needs for health, nutrition, and convenience. Products tended to include smaller package sizes, more ready or easy to prepare options, and unique packaging options that included nutritional information. They are even capitalizing on the buy local trend by profiling the farmers that produced the potatoes on the packaging and on promotional media. Some of the examples included small and cut potatoes in steam packs, marketing by specialty use variety, specialty items like diced potatoes in French goose gravy, etc.

4.4 Future success factors for Great Britain's fresh sector

As mentioned earlier, Great Britain is recognized as a world leader in the fresh potato sector. The previous sections discussed reasons why the country has been so successful. In this section, I will discuss some of the future success factors that were identified during the study tour. The future success factors include: managing supply; promoting health benefits; improved convenience; and environmental stewardship.

- i.) Managing Supply: During the study tour and throughout the region (in Belgium and Netherlands included), it was apparent there was great frustration among potato producers over the low prices. The low prices were the result of an oversupply from the 2014 crop. Basic economics says that when supply exceeds demand, price will suffer. Indeed that was the case there, and it was evident that greater effort will be needed by organizations like AHDB potatoes to provide market information on supply and demand to producers and try to prevent over-supply.
- ii.) Promoting Health Benefits: In an effort to curb the decline in fresh potato consumption, it was apparent that efforts to promote the health benefits of potatoes must continue.
- iii.) Improved Convenience: Consumers' needs continue to change and convenience in meal preparations is very important.
- iv.) Increased Environmental Stewardship: LEAF (Linking Environment And Farming) promotes trust of food and farming in a number of ways—including open farm days and a national network of demonstration farms. One of the specific on-farm initiatives include LEAF's Integrated Farm Management that helps farmers follow best practices in potato production, enabling them to manage the environmental risks, and maximize the opportunities for their industry. Against a backdrop of consumers who are increasingly interested in the provenance of their food, those who can demonstrate continual improvement and that are working harmoniously with the environment, through the LEAF Marque, are finding greater marketing and production benefits. LEAF might offer an opportunity for the PEI potato industry. More information can be found at www.leafuk.org or www.leafmarque.com.

5.0 A Broader Perspective

5.1 Introduction

I also attended numerous potato industry events including the World Potato Congress in China and the North American Potato Expos in 2015 (Florida) and 2016 (Nevada) to broaden my perspective on the future success factors for the potato industry.

While attending various potato events I kept in mind the question: "What will the future of the potato industry be like?" I have spoken to many people and listened to a variety of

presentations. A recurring theme was the importance of future food production being able to meet the demand of the world's growing population—that will reach nine billion by 2050. The potato will play an important role in this challenge.

Currently, the world's leading food crops are corn, sugar, rice, wheat, and potatoes (Table 5). Although potatoes are currently in fifth place, the potato is considered the best crop for producing energy and protein per unit of land and water. Potatoes only require 20 litres of water per 100 kcal food value. Rice, on the other hand, requires four times the water required by potatoes, and wheat requires two and a half times the water. These factors will lead to increased global potato production to meet the world's increasing need for food. Where will

Table 5. World's Top Crops

World's top crops			
	2013 production million tonnes	Yield change 1993-2013	Area change 1993-2013
Corn (maize)	1018	+52.8%	+39.7%
Sugar	930	+38.0%	-11.2%
Rice	741	+25.0%	+11.6%
Wheat	716	+32.0%	-3.9%
Potatoes	376	+18.2%	+4.3%
Cassava	276	+38.8%	+22.0%
Soyabeans	276	+31.6%	+82.4%
Note: 2014 figures not yet available. Source: UN FAOSTAT Database			

(Faulkner and Porter, World Potato Markets: Trends, Investments, Intercontinental Trade and its implications for the future. 2015)

this increased production occur? Industry analysts project that most of this growth will occur in developing countries while growth will be limited in developed countries (Table 6.).

5.2 The Processing Sector

International trade of potatoes is predominantly done with frozen processed products. Trade is on the increase as trade barriers are eliminated and the shipment of goods becomes more

efficient. In the processing sector, supply is led by regions with the lowest costs—like northwest United States and northwest Europe.

The northwest United States has the highest yields in the world. This is attributed to their unique dry climate, extended growing season; and irrigation water. They are, and will continue, to be a major player in the frozen processed potato products. Similar advantages occur in

Table 6. Predicted Human Consumption

Predicted human potato consumption in million tonnes			
	2015	% change 2015:2050	2050
World	253.4	+30.4%	330.5
Asia	127.2	+17.8%	149.8
Europe	62.6	-4.6%	59.7
Africa	21.9	+105.2%	45.0
North America	20.9	+23.6%	25.8
South America	12.3	+21.7%	15.0
Oceania	1.9	+44.5%	2.7
Note: Based on 2011 UN FAOSTAT potato use figures Source: UN FAOSTAT & UN Population estimates			

(Faulkner and Porter, World Potato Markets: Trends, Investments, Intercontinental Trade and its implications for the future. 2015)

Northwest Europe only with rain fed conditions. High yields and low raw product costs for processors in these regions are giving them a global competitive advantage.

Areas like these will have an international advantage while others will be disadvantaged. Frozen processed product markets are close to maturity in the developed countries, and future growth opportunities are in the developing countries. It will be interesting to see if local production in the developing countries will be able to compete with the cost and quality of the current export leaders of northwest United States and Europe. Regardless of the potato production region of the world, high yields, quality, and low cost raw for processing are, and will always be, key success factors.

5.3 The Fresh Sector

Potato production, supply, and consumption have fallen across Europe over the last 35+ years—with the total area devoted to the crop down more than 50%, and supply per head also down nearly 20%. This contrasts with massive increases in Asia and Africa, although there is still opportunity for increased consumption of potatoes where the average Asian usage is just nearly a third of the average European. The supply of potatoes per African is around a quarter of what it is per European (Faulkner, Strong future for potato production 2015). North American potato supply, or consumption per head, was static over the last 35+ year period. Yet a 53.7% increase in yields, allowed North American growers to produce 35.7% more potatoes in 2010 on 11% less land than was used for the crop in 1975. There were also steady gains in production, yields, and use in South America and Oceania (Faulkner, Strong future for potato production 2015).

World Potato Markets (2015) used historic figures to make some projections about future consumption, supply and production. Basically they predicted that there will be a significant increase in individual consumption in many developing parts of the world, increasing yields across the world, and a decline in consumption and production in developed markets. This will have different implications for various regions that are involved in potato production around the world.

It is believed that fresh potato production in the developed regions like Europe, North America, and South America will continue to decline in the next thirty-five years as result of static to declines in consumption and increasing yields. World Potato Markets projected that the decline in potato acres could be as high as forty-two percent in Europe and as high as twenty-three percent in North America and South America. In contrast, significant increases in potato acres are projected to occur in Asia, India, and Africa.

It was very evident at the World Potato Congress in China that their government aims to double production and announcing the potato as their new food staple. If that were to happen, China would need to increase the area growing potatoes by 50% over the next 35+ years. India has also announced its intention to double its potato use. That will require 25% more land if the rate of increase in yields seen between 1975 and 2010 is maintained. If Africa continues its upward trend for potato consumption their potato production area will need to increase by 178% of the next thirty five plus years. Output in Oceania needs to increase by around two thirds to maintain the current levels of supply for an increasing population (Faulkner, Strong future for potato production 2015).

It has previously been stated that demand for frozen processed potato products are increasing, particularly in the developing populations around the world, whereas fresh potato demand has been experiencing decreasing demand, particularly in the developed countries.

I heard, at the World Potato Congress, Potato Expos, and through many other events and articles, about the focus on education, promotion, and communication around the health benefits of potatoes for all ages. The question will be whether these efforts will reverse the declining trends in fresh potato consumption experienced in developed countries. Also, will the health benefits of the potato, and efforts to develop potato products that are more convenient to consumers, be enough? There are many new products such as small potatoes, microwaveable potatoes, pre-cooked, pre-peeled, and more ready to use. I was concerned when visiting Great Britain, where efforts in this regard are probably ten years ahead of North America, has also experienced a significant decline in fresh consumption. There are, however, indications that the decline might be slowing down and possibly stabilizing. No doubt the decline would have been much greater had it not been for industry's efforts to increase consumption. It is also important to note that price is also a major factor in the future success of fresh potato consumption.

5.4 The Seed Sector

It was evident from presentations at the World Potato Congress in China that the demand for better varieties for different end users in different climate zones around the world will be one of the greatest opportunities for closing the yield gap and meeting consumers' demands. This will continue to be the major opportunity for the seed sector. Most new varieties will be proprietary, supported by plant breeder's rights. Seed production will be controlled by the variety owners, and supply will be provided locally or regionally. It is likely that widespread adoption of cisgenics will occur in the next several years. Research on late blight resistance through cisgenics would be one of the biggest contributors to better management.

It is also possible that the use of true seed will become more prevalent in future years. Tuberosum Technologies Inc. of Saskatchewan is already using true seed in its seed program. Tuberosum's General Manager, Joel Vanderschaaf, described how his company is using true seed in a presentation he made at the World Potato Congress. Still much is to be learned about using true seed, in particular how to manage the genetic variability of the seeds. If this can be managed, hybrid seed (using true potato seed) could replace traditional seed production in the future. Growers will be able to use a 100 gram packet of seeds, where they would have had to

use three tonnes of potatoes to plant a hectare of crop. This development could dramatically change the dynamics of the seed potato industry.

6.0 Implications for the PEI Potato Industry

6.1 Introduction

My project allowed me to gain greater knowledge and insight to assist in the long term planning of the PEI potato industry. There were much learnings to consider however I have narrowed them down to a few specific items I believe are most relevant to PEI. Some of the key implications from this study for PEI's long term planning include an ever increasing need for research and extension to improve marketable yields, the value of exclusive market oriented production, varieties and marketing initiatives, effective disease management, and environmental sustainability. Some of these implications are more relevant to either the processing, seed or table sectors, while some are relevant to all sectors.

6.2 The Processing Sector

It was very clear from this study that high yields are critical to the long term success in the processing sector. Potato yields in PEI are approximately 43% lower than in Belgium. Potato yields in Prince Edward Island have increased over time, but seem to have stagnated over the past five to six years despite increased awareness of and commitment on the part of growers to the need for improved productivity. Below is the average gross yields for Prince Edward Island over five year increments from 1985 to present:

Average PEI Potato Yield, 1985 to Present

Time Period	Average Yield
1985 – 1989	262 cwt/acre
1990 – 1994	259 cwt/acre
1995 – 1999	263 cwt/acre
2000 – 2004 *	273 cwt/acre *
2005 – 2009	290 cwt/acre
2010 – 2014	285 cwt acre

Source: Statistics Canada, CANSIM Table 001-0014

* Note: 2001 was a drought year in PEI, with an average yield of 172 cwt/acre. It has been omitted from the average for the period 2000 – 2004.

Breaking down the last five year period and including 2015, it seems yields have flattened out: 2010: 300 cwt/acre; 2011: 285 cwt/acre; 2012: 278 cwt/acre; 2013: 281 cwt/acre; 2014: 280 cwt/acre; 2015: 279 cwt/acre.

Growers and processors on PEI have expressed a strong interest in finding ways to increase the marketable yield on PEI farms in order to improve financial returns on farms and to enable processors to access competitively priced potatoes that will help maintain and expand opportunities for all parties within our province. A more coordinated, collaborative approach will be necessary to enable the best use of the resources we have available to the potato industry in PEI, and to identify and access expertise that will help address gaps in knowledge or practices that may be limiting yield in our province. A number of examples of ways to address these gaps have been discussed in this report.

6.3 The Seed Sector

It was also clear from this study that new market-oriented variety development and effective disease management are essential to the future success of the seed sector. The production of new market-oriented varieties has been increasing on PEI; however, the challenge has been to replace dominant varieties like Russet Burbank. Greater effort is needed to collaborate with private and public breeders together with buyers (whether consumers, retailers, or processors) to determine future sales developments. It will be important that new varieties meet these future sales. Just as important will be the marketable yields, pest resistances, and environmental sustainability of new varieties for production on PEI.

With ever-increasing pest challenges and limited resources, it will be important that PEI's potato sector embraces the need for all stakeholders to work together collaboratively for our future success. We have a positive track record dealing with pest issues such as potato wart and wireworm. I am encouraged by the Netherlands' success in managing their pest challenges while maintaining a leadership role in the world's potato seed sector. Best management of pest challenges on PEI will be essential.

The development of new varieties requires significant investment of time and resources. I believe it will be important to provide the necessary support to both private and public breeders for the potato sector's long term success. Likewise, I encourage strong leadership to support the advancement of cisgenic potato varieties that can better meet consumer needs, improve environmental stewardship, and grower profitability.

6.4 The Fresh Sector

While conducting my study it was apparent that decreasing consumption is not unique to the markets that PEI is supplying. It was also apparent that decreasing consumption combined with increasing yield trends (in most production areas), will intensify competition. To maintain and grow our fresh business in this environment, we will need to increase efforts to strengthen our brand, offer unique market oriented varieties (ideally exclusive proprietary varieties), and new innovative products that offer greater consumer convenience and health awareness.

PEI currently has strong brand recognition in Canadian markets. This brand has been built over many years by differentiating our potatoes on quality from experienced growers and grown under unique conditions (soil and climate). Many in our industry believe that this advantage has been deteriorating. Efforts with available resources will need to continue to maintain and strengthen our brand's recognition and continue to build our brand in export markets.

PEI has many challenges from a competitiveness perspective. One of those challenges relative to other production areas is our high transportation costs. Since costs are, and will be, a challenge for PEI, I believe we will need to continue differentiation efforts for our fresh potatoes in the marketplace. The Jersey Royal variety and Albert Bartlett varieties in Great Britain discussed in this report are excellent examples of the value of exclusive proprietary varieties. The use of exclusive proprietary varieties on PEI would be a good fit with our differentiation strategy.

I had limited opportunities during my study tour to explore opportunities for new and innovative value added products; however, there were numerous examples observed when touring retail stores in Great Britain. Many of these new products aimed to meet consumers' needs for taste, convenience, and versatility. There were small potatoes, microwaveable potatoes, pre-cooked, pre-peeled, and more ready-to-use. Some of these value added products are being prepared on PEI, but much more effort is needed in this area. PEI has some good resources to help with new product development such as the Food Island Partnership, Innovation PEI, the PEI Food Technology Institute, and Canada's Smartest Kitchen. New value added potato products that will improve consumer convenience will be important to future consumption of PEI potatoes.

There were considerable efforts in almost every region that I visited to promote the health benefits of potatoes to help curb the decline in fresh consumption. Promotion of health

benefits were observed at all levels, from packaging all the way to national campaigns. Most efforts were from national potato organizations such as Great Britain's AHDP, Belgium's Belgapom or Netherland's NAO. Devoid of a national marketing agency in Canada, the greatest opportunities to promote the health benefits of PEI potatoes are limited to packaging, point of sale materials, and social media. PEI marketers are using these opportunities; however, more needs to be done. Efforts are being made, and need to continue, to explore a national promotion agency for Canada.

6.5 All Sectors

During my study tour it was apparent there was great frustration among potato growers over low prices. The low prices were the result of an oversupply from the 2014 crop. Basic economics says that when supply exceeds demand, price will suffer. This applies to all sectors anywhere in the world. Greater collective efforts are needed by growers to only produce what the market needs. PEI needs to do its part and work together with other regions through efforts like the United Potato Growers of Canada. Efforts need to be made to try to match supply with demand and achieve fair prices for growers.

PEI potato growers continue to make significant efforts to improve environmental sustainability. These efforts follow a path of continual improvement. Positive efforts include environmental farm plans, implementation of a 4R nutrient stewardship program, soil conservation structures, buffer zones, integrated pest management, longer crop rotations, cover crops, and the use of alternative tillage systems. In my opinion, environmental stewardship standards achieved by PEI growers would rank among the highest in the world. It is important that growers maintain a path of continual improvement given the sensitive nature of our soils and aquatic environment.

PEI potato farmers are often under pressure from the public to do more, despite continuous efforts to improve environmental stewardship. In some cases, public concern is based on false information and misconceptions. There is also increasing opportunity to appeal to consumers' interests to purchasing produce that is grown in a more environmentally friendly manner. To improve public perception and capitalize on marketing opportunities, I believe the PEI potato industry should consider adopting an environmental stewardship program such as Great Britain's "Leaf" program.

I cannot overemphasize the on-going need for investment in research and extension activities to advance the PEI potato industry. It is necessary to solve existing problems and adopting new technologies and innovations.

Last but not least, it was very apparent during my project tour the endless opportunities to collaborate with stakeholders on PEI, across Canada, and around the world.

7.0 CONCLUSION

This project enabled me to learn about the current state and the key success factors for the processing potato sector in Belgium; the seed sector in the Netherlands; and the fresh sector in Great Britain. Numerous potato industry events that I attended, including the World Potato Congress in China and North American Potato Expo's in 2015 and 2016, also broadened my perspective and helped with this study.

Belgium is the world's leader in processing potatoes because of its strategic location, high yields, competitiveness (low cost of production), and the industry's expertise. Belgium is located in the centre of Western Europe and its 400 million people. It also has access to some of the largest seaports in the world. Belgium's overall potato yields are 56 tonnes per hectare (500 cwt per acre), second only to Washington State. Belgium's potato producers have the lowest cost of production in Western Europe of approximately \$3126 CAD per acre. The industry also has excellent research and technical resources to support the processing sector. These are the key success factors for the Belgium processing sector. Belgium's future success factors include a continued focus on sustainability, research and innovation, collaborations within the sector, increasing promotion, and capitalizing on growing export markets, in particular the Middle East, North Africa, and South America. It was very apparent that high yields, low cost, and subsequent competitiveness are key success factors for the Belgium processing sector. The ability to maintain and improve this position will be key for future success.

The Netherlands is the world leader in seed potatoes because of its strategic location, favourable soil and climate, expertise, innovation, and infrastructure. The Netherlands is strategically located near the major potato production areas in Europe as well as some of the largest seaports in the world, such as Rotterdam that can provide access to growing markets. The Netherlands has excellent soils for seed potato production as well as a moderate climate with an appropriate water supply. The Netherlands has many specialized farmers with a long

history of seed production. It was evident that these farmers embrace new technology and innovation from production practices, to the farm equipment used in the fields, to seed handling equipment and storages. There are over 100 seed companies, either private or cooperatives, that are involved in breeding and trading. An effective system for protecting plant breeder's rights is in place. The independent inspection and certification system in the Netherlands is second to none. These attributes are the key success factors for the Netherlands' seed sector. The Netherlands' future success factors include: a continued focus on new market-oriented variety development; research and innovation; and pest management. It was very apparent that production costs are very high, in particular land and the prevalence of the latest in technology. These two factors are among the reasons why it is believed the seed potato sector in the Netherlands has become, and will continue, as a world leader in the seed sector because of the need to focus on getting better, and not necessarily bigger.

The key success factors that have made Great Britain a world leader in the fresh potato sector include: a huge local market; focus on new exclusive varieties; branding; promotion of healthy attributes; economies of scale; and value-added products. The local market is sixty-five million people strong. Some of Great Britain's fresh potato businesses have invested in the development of new and exclusive proprietary varieties to achieve a differentiation strategy in the marketplace. Branding is also an important strategy that is used by Albert Bartlett and Greenvale. Significant consolidation of potato fresh pack operations has occurred over the last decade or more. Most packing today is done by five major fresh packers that have achieved significant economies of scale. Despite recognition as a world leader in the fresh sector, I was surprised at the significant decline in the region's fresh consumption. AHDB has been very active in promoting the health benefits of potatoes to counteract the decline. Numerous examples of innovative and value-added products were observed in retail stores. Great Britain's future success factors will include: managing supply; promoting the health benefits of potatoes; improving convenience; and increasing environmental stewardship. It was most apparent that addressing the decline in fresh consumption will be the single most important future success factor for Great Britain.

A broader perspective on the current and future success factors for the potato sectors was gained by attending the World Potato Congress in China and the North American Potato Expos in 2015 and 2016. To meet the world's increasing food needs, the potato will play a critical role because of its ability to produce a great deal of food per unit of area with less water per unit of production versus the world's other major crops. As described in this section, growth in potato consumption and production area will occur in the developing countries, while consumption

will be static or declining and production area will decline in developed countries as well, due to increasing yield trend.

Trade of frozen processed products will follow a similar trend, however, it is believed that production of processing potatoes and processing will be provided by the most competitive suppliers. The big question will be whether local processing sectors in developing countries will be able to compete with the quality and price of world leaders like Washington and Belgium.

This project enabled me to gain greater knowledge and broadened my insight into the long term success factors identified in other regions that can be used to assist in the long term planning and success of the PEI Potato Industry. There were many learnings however the key success factors that I believe will have the most significant implications for PEI's long term planning include an ever increasing need for research and extension to improve marketable yields, exclusive market oriented production, varieties and marketing initiatives, effective disease management, and environmental sustainability. Also important will be efforts to strengthen PEI's brand and the development of new products that offer greater consumer convenience. As a final note, there are endless opportunities to ensure long term success by collaborating with stakeholders on PEI, across Canada and around the world.

8.0 SUMMARY OF KEY LEARNINGS

The ultimate goal of this project was to gain useful information to assist in the long term planning and success of the PEI potato industry. Future success factors for the PEI potato industry should include:

- i.) Processing Sector
 - a.) Higher marketable yields and processor competitiveness
- ii.) Seed Sector
 - a.) Market oriented variety development
 - b.) Effective disease management
- iii.) Fresh Sector
 - a.) The use of exclusive proprietary varieties
 - b.) Strengthening our brand

- c.) The development of new innovative products that offer greater consumer convenience
 - d.) Promoting our potatoes and their health benefits
 - e.) Greater economies of scale with packing operations
- iv.) All Sectors
- a.) Focusing on market oriented production and ensuring producers will not over supply the market or prices below the cost of production will be guaranteed
 - b.) Leaders in environmental stewardship and consideration of adopting a program such as Great Britain's "LEAF"
 - c.) Investment in research and extension
 - d.) Opportunities to adopt new technology and innovations
 - e.) Taking advantage of opportunities to collaborate with stakeholders on PEI, across Canada, and around the World

9.0 GLOSSARY

Processing Sector – production of potatoes destined for processing into french fries, chips, dehydrated, and formed products.

Fresh Sector – production of potatoes destined for fresh consumption via the retail grocery or foodservice markets.

Seed Sector – production of potatoes intended for re-planting as seed.

cwt – 100 lbs

Cisgenics - (from "same" and "beginning") organisms that have been engineered using a process in which genes are artificially transferred between organisms that could otherwise be conventionally bred.

True Seed – These seeds are also called "botanical potato seed" or "True Potato Seed", or "TPS" to differentiate them from "seed potatoes" which are genetically identical clones produced in large numbers by planting pieces of tuber or through tissue culture. True potato seed is the actual botanical seed produced by the potato plant (*Solanum tuberosum*). Found in tiny seed balls resembling tomatoes, true seed is occasionally formed after the potato has finished flowering.

AHDB Potatoes – is a division of the Agriculture & Horticulture Development Board in the UK, and is committed to making the potato industry more competitive and sustainable through factual, evidence-based advice, information and activity.

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