The Pulse Industry In Western Canada

Alberta

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In
Western Canada

Prepared for:

Alberta Agriculture and Food

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Executive Summary

Pulse crops are the edible seed of legume crops, and include dry peas and beans, lentils and chickpeas. World production of these crops has remained around 40 million tonnes per year for the last 10 years; India is the largest producer of these crops followed by Canada. Canada has become the world's largest exporter of peas and lentils and a leader in exports of chickpeas and beans.

Canada's pulse production and exports have been rising since the early 1990s. In 2006, Canada produced 3.6 million tonnes of peas, lentils, chickpeas and beans. The 2007 production area was estimated at 2.3 million hectares. The Prairies produce approximately 96% of Canada's pulses, with peas representing the greatest volume (68%) followed by lentils (17%), beans (10%), and chickpeas (4%). Canada exports approximately 75% of its total production: pea exports mainly go into India, Spain, and China; lentils are distributed to several countries; a large percentage of beans go to the US and UK; and chickpeas are exported to Pakistan, India, Jordan and other countries.

The three main markets for pulses are food, feed, and ingredients. The ingredient market breaks pulses into starch, protein, and fibre that can then be used for food or feed. Canada's pulse consumption as food is small compared to other countries. Canada's pea consumption is estimated at 1% of its total production, while around 19% is used for feed. The demand for pulses for use as food and feed is expected to rise globally. The Canadian ingredient market uses approximately 50,000-70,000 tonnes of pulses processed into flour or its constituent parts.

The use of feed peas in a number of animal rations has proved successful. Peas are rich in protein, lysine, and starch to provide the essential amino acids and energy required by high-producing animals.

Pulses are a healthy food choice providing twice the amount of protein of cereal grains, high levels of dietary fibre and important vitamins and minerals. They are a gluten free food and have a low glycemic index (important for people with diabetes). Regular consumption of pulses may reduce the risk of certain diseases.

There are benefits to increasing the use of pulses in crop rotations. They reduce the amount of fertilizer needed due to nitrogen fixation, as well as provide secondary benefits to the soil and crops that follow in rotation. Peas can fix up to 90% of their nitrogen needs, and provide some residual nitrogen for the following crop.

Transportation presents some challenges and opportunities for pulse growers. Product moves by rail on hopper cars, boxcars, containers, or through intermodal terminals to the ports. The pulse industry is concerned about the lack of containers and inability to move product quickly enough to overseas markets. In September 2007, a new container facility opened in Prince Rupert. This will further ease the pressure at the Port of Vancouver, in their capacity to handle special crops and export product more quickly into the Asian market.

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The Pulse Industry in Western Canada

Background

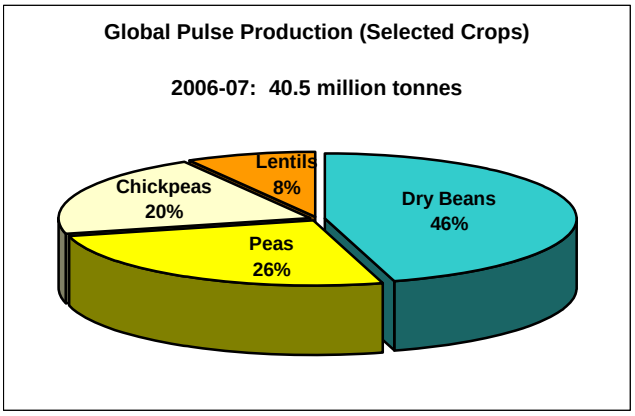
"'Pulses' are the edible seed of legumes, plants that include lentils, beans, peas and chickpeas" (Pulse Canada, 2007, "What are pulses?"). Canada's production and exports of pulse crops have seen a steady increase over the last 15 years. Canada is the world's largest exporter of peas and lentils and a world leader in the exports of chickpeas and beans.

Opportunities for pulse crops are likely to expand in both the domestic and international marketplace. Pulse consumption is expected to increase with rising population in Asia and Africa. Urbanization, which is expected to increase globally, often results in higher incomes and a trend toward greater meat consumption. There has been an increase in pulse research techniques, a greater knowledge of nutrient levels and other pulse components as well as their application, and an increased awareness that pulses are a healthy food. Therefore, there is an opportunity to increase the food and feed consumption of pulses.

World Production

Globally pulse production has remained steady, around 40 million tonnes per year over the last 10 years.[1] In 2006, beans represented the largest percentage (46%) of all pulse production in the world, amounting to over 18 million tonnes per year. This is followed by peas (26%), chickpeas (21%), and lentils (10%) (Pulse Canada, August 22, 2007).

Figure 1



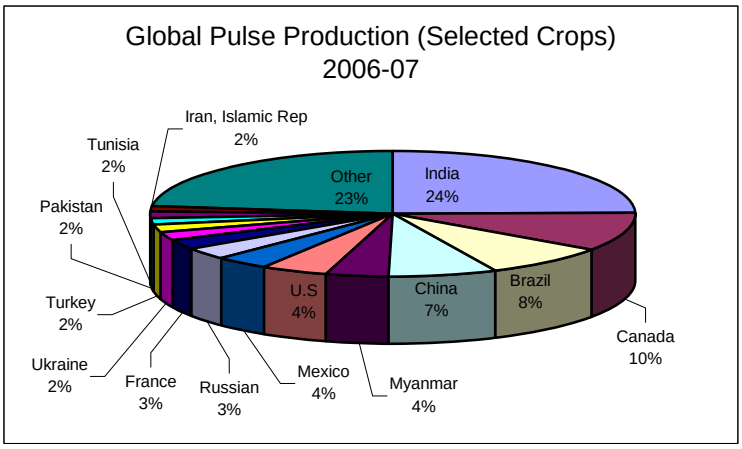
Source: FAO; Pulse Canada, August 2007

[1] Information sources from the UN Food & Agriculture Organization (FAO). Figures exclude pigeon peas, broad beans and cowpeas, which Asia produces in significant quantities. Lupins are also excluded, produced largely in Australia and the EU. These crops amount to an additional 20 million tonnes per year globally. Canadian soybeans are also excluded from these figures.

India is the largest producer of these pulse crops, followed by Canada. Countries mainly producing beans are Brazil, Myanmar and Mexico, while countries like Canada, China, the US, and to a degree Mexico, produce some of all the pulse crops. Turkey largely produces lentils and chickpeas, while France and Russia are pea-producing countries.

Over the last 10 years, international pulse trade has averaged around 7.4 million tonnes per year. Peas accounted for approximately 42%, with beans at 36%, lentils at 12% and chickpeas at 9% (Pulse Canada, August 22, 2007).

Figure 2

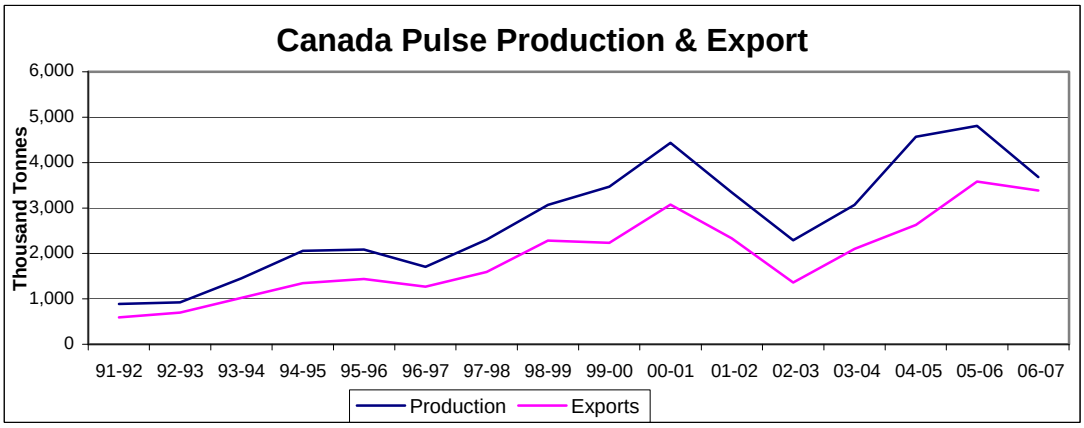


Source: FAO; Pulse Canada, August 2007

Canada's Production and Exports

Pulse production and exports have continued to rise in Canada since the early 1990s. Increases have been due to enhanced market opportunities, plant breeding, increased acreage and new technologies to improve production, harvest capabilities and varieties (Figure 3).

Figure 3

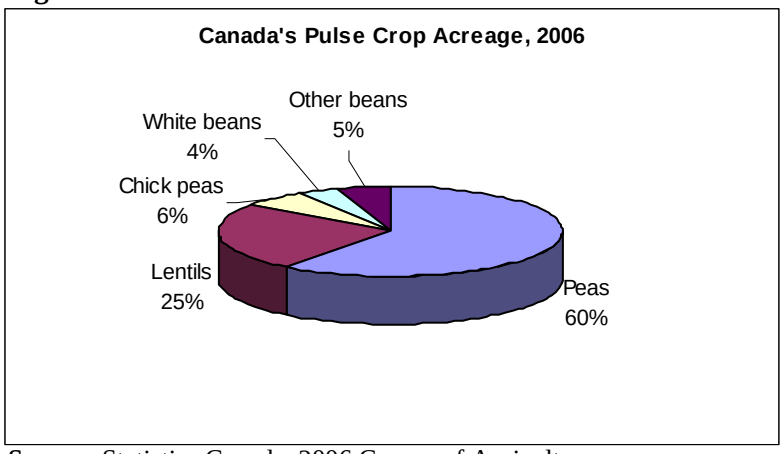


Source: Statistics Canada; Pulse Canada, August 2007

In 2006, Canada produced 3.6 million tonnes of peas, lentils, chickpeas and beans, representing a 116% increase from 10 years ago. Canada's 2007 estimates of seeded area for these pulse crops are over 2.3 million hectares (Mha). This is an 11.9% change over 2006. In Canada, the main bean producing provinces are Manitoba, Quebec and Ontario. Manitoba's bean crop represents 59% of its total production volume of pulses, followed by a large proportion of peas (40%), and some lentils. Saskatchewan mostly produces peas (71% of its total volume), followed by lentils (24%), chickpeas (5%), along with some bean production. Alberta largely produces peas (86% of its total), followed by beans (9%), then chickpeas (4%) and some lentil production as well (Pulse Canada, August 22, 2007; Statistics Canada, August 2007).[2]

Figure 4 demonstrates the 2006 distribution of pulse crop acreage in Canada. Peas make up 60% of the pulse acres in Canada, followed by lentils at 25%, various types of beans at 9% and chickpeas are 6% of the total acreage.

Figure 4



Source: Statistics Canada, 2006 Census of Agriculture

In 2006, Canadian pulse exports were worth over $1 billion (Cdn), approximately a 37% increase over 2002. Pulse Canada reports that on average Canada exports 75% of its total production. This can vary greatly from year to year (Statistics Canada, July, August & n.d. 2007; Pulse Canada, 2007, "Statistics").

[2] Soybeans, not included in these pulse totals, are mainly grown in Quebec, Ontario, and Manitoba.

The following subsections focus on the prairie region and the growing of pulse crops in relation to other crops.

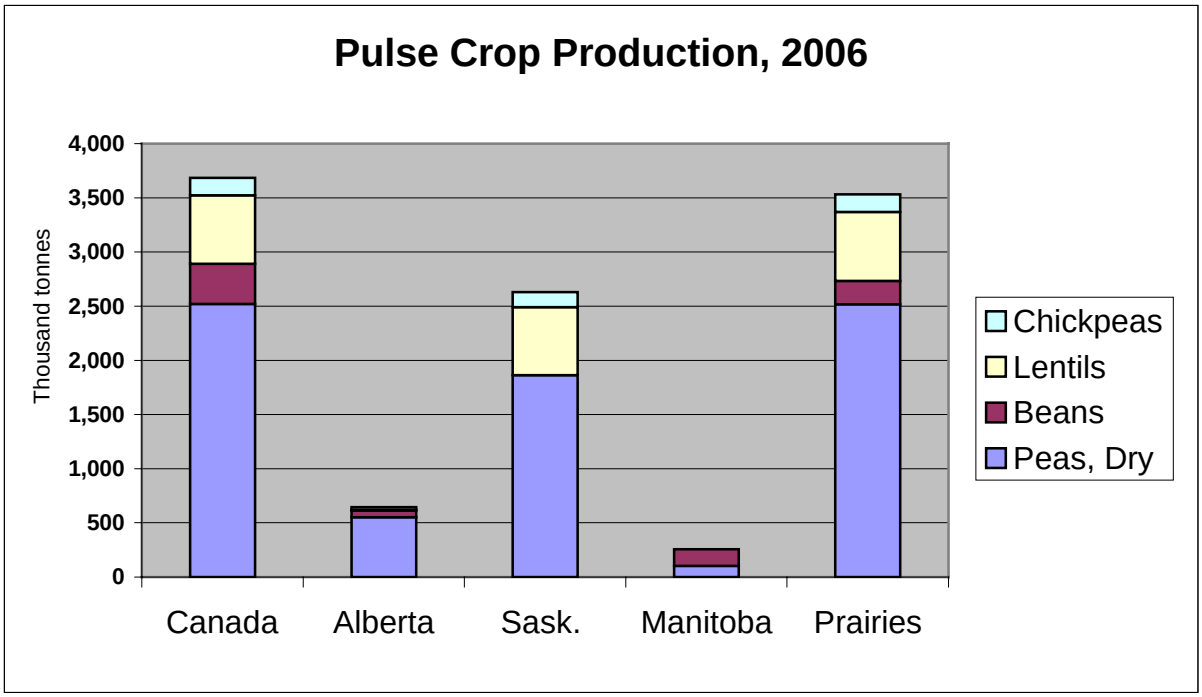
Prairie region

Approximately 96% of Canadian grown pulses are produced on the Prairies, with Saskatchewan as the largest producer of pulses (71%) followed by Alberta (18%) and Manitoba (7%) (Statistics Canada, August 2007). Pulse production estimates in Canada for 2006 are as follows:

- Peas – 2.52 million tonnes
- Lentils – 630,000 tonnes
- Beans – 372,000 tonnes
- Chickpeas – 163,000 tonnes

Figure 5 displays the production volumes of each pulse crop in Canada, compared to volumes in each of the Prairie Provinces, and on the Prairies as a whole.

Figure 5



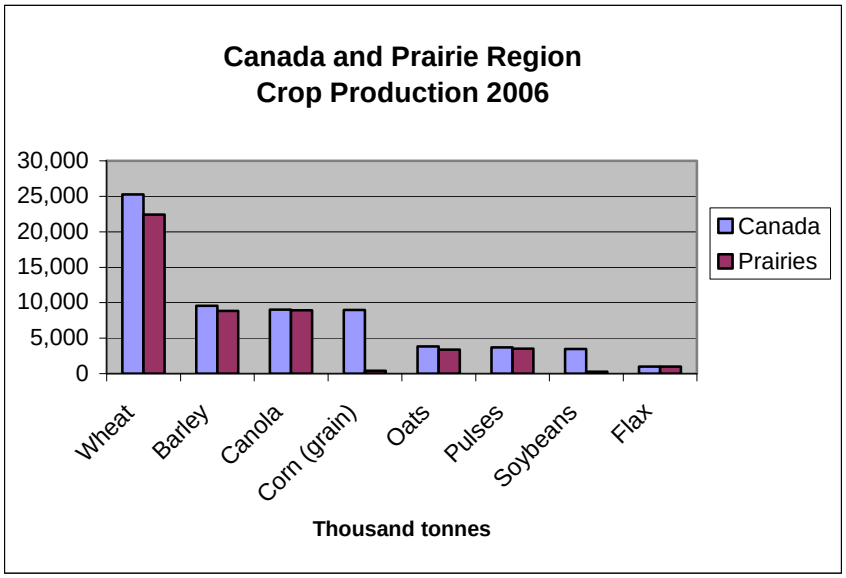
Source: Statistics Canada, August 2007; Alberta Agriculture and Food

Production area of grains, oilseeds and pulse crops

Canada's production area of pulse crops has been on the rise over the last 15 years. As global population and incomes rise and as the application of pulses used in animal feeds expand, the demand for Canada's pulses could increase more rapidly. Pulse crops incorporated into crop rotations benefit crop yields and the soil environment. Also, the recent focus on biofuel production has created a demand for growing cereal and oilseed crops. As a result, prices for all crops have risen, including pulse crops. These and other factors will influence the shift in production acres that occurs between the various crops.

Figure 6 demonstrates the volume of production for each of the major crops and their relative position to other crops grown in Canada and in the prairie region. A similar chart is displayed in Figure 7 in terms of production area for each of the main crops in each of the Prairie Provinces.

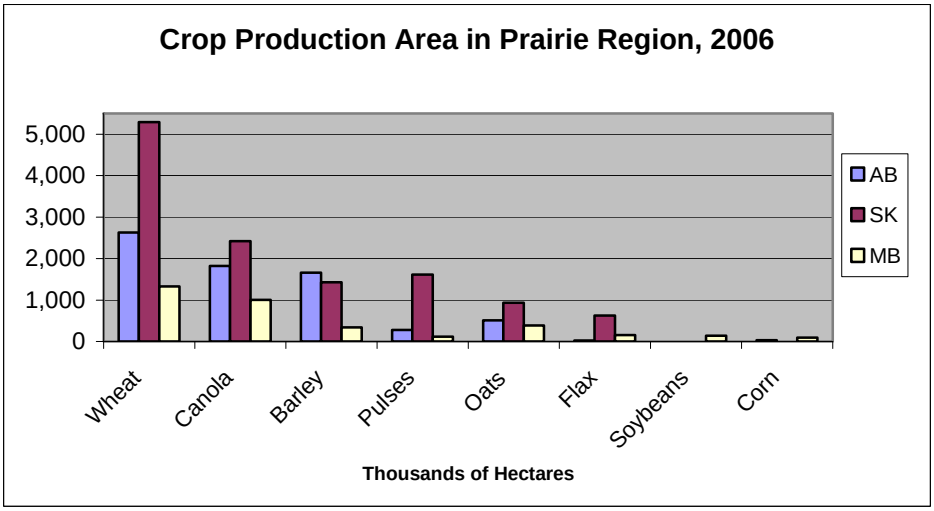
Figure 6



Source: Statistics Canada, August 2007

Total pulse acreage has grown by more than 82% over the last 10 years. Area seeded to pulse crops for 2007 is estimated at 2.3 million hectares (Mha), an increase of almost 12% over 2006.

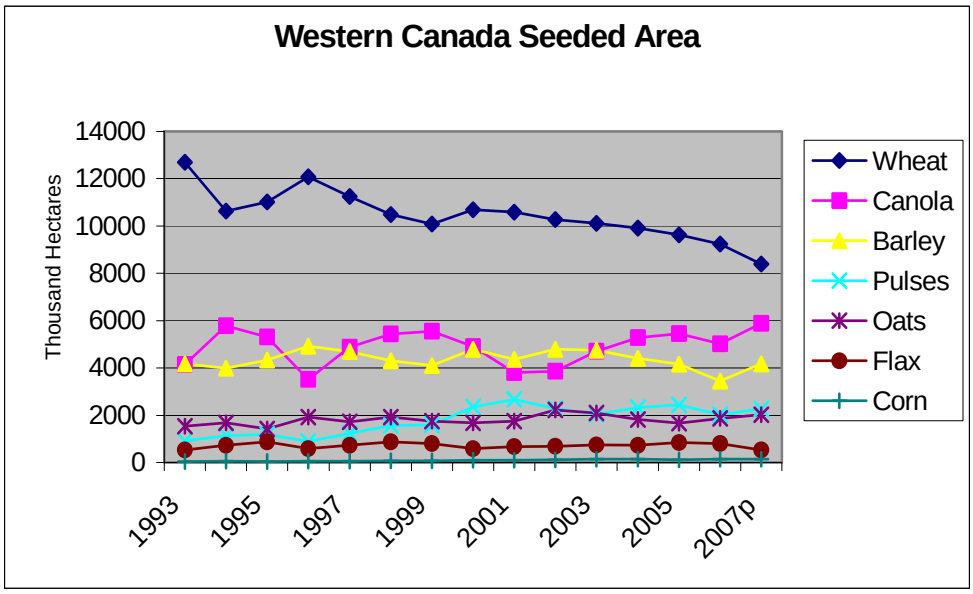
Figure 7



(Note: Chart includes corn hectares for both grain and fodder.)
Source: Statistics Canada, August 2007

Figure 8 displays seeded area for the major crops grown in western Canada between 1993 and 2007. Wheat has seen a decline over this period, while canola and barley have fluctuated. Barley has remained fairly steady over the long term (i.e., ranging from 3.4 – 4.8 Mha) while canola increased from 3.5 Mha, surpassing its 1994 peak and reaching almost 5.9 Mha by 2007. Pulses have climbed during the same period, ranging from 0.9 Mha to as high as 2.6 Mha in 2001. Seeded area to oats, flax and corn has remained fairly steady over time. This chart, along with charts for Alberta, Saskatchewan, and Manitoba is in Appendix 1.

Figure 8



Source: Canadian Grains Council

Note:
p = preliminary data for 2007.
Chart includes BC along with the Prairie region.
Corn hectares include both grain and fodder.
Pulse crops include peas, beans, chickpeas, lentils and fababeans.

Canadian exports

Canada is a major exporter of peas, lentils, beans and chickpeas. Statistics Canada (n.d. 2007) reports the following volume of pulse exports.[3]

- Canadian exports of peas are 2.3 million tonnes, with the majority of peas going to India (30%), Spain (20%), China (12%), followed by Bangladesh, Pakistan, and Belgium together accounting for another 18%.
- Lentil exports are approximately 682,000 tonnes and are distributed to a wide range of countries, such as Turkey, Algeria, United Arab Emirates, and Colombia (between 8-9% each), followed by exports to many other countries.

[3] Statistics for chickpeas are often included with pea totals. In this instance, chickpea exports have been separated from peas, leaving total pea exports at 2.3 million tonnes.

- Bean exports are around 319,000 tonnes, with the majority going into the US market (28%), followed by the UK (21%), Italy (8%), and Japan, Netherlands and many other countries (each at 5% or less).
- Chickpea exports are around 98,000 tonnes and are widely distributed; the main exports going to Pakistan (20%), India (14%) and Jordan (11%), followed by a number of other countries.

In 2006, these pulse exports amounted to more than $1 billion, with peas worth approximately $469 million (M), lentils valued at $274M, beans approximately $207M, and $63M for chickpeas.

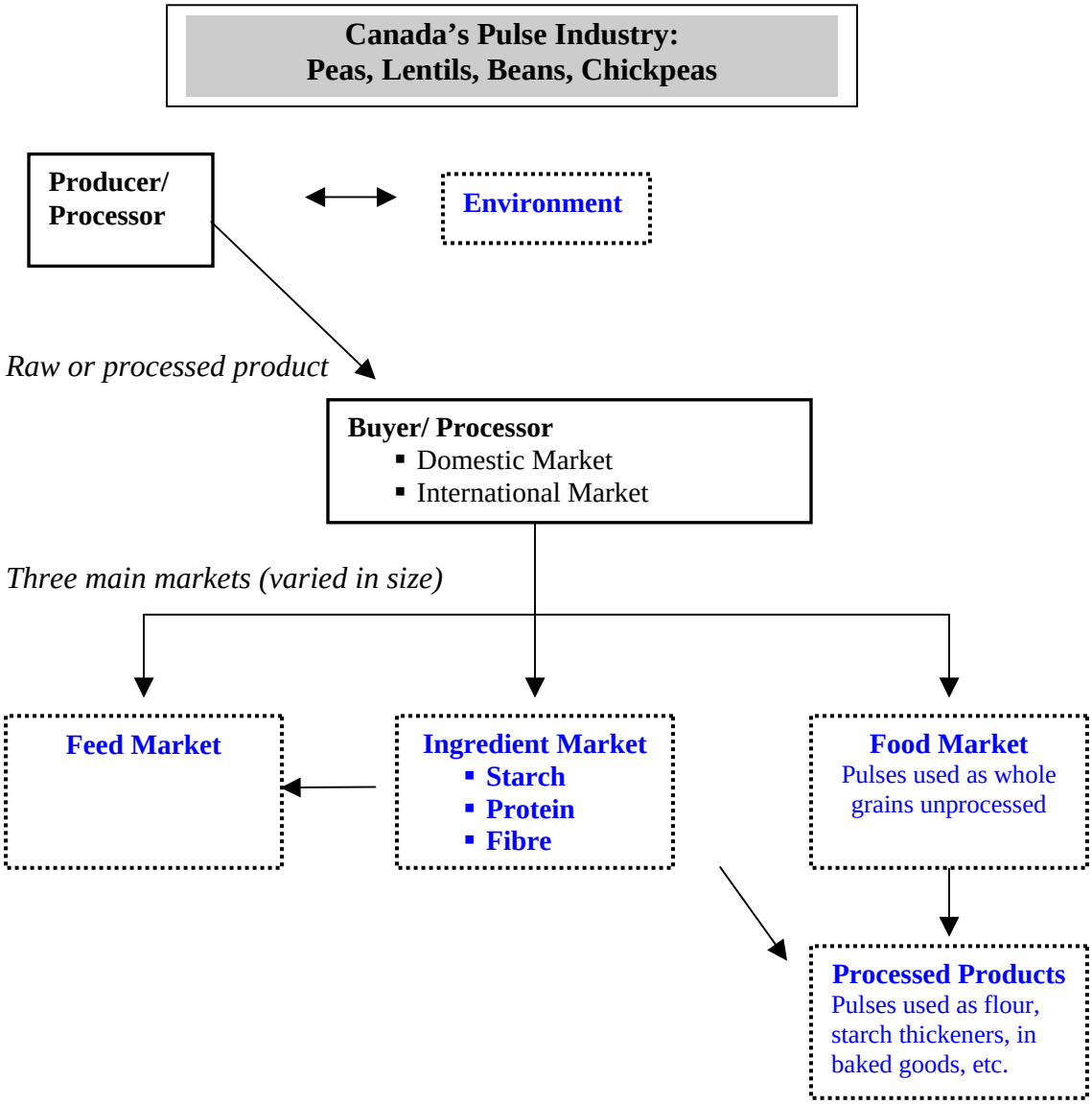
Canadian Pulse Exports (in millions of dollars)

	2002	**2003**	**2004**	**2005**	**2006**
Peas	264.2	285.5	375.4	490.0	468.8
Lentils	179.6	212.2	205.2	274.1	273.5
Beans	224.9	204.5	214.5	195.4	206.7
Chickpeas	67.8	40.3	42.0	37.1	62.5
Total	$736.5	$742.6	$837.0	$996.6	$1,011.4

Source: Statistics, n.d.

Chart of the Pulse Industry Supply Chain

Figure 9
The pulse supply chain is represented by the following chart.



Producers base their cropping choices on a number of factors, aiming for profitability from growing pulse crops versus other uses for the land. At the producer stage, the use of pulse crops in a crop rotation is closely connected with the environment, due to its nitrogen fixing capabilities, providing other soil benefits and promoting higher yielding crops in the year that follows.

Processors may also be producers, selling into the domestic or international market. Approximately 75% of Canada's pulse crop is exported.

The three main markets are feed, food and the ingredient market, some which are well established while others are emerging. In Canada, the feed market is a larger consumer of pulses than the human food market, while other countries' main use of pulse crops is food. The food market includes selling product as a whole food product, or processed food products, such as pulse flour, starches or baked goods. The ingredient market consists of breaking pulses down into its components of starch, protein or fibre, which can enter either the food or feed markets.

Canada's Production and Consumption

Peas make up the largest component of pulse production in Canada, totaling more than 3 million metric tonnes (MMT) in 2005. In 2006, total volumes declined to about 2.5 MMT, and seeded acreage was also down. In 2007, the seeded area of peas has increased again to levels greater than the 2005 acreage by 12.7%, while acreage for other pulse crops are still below 2005 levels. Therefore, the volume of peas for 2007 is forecast to be approximately 3 MMT (Statistics Canada, August 2007).

Around 25% of Canada's pea production is used in the domestic market. Pulse Canada (August 22, 2007) reports that the domestic feed pea market used approximately 550,000 tonnes annually over the last five years. This represents approximately 19% of Canadian pea production.

Statistics Canada (May 2007) estimates that domestic food consumption of peas is approximately 1.21 kg per person, an equivalent of 39,400 tonnes or about 1% of Canada's total pea production.[4] The proportion of peas used in the ingredients market is unknown. The domestic food market has remained constant to this point, while the food export market has been growing in recent years.

Other pulses, such as beans, lentils and chickpeas would largely be used in the human food market. Some off-grade types of pulses, such as lentils, occasionally make it to the feed market (Zijlstra, Kessel & Drew, 2004); the tannin content of lentils is higher (Gowan, 2006) than peas and therefore would generally be used in lesser quantities in feed rations. Anti-nutritional components, such as trypsin inhibitors and tannins are more prevalent in lentils and pulse crops other than peas, which limit their utilization in feed (Wang, N. & Daun, J.K., 2004).

Production and the Environment

There are multiple benefits to increasing pulses within crop rotations. Pulse crops in rotation reduce the energy footprint on the environment, partly through fixing part of their nitrogen (N) needs, therefore requiring fewer N inputs. There are also side benefits apart from residual nitrogen; the soil is left in a healthier condition supporting microbial life and better soil-plant interactions.

[4] With 19% of pea production going into the feed market (550,000 tonnes/ <3 MMT) and currently about 1% into food (39,400 tones/ <3MMT), then seed, waste, and dockage would account for the remaining 5% of the domestic market.

The other rotational (non-nitrogen) effects of pulses on crops that follow are not fully understood. Besides enhancing crop yields and reducing the nutrient requirements, effects include an increase in *plant growth promoting bacteria* (PGPR) that enhance disease resistance or balance growth regulators, a break in disease cycles, and water use efficiency of field peas leaving behind moisture for crops that will follow (due to the shallow roots of peas), etc. Therefore, there is a mutual benefit between the environment and the crops that follow a pulse crop in rotation; however, the complete cost benefit has not been determined (Olson, 2007).

Overall there is a reduction in greenhouse gases, therefore minimizing the energy footprint. Legume production, relative to wheat crop production, uses about half the energy. There is a reduction in agricultural activity, reduced CO_2 emission, as well as reduced N_2O CH_4, NO and NO_2 emission at different steps of manufacturing and application of N fertilizers (Grain Legumes Portal, March 13, 2007).

It has been estimated that "for every bushel of field peas harvested (assuming good nodulation and proper fixing of atmospheric N) the 'nitrogen equivalent' is approximately 0.75 to 1.0 lb/bushel. Peas supply part of their own N needs (fixing up to 90%) and reduce the amount of inputs needed in the following year, (i.e., crops requiring only 1/3 to 1/2 the amount of N). For example, a pea crop yielding 40 bu/acre (average yield in Alberta) could potentially fix 108 lbs/ac of nitrogen during the crop year and leave behind 40 lbs/acre of N equivalent for the following crop year. This is a saving of close to 150 lbs/ac of nitrogen over a two-year period. Using nitrogen prices of $0.58/lb (actual N) the total saving comes to $87.00, or $43.50/acre per year (Olson, 2007).[5]

In comparison, Pulse Canada (August 22, 2007) provides a figure of the benefits of fixing nitrogen by peas on a global scale. Potentially savings could be as much as $115 million in natural gas costs.[6] This does not include additional benefits of storage, transport and application of fertilizer, or savings from reduction related to greenhouse gas emissions.

Processing and Marketing

Special crops are marketed through the elevator system or through specialized processors. The route taken is determined by the crop type, prices and producer preference. Part of the market is secured through "production contracts, deferred delivery contracts or forward pricing contracts", while "the remainder of the crop is likely to be sold at spot prices upon delivery" (Quorum Corporation, June 2006, p.15).

[5] Calculation: A 40-bushel/ac pea crop (average yield for Alberta) requires 120 lbs/ac of N for growth. Around 90% is fixed (i.e., 108 lbs/ac) by the crop. Savings are 108 lbs/ac in year 1 plus 40 lbs/ac in year 2, or close to 150 lbs over a 2-year period. Therefore, 150 lbs/ac x $0.58/lb actual = $87.00/ac N total savings, or $43.50/ac per year.

[6] With over 1.4 million hectares of peas planted in 2006, which could potentially fix 282,000 tonnes of nitrogen, equal to 613,000 tonnes of urea, valued at $280 million. It takes 25.6 gigajoules (Gj) of natural gas to produce one tonne of urea, equal to nearly 15.7 million Gj of natural gas or more than $115 million in natural gas costs.

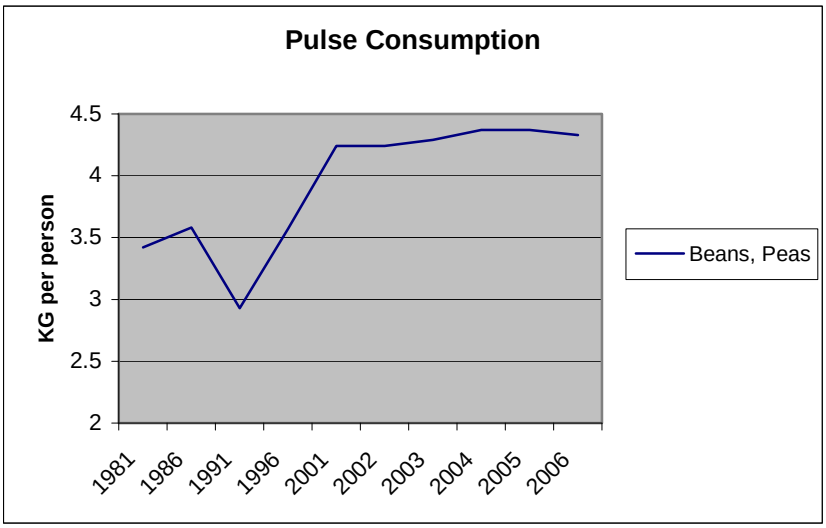
Western Canada has approximately 100 dealers spread over 300 locations, competing to purchase pulse and special crops. They range from small family run operations to large grain companies (AAFC, as cited in Quorum Corporation, 2006).

Most special crops are delivered to a processing plant or elevator by truck where initial processing, such as cleaning and quality sorting can take place. Secondary processing may involve blending of products for the livestock and birdseed industry, and the splitting of dry peas, lentils and chickpeas before dry packaging or further preparation for use as foodstuffs. From the processing facilities pulse crops move by railway hopper cars, boxcars or by inter-modal containers (by rail or truck). Feed peas and some food peas, lentils, and chickpeas move by hopper cars to domestic markets or to port. Packaged or bagged product may be loaded into boxcars or moved by containers.

Food Market

Pulses act as a major source of protein in many developing countries, while in North America consumption is quite low (EDC, June 2007; Pulses: Past trends and future prospects, 2005). In spite of low levels, Canada's consumption levels have increased over the last 25 years by approximately one kg per person. The following table displays Canadian consumption for beans and peas only (i.e., baked, canned and dry product), for a total of 4.3 kg per person in 2006 (Statistics Canada, May 2007).

Figure 10



Source: Statistics Canada, Food Statistics 2006

Using the same consumption figures of 4.3 kg per person, this would amount to over 142,000 tonnes for Canada. This does not include other pulses or other forms of beans and peas consumed. AC Neilson (2006) reports 2006 retail sales of beans and peas (baked, canned and dried) from large supermarkets. This retail segment reported over 74,000 tonnes or product, worth approximately $164 million. Beans represents 75% of total sales, followed by peas at 15%, lentils at 9% and chickpeas at 4%.

While current Canadian consumption of pulses has been relatively low, changing demographics in Canada could change the consumption level of pulses in the future. Immigration from Asian countries to Canada leads all other ethnic groups; South Asia being one of the fastest growing minority groups. In 2006, the South Asian population represented 3% of Canada's total population (i.e., about one million people), and the trend is expected to continue (CBC News, October 12, 2007).

Beans, peas, lentils and chickpeas, are found to be a healthy food choice in a number of ways. They have close to twice the amount of protein of cereals grains, high levels of dietary fibre and important vitamins, and minerals. Nutritionally, they contain complex carbohydrates (i.e., fibre, resistant or slowly digested starch) vegetable protein, and vitamins and minerals (i.e., folate, potassium, iron), as well as antioxidants and a small fat content. Their fibre content and resistant starch (prebiotics) help stimulate growth of good bacteria in the colon and enable digestive health in general. The high protein content and complex carbohydrates provide longer lasting energy, which is beneficial for sports or endurance activities. The following points explain the important role that pulses can play in health management (Pulse Canada, 2007, Nutrition and health fact sheets). A greater awareness of the health benefits of pulses could encourage increased consumption in the North American food market.

- Special Diets – Pulses do not contain gluten, therefore they provide an additional food choice for people that are gluten intolerant, or those with celiac disease. Celiac disease causes damage to the small intestine, which inhibits the absorption of nutrients and cannot tolerate gluten protein. Pulses are a key part of vegetarian diets since they are high in protein and contain the amino acid lysine. Lysine combined with the amino acid methionine, found in cereals, provides a balanced protein diet.

- Weight Management – Pulses can play an important part in weight maintenance, due to their profile of high fibre, complex carbohydrates and protein, low fat and low caloric density. They have a low glycemic index (GI), meaning that they do not cause a sharp spike in blood sugar levels. With their slow release of energy, there is an earlier sense of fullness during a meal (satiety). There is preliminary evidence that pulses can help with weight management, however further studies are needed to confirm this.

- Diabetes – Since the glycemic index (GI) is low in pulses (i.e., foods with GI <55), they are a good food choice for people with diabetes. Pulses have a slow release of glucose when consumed, resulting in minimal fluctuations in blood glucose levels and a more stable insulin response.

- Cardiovascular disease - CVD accounts for 30% of deaths worldwide, and is the leading cause of death in industrialized countries. Regular consumption of pulses can help to reduce serum cholesterol and triglycerides – two major risk factors in CVD (heart disease). They also have positive effects on blood pressure, blood glucose and insulin moderation and they lessen the chances of obesity. Their nutritional

composition, as well as containing antioxidants and other phytochemcials, helps support a heart-healthy diet. They are low in fat and sodium, have minimal amounts of saturated fatty acids, and contain no cholesterol.

- Cancer - In North America, cancer is the second leading cause of death (i.e., one in four deaths). Organizations are showing support in the consumption of pulses to reduce the risks of cancer. These include the United States Food and Drug Administration (USDA), the American Institute of Cancer Research, the Canadian Cancer Society and the World Cancer Research Fund. Although evidence for consuming sufficient quantities of pulses to protect against cancer has not been confirmed, there are various anticarcinogenic components within pulses, including dietary fibre and folate.

Feed Market

Feed peas are a good source of nutrients and can be used in a number of animal rations. Peas are rich in protein, lysine and starch (23%, 1.8% and 44.9% on a dry matter basis, respectively), and able to provide both the amino acids and energy requirements for high-producing animals (Saskatchewan Pulse Growers, n.d.).

Global overview

The global demand for peas as a feedstock is expected to grow sharply, driven by factors such as increasing meat consumption and increased demand for biofuel production. This will influence the shift of production and trade flows, according to Gibson Capital Inc. (2007, p.3) in their study of the *Economic Analysis of the Global Feed Ingredient Market and Opportunity for Canadian Feed Peas.*

Gibson Capital states that almost 90% of world population growth between 2000-2050 is expected to come from Asia and African countries (i.e., largely from developing countries). Urbanization is expected to increase globally and with an increase in urbanization there is a trend of increased meat consumption. Often increased meat consumption and higher incomes occur simultaneously. Peas are a good protein source to be used in feed rations for swine, although the relationship between higher incomes and pork consumption is not as strong as for total meat consumption (i.e., beef, pork, poultry, sheep).

Aquaculture is a growing industry and production has quadrupled in the last 20 years to 48 million metric tonnes (MMT) per year. It is difficult to meet the existing demand for fishmeal. Since feed peas can be used as a source of protein for fish, it has the potential to play a larger role in aquaculture feeding rations.[7]

[7] Vegetable proteins such as in feed peas, require enzymes to remove anti-nutritional factors and amino acids, which increases the cost. Therefore, higher-end fish markets (crustaceans and marine fish) and lower market non-carnivorous fish may be the targets for fishmeal using pea protein (Gibson Capital Inc. 2007, pp. 54-55).

Gibson Capital Inc. uses a linear programming (LP) model to analyze feedstock trade flows between countries, taking into consideration a number of economic factors and scenarios. The model was to determine which markets had the greatest potential for Canadian feed peas over the next 10 years. While the majority of Canadian feed peas is exported through Thunder Bay, the model suggests that over the next 10 years the greatest economic opportunity for producers is through the West Coast port.

Overall global trade for feed ingredients is expected to increase significantly. The scenario for 2016/17 indicates that the North East Asian countries of Taiwan, South Korea and China show the greatest potential for Canadian feed peas. While the Philippines outrank all of the above, it is solely due to its 30% tariff on corn imports. In running a similar model without tariffs, the Philippines drops from first to eleventh place as the corn tariff is removed. In this non-tariff model, Taiwan, South Korea and China still remain as having the greatest potential (top three markets) for Canadian pea exports.

It is important to note that this is a ten-year projection and that many of the trends identified are expected to continue well past this point in time. At the same time, there are a number of influencing factors that will determine the final picture. It is uncertain when the global ethanol and biodiesel production will peak and how it will be affected by energy prices, feedstock prices on margins, and government incentives for production. The expected increase in global meat production will depend heavily on the continuation of strong economic growth in the developing world. It is expected that over the long term there would be a shift from US to South American corn, soybeans and soymeal. Another unknown factor is China's trade balance for Chinese corn, due to the difficulty in estimating China's supply and demand for various crops (Gibson Capital Inc., 2007, pp. 59, 70-75).

Local feed market

Statistics Canada (July 2007) reports feedmill grain purchases from western Canadian farmers and grain dealers, which include barely, corn, oats, peas, wheat, and other grains. Of all grains purchased by commercial feedmills, peas in western Canada represent 6% of total feed grain purchases, while peas in AB/BC represent 7% of total feed grain purchases, and in Saskatchewan peas represent 10% of total feed grains.[8]

Feed peas are used in a number of livestock feed rations, with the majority going into hog production. Pulse Canada conducted a study interviewing 20 feed manufacturing firms, evenly distributed between the three Prairie Provinces (MB, SK and AB). The study also interviewed nutritionists across these provinces to determine the nutritional value and formulation of peas in various livestock diets. The greatest number of firms using peas were producing feed for hogs; half of these firms stated that 45% or more of their total feed production went into hog feed. Feed pea use for poultry was the next most frequent feed manufacturing activity, followed by beef, then dairy. However, volumes for each of these species were well behind feed pea volumes used for hog production. When purchasing feed peas, important considerations were as follows: percentage of foreign

[8] Excludes feedlots and feedmill purchases from licensed grain companies. Coverage of companies in Alberta is also incomplete. Manitoba feedmill peas are not recorded.

matter (40% of respondents wanted a maximum of 3% or less), percent moisture, and then percent protein. Other considerations were bushel weight (i.e., the most common was 59 lbs), mold/mustiness/ergot/odour factors, and fibre at 6% (Enns, 2007).

Enns' (2007) study points out that the most common pricing method for feed peas is the *Least Cost Formulation Program*, used by 90% of manufacturers. Another 15% use a *percentage of alternative feed ingredients formula* that may incorporate factors such as: 1/2 of the value of soybean meal, a percentage of the price of wheat, or the price and availability of feed lentils. About 80% of firms were interested in using an *industry standard price discovery model* and *basis trading mechanism*, if made available. Pulse Canada and a number of representatives within the pulse industry are exploring this further.

To determine the preferred nutritional profile of feed peas, nutritionists were asked about their nutritional profile. They provided the following information on the nutrient levels used in their formulation software.

Components	Range	Most common response
Crude protein	19.26 – 24.0%	22.0 – 24.0%
Crude fibre	3.55 – 10.0%	5.5 – 10.0%
Fat	0.96 – 4.0%	1.3 – 4.0%
Moisture	10.0 – 15.0%	10.0 – 10.3%
Acid Detergent Fibre (ADF)	5.56 – 9.0%	8.0%
Neutral Detergent Fibre	6.8 – 17.65%	16.0%

The following is a list of pulse feed industry projects along with some general industry impressions. These activities could expand future opportunities for the feed pea market. Overall, there appears to be fairly good communication within the industry, continual development of markets and baseline information, along with price discovery tools being explored.

- Pulse Survey – Information from the survey indicated that respondents saw the pulse industry in a positive light, due to the improved information flow that helped their individual businesses (i.e., pricing, market, research). They also had a positive impression of activity around the development of international markets (Enns, 2007).
- Private Sector Risk Management Partnerships (PSRMP Project) – Market assessment surveys, analysis of feed pea pricing relationships and development of tools for enhancing price discovery (Pulse Canada, 2007, June 25).
- Near Infra-Red Reflectance Spectroscopy (NIRS) – The Alberta Pulse Growers (2006) describe the current pulse feed industry as not having an accurate method to determine quality. NIRS is being used in the Canadian grain industry to profile protein, moisture, and colour for grain, forages, and ensiled crops by commercial laboratories and the grain grading chain. Through Alberta Agriculture and Food,[9] over 50 NIRS calibrations have been developed, which better enables plant

[9] Research conducted at the Field Crops Development Center (FDCD) in Lacombe, Alberta.

breeding selections. Further investment and development is expanding the scope of this method from barley to peas, wheat, triticale, canola, and wheat by-products.

The strength of the NIRS method includes the following:

- It allows for easier genetic selection and development of peas by improving its quality characteristics.
- Rapid evaluation on pea characteristics.
- It gives the feed industry a more accurate reading of the quality level. In the past, peas were valued on protein only, unless using a Least Cost Formulation Program. This method evaluates for energy and protein. This will allow for better payment criteria and give the end-user confidence when purchasing livestock feed.
- Enable the strengthening of standards for western Canada.
- Develop a NIRS platform. This will allow all users in the industry to use a common approach.

Ingredients Market

Currently there are about nine Canadian companies that manufacture pulse flour and fractions; six from the Prairie Provinces and three from Ontario. The types of flour produced are made from peas (yellow and green), beans (various types), lentils, chickpeas and fababeans. Fractions that companies are producing are pea and bean protein and starch, as well as pea fibre. Other products include pre-cooked lentils, beans and chickpeas, which may include flaked or powdered products (Pulse Canada, n.d.).

Pulse Canada provides rough estimates of the volume of pulse crops used in the ingredient market in Canada. Approximately 40,000-50,000 tonnes of peas are processed into flour or its constituent fractions, around 5,000-10,000 tonnes of chickpeas are made into flour, bean flour production is approximately 5,000-10,000 tonnes, while the amount of lentil flour produced is minimal (Pulse Canada, personal communication, September 18, 2007).

As an ingredient is fractionated, one or more ingredients may be used for food or an industrial purpose, while the remaining by-product (or co-product) is used in feed rations. Feed rations using a *least-cost diet formulation* select ingredients or fractions with the lowest cost per digestible nutrient to meet specific nutrient requirements (Zijlstra, R.T., van Kessel, A.G. & Drew, M.D., 2004).

The study by Zijlstra, van Kessel & Drew describes how the functional properties of fractions play an important part in both food and livestock nutrition. Legume starches behave differently from cereal grain and potato starches and they have some added functional benefits. Pea starch is better soluble and swells less than cereal starch. This is important in animal nutrition, where total starch and rate of digestion are key characteristics. The rate of starch digestion affects the glycemic index of feed and may impact protein deposition. Non-starch polysaccharides (NSP) can be broken into soluble and insoluble fractions, and its properties affect digestion and absorption, passage rate

and microbial populations (De Lange; Fledderus et al.; Wang, as cited in Zijlstra, R.T., van Kessel, A.G. & Drew, M.D., 2004). Pea starch is also beneficial in increasing pellet strength and durability.

Transportation

The special crops industry faces some particular challenges in the movement of its product to export markets relative to most other grains. The volume of special crop exports is smaller than most grains, and often more handling is required for cleaning and bagging in order to prevent splitting or damaged product (particularly in the food market). The biggest concerns are delivering product from the prairie region to the ports to meet market demand on time. This is complicated by the availability of rail cars and grain handling at the ports, due to competition from other grains. Also, there is a requirement for an *intermodal* and a *multi-stepped* transportation process (more than one means of transportation, such as truck and rail, transport to stuffing plants, and finally to the ports for shipping), among other issues (Goyeau, 2001).

Movement of goods

Special crops face the challenge that ocean freight moves at market based rates; therefore, higher valued goods will take priority, whether they come from Calgary, Edmonton or Vancouver (e.g. forest products, manufactured goods). Due to the smaller volumes, special crop shippers may have difficulty filling a container in time, resulting in shipping companies preferring other commodities.

Rail service is provided to industry on the Prairies through Canadian National Railways (CN) and Canadian Pacific Railways (CP) along with some short line railways. Bulk hopper cars and boxcars are delivered to elevators and processing plants with rail siding. Empty containers are delivered to railway container terminals, where shippers can pick up and then return them once loaded with bulked or bagged product. Containers loaded at prarie points *(source loading)* eventually return to the ports for export. Bulk product arriving by hopper cars to port positions first go to a *container stuffing facility*, which may be located at the port or in a suburban area, where cars are then unloaded and transloaded into export containers (Quorum Consulting Ltd., June 2006).

Currently there is an imbalance of the movement of containers. Marinova Consulting Ltd. (2006) reports that, “For every three loaded import containers arriving in central/eastern Canada from Vancouver, there is only one export marine container returning westbound loaded with exports” (p. vi). Of the other two, one returns empty directly to Vancouver, and the other is used for domestic movement of product en-route back to the port of exit. In other words, about 30% of containers (as of 2005) move empty by rail across western Canada to Vancouver. Vancouver and Montreal are dealing with a large number of empties that could be repositioned to the Prairies and loaded with export goods.

Some of these issues have been addressed by setting up inland intermodal container terminals for the handling of special crops, such as those in Edmonton and Calgary. Product is trucked to these terminals for loading into containers. The containers are then shipped by rail to the ports, reducing the amount of handling at the ports. Since the

transporting of special crops has to compete with higher priced, higher priority goods, there is a risk of container shortages in smaller cities and rural areas, and if containers are available then they often become delayed.

If containers are not available, shippers may decide to truck product to Vancouver instead. This may also cause concern at the ports if a large number of trucks need to access the terminals (Goyeau, 2001).

Transportation and handling opportunities

Prairie pulse producers are aware of the current economic and logistical hurdles of shipping. At the same time, there are potential opportunities for producers to overcome some of these hurdles. These would require further study to determine their feasibility and the best alternative.

Marinova Consulting Ltd. (2006) suggests that one option is to encourage more source loading rather than port loading. This could include: a) greater utilization of *transload terminals* further inland (i.e., such as in Edmonton or Calgary) to handle grain coming from the Prairies, and to receive containers from shippers and railways. This would reduce the amount of empty containers going straight to Vancouver; b) the use of *satellite terminals* could be positioned closer to the source load activities. Not only would this provide a better supply of empty containers for producers, but also would benefit ports that could clear out empty containers from their yards and send them directly to satellite terminals, providing that market conditions and economics warranted this; or c) align with an existing *inland terminal* (a variation of transload and satellite terminals), or create a new intermodal facility. However, a new intermodal terminal would require sufficient import and export volume to attract empty containers and be able to cover capital and operating costs, and additional rail costs.

Another alternative is to create a shipper association, pools, or cooperative arrangements. The Midwest Shippers Association in Minnesota assists smaller growers to market identity preserved (IP) products to international markets. Marinova Consulting Ltd. points out that the Prairies have the mechanism to pool or work cooperatively amongst shippers to reduce overall logistic costs; the model could include a seasonal inland container terminal. Purchasing and leasing containers by an organization would better ensure suitable and available containers for pulse products. There would be other logistical issues that would occur in this instance, such as equipment control in foreign countries and the return of containers.

Canadian ports

The majority of pulse exports move through Vancouver, Thunder Bay, Montreal and the ports along the St. Lawrence Seaway (Canadian Grain Commission, n.d.; Port of Montreal, 2006).[10] The port in Vancouver has facilities for the soft handling of bulk dry peas, lentils and chickpeas. As of September 2007, a new container facility opened in Prince Rupert, which will further ease the pressure at the Vancouver port and allow product to move more quickly into the Asian market (AAFC, 2005, January 28; Western

[10] Other ports that handle special crops in smaller volumes include Prince Rupert, and Churchill.

Economic Diversification Canada, September 12, 2007). In 2006, Canada exported 3.4 MMT of pulse crops (Statistics Canada, 2007, n.d.).

Conclusions

Canada's pulse industry has been gaining momentum over the last 10-15 years as seen by its increased acreage and export market opportunities. The demand is likely to expand in both the food and feed markets as world population, urbanization and income grows. The importance of the ingredient market is just starting to be recognized and will grow along with the awareness and use of pulse flour and fractions.

Pulses as food are a staple protein in certain countries and the demand is strong, such as in India. At the same time, population growth is expected in Asian and African countries. On a global scale, urbanization is expected to increase along with higher incomes. Immigration of Asians to Canada has also been increasing. In 2006, the Asian population represented 3% of the total; this trend is expected to continue. Their demand for pulses would increase domestic pulse consumption figures. Healthier diets are becoming an important trend in many countries as a preventative measure to serious health conditions and diseases. Research efforts are expanding in the uses of pulse flours and fractions, such as protein, starch, and fibre. With continued research, increased awareness of the healthy aspects of pulses, and global and national demographic changes, the consumption levels of pulses as food could rise in the North American and international markets.

The application of feed peas in animal rations has been successful and is becoming more widely known and accepted. Projections over the next 10 years indicate that NE Asia has the greatest potential for feed peas. With increased global urbanization and income levels, often comes an increase in meat consumption. Feed peas could play an important role in animal diets. Aquaculture is a growing industry in the global market and could also benefit from feed pea protein. Near Infra-Red Reflectance Spectroscopy (NIRS) is a tool that could more accurately assess quality for the grading and pricing of pulse crops accordingly, as well as be used for plant breeding purposes.

There are also benefits to increasing the use of pulses in crop rotations to reduce the environment impact. Pulse fix some of their own nitrogen needs therefore requiring fewer inputs, as well as leaving behind a better soil environment for crops that follow (both nitrogen and non-nitrogen benefits). A greater understanding and awareness of rotational effects could encourage a greater use of pulses within current crop rotations.

The challenge remains to overcome transportation hurdles and to meet market demands in a timely fashion. Through the use of Edmonton and Calgary's transload terminals and the new container facility at the Port of Prince Rupert, the pressure will be eased at Vancouver's port in the handling of special crops. Ongoing coordination and management of containers continues to be one of the main focal points for industry at this point in time.

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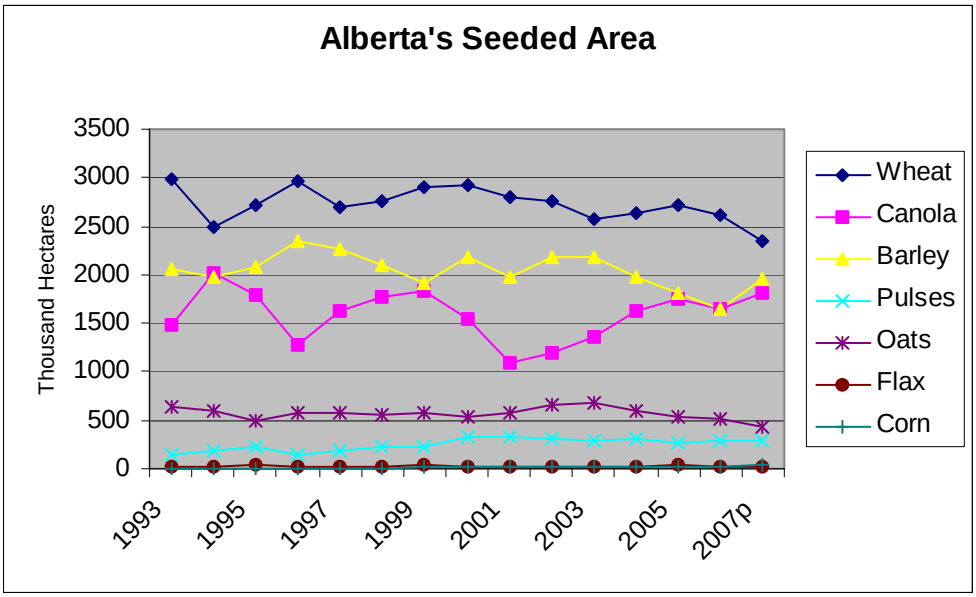
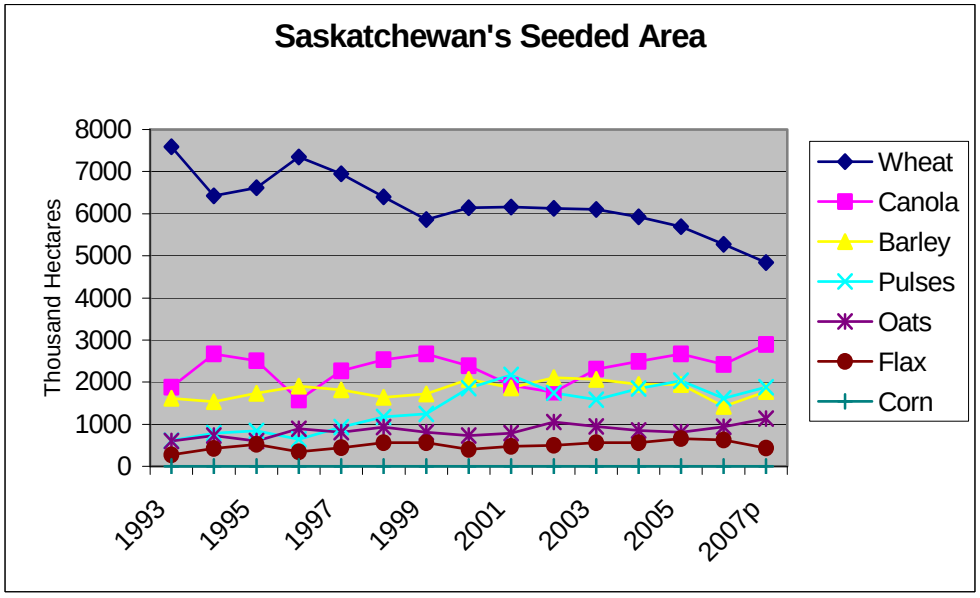
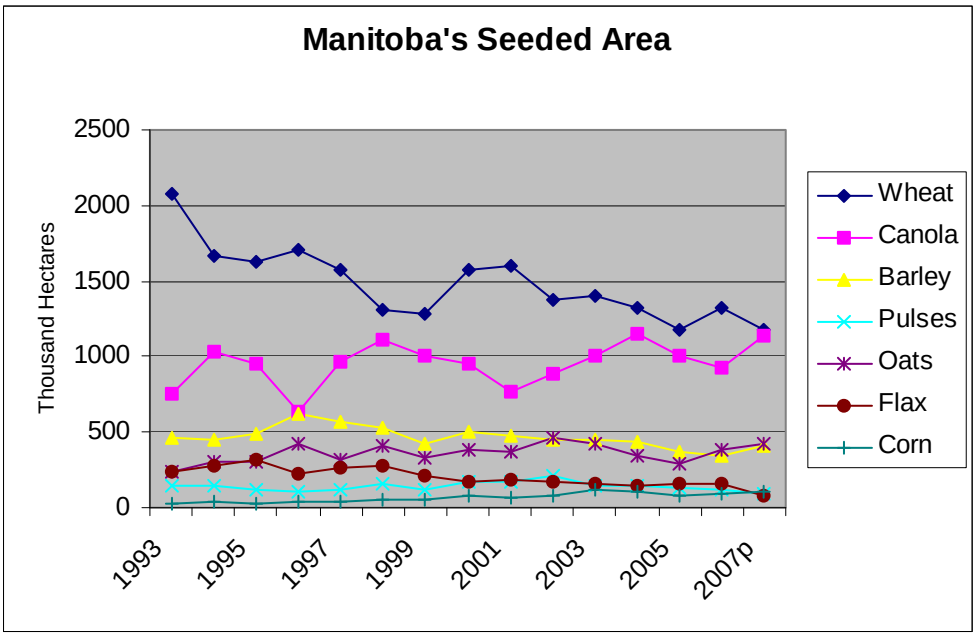
Appendix

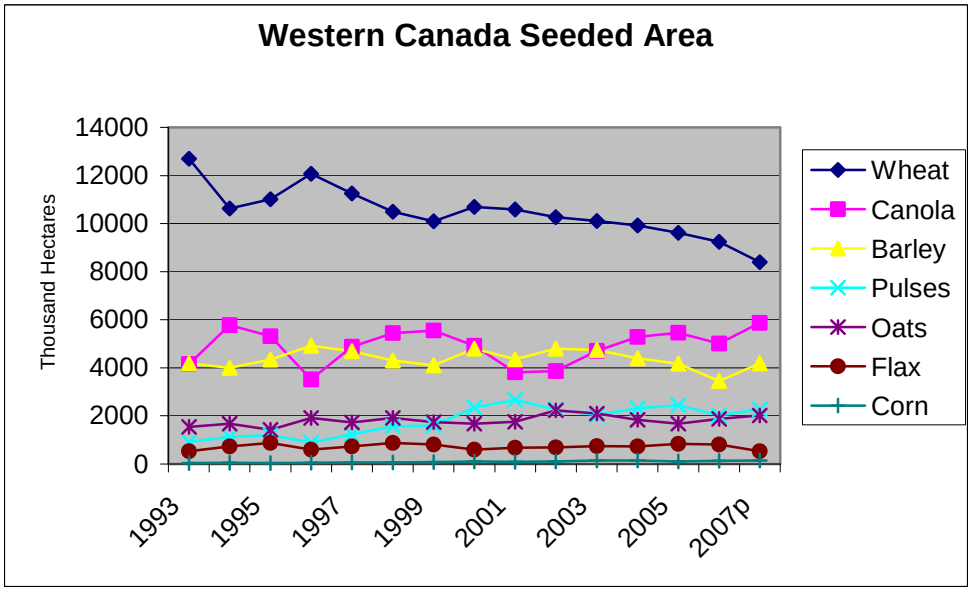
Please note that in comparing the charts that the scale for "Thousand Hectares" will vary. This is to better distinguish the line pattern for each of the crops.





Note:
p = preliminary data for 2007.
Chart includes BC along with the Prairie region.
Corn hectares include both grain and fodder.
Pulse crops include peas, beans, chickpeas, lentils and fababeans.





Note:
p = preliminary data for 2007.
Chart includes BC along with the Prairie region.
Corn hectares include both grain and fodder.
Pulse crops include peas, beans, chickpeas, lentils and fababeans.

Source: Canadian Grains Council