Table of Contents

Saskatchewan Pulses Case Study

<table>
<thead>
<tr>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary</td>
</tr>
<tr>
<td>1. Market Dynamics</td>
</tr>
<tr>
<td>2. Leadership</td>
</tr>
<tr>
<td>3. Research &amp; Varietal Development</td>
</tr>
<tr>
<td>4. Demand Planning &amp; Operations</td>
</tr>
<tr>
<td>5. Financial Sustainability</td>
</tr>
<tr>
<td>6. Enabling Environment</td>
</tr>
</tbody>
</table>

Appendix
Crop: Pulses
Location: Saskatchewan, Canada
University of Saskatchewan Breeding Program Enables the Seed System

**Varietal Development & Seed Deployment**

**Varietal Development**

Varietal development for Saskatchewan pulses is conducted through the University of Saskatchewan’s Crop Development Centre (CDC) and is supported by the Saskatchewan pulse levy, provincial government grants, and royalties on varieties marketed outside of Saskatchewan.

**Seed Multiplication**

Most pulse breeder seed produced at CDC is distributed and managed through licensing agreements with the Saskatchewan Pulse Growers (SPG). SPG manages a Varietal Release Program, through which Select Status growers can purchase CDC breeder seed varieties for multiplication as pedigree seed. These growers maintain decision rights over production, marketing, and pricing.

**Certified Seed Production**

Seed producers must be members of the Canadian Seed Growers Association, which is recognized by the federal Seeds Act and Regulations as the official Canadian pedigreeing agency. Growers may choose to demote seed of any stage (e.g. select, foundation, registered) and have it certified without completing all multiplication steps.

**Farmer Production, Marketing, and Key Demand Segments**

**Farm Production**

Saskatchewan is home to 17,000 pulse growers, and in this system, commercial and seed growers are often one in the same. Most farms are large and family run, with 1,000 to 2,000 acres of production. Growers use pulses to improve soil nitrogen fixation in rotation with oil and cereal crops. Growers operate independently, with no co-ops present, but are connected through industry associations.

**Industry Advocacy**

The size of the Canadian pulse industry is complemented by a number of industry advocacy groups including provincial pulse grower associations; Pulse Canada, which manages the branding for pulses grown inside the country; Ag-West Bio, a bridging organization dedicated to industry growth; Saskatchewan Food Industry Development Centre, which provides pilot testing for value-added products; and the University of Saskatchewan, which helps bring research and industry together.

**Demand Segments**

Saskatchewan pulses are shipped internationally, with $3.6 billion exported in 2016. The demand for pulses worldwide is being driven by a few main factors, including consumer desire for alternative protein sources, doubling as value-added products, and consumer averseness to crops produced with GMO technologies. Pulses are also used widely as animal feed additives.

**Enabling Environment Stakeholders**

- Crop Development Centre
- Saskatchewan Pulse Growers
- Canadian Seed Growers Association
- Pulse Canada

SOURCE: (2) Saskatchewan Advantage PDF from Saskatchewan Ministry of Agriculture
University-Led Varietal Development Program and Commodity Levy Support Seed System

**Seed System Structure**

- **Germplasm/Varieties**
- **Breeder Seed**
- **Foundation/Basic Seed**
- **Certified Seed/QDS**
- **Distribution**
- **Primary Production**
- **Distribution/Consumers**

**How financially self-sustaining?**
- Low: ≤ 1/3 of OpEx
- Medium: 2/3 x >1/3 of OpEx
- High: ≥ 2/3 of OpEx

**Who does?**
- Public
- Private

**Varietal Development**

- **Cultivation**
- **Storage**
- **Consumption**

**Seed**

- **Operator**
- **Grower**
- **Consumer**

**Certified Seed**

- Demand forecasting and production planning

**Foundation Seed**

- Demand forecasting and production planning

**Breeder Seed**

- Demand forecasting and production planning

Pulse producers’ association contracts the University of Sask. to increase breeder seed that it then sells to seed producers on a cost-recovery basis.
### Summary of EGS System Success Factors

#### Key Success Factors

**FINANCIAL SUSTAINABILITY**
- Public and Private Sector Reliably and Jointly Fund Research, Breeding, and Bridging Organizations
- Farmers Fund Varietal Development Through Commodity Levies and Are Willing to Pay for Improved Varieties
- Pulse Producer Association Licenses and Distributes University Developed Germplasm to Saskatchewan Growers On a Royalty-Free Basis
- Pulse Producers’ Association Contracts the University to Increase Breeder Seed That is Sold on a Cost-Recovery Basis
- University is Anchor for Large Research Institutions, Drawing Funding and Infrastructure

**DEMAND PLANNING & OPERATIONS**
- Pulse Growers’ Association is Responsive to Farmer-Member Needs and Market Dynamics
- Select Seed Growers Match Supply to Demand and Establish Certified Seed Pricing
- Pulse Producers’ Association Hedges the Risk of Breeder Seed Stockouts by Maintaining Safety Stocks
- Collaborative Demand Planning Process Between Breeding Program & Growers’ Association
- Vertically Integrated Seed Producers’ Overproduction Risk Is Mitigated by the Ability to Plant Own Seed

**ENABLING ENVIRONMENT**
- Main Actors in EGS Deployment System Have Clearly Defined Roles
- Close Proximity of Actors & Trust-Based Relationships
- Bridging Organizations Exist as Local Glue For Industry and Catalysts to Create Strong, Trusted Networks
- Federal and Provincial Government Incentives Exist to Encourage Several Levels of University and Industry Collaboration
- Strength of Pulse Industry Is Driven By Long-Term Planning and Solutions
# Financial Sustainability

<table>
<thead>
<tr>
<th>Key Success Factors</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public and Private Sector Reliably and Jointly Fund Research, Breeding, and Bridging Organizations</td>
<td>Private and public sector stakeholders are jointly committed to fund the operations that enable varietal development, research programs, and bridging organizations. The Saskatchewan Ministry of Agriculture provides the largest share of the Crop Development Centre’s (CDC) funding, with additional funding coming from SeCan, Saskatchewan Pulse Growers, royalties collected on released varieties sold outside of Saskatchewan. Bridging organizations, such as the Saskatchewan Food Industry Development Centre (Food Centre) and Ag-West Bio, exist as part of government mandates and receive governmental funding for their operations.</td>
</tr>
<tr>
<td>Growers Fund Varietal Development Through Commodity Levies and Are Willing to Pay for Improved Varieties</td>
<td>Saskatchewan pulse growers value and support an end-point levy for research funding, which is applied on the sale of (pulse) grain. Growers’ commitment to supporting research is exemplified by the SPG’s decision to double the levy in 2002, from 0.5% to 1%. The end-point levy, captured at the sale of the commodity, applies regardless of whether the production originated from saved or purchased seed (25-30% of pulse area is planted with certified seed annually). The end-point levy reduces growers’ input costs, as compared to a varietal royalty scheme, and better links the timing and cost of funding research with when growers realize the value of past research.</td>
</tr>
<tr>
<td>Pulse Growers Association Licenses and Distributes University Developed Germplasm to Saskatchewan Growers On a Royalty-Free Basis</td>
<td>Saskatchewan pulse growers pay for certified seed of SPG-licensed varieties, but do not pay a royalty as a part of those transactions. SPG is able to avoid charging royalties because it is funded almost exclusively through the aforementioned grower-legislated levy on commodity sales. Royalties are assessed on SPG-licensed varieties sold outside of Saskatchewan and CDC has executed distributor contracts with select seed companies that are responsible for royalty collection and remittance.</td>
</tr>
<tr>
<td>Pulse Growers Association Contracts the University to Increase Breeder Seed That is Sold on a Cost-Recovery Basis</td>
<td>SPG is able to leverage the physical and technical resources of CDC to increase and deploy breeder seed of improved varieties to the market. SPG contracts CDC to produce breeder seed of its licensed varieties, which it in turn sells to hundreds of Select Seed Growers on a cost recovery basis. SPG funds the production of breeder seed by the CDC Breeder Seed Unit, which utilizes University of Saskatchewan-owned fields, equipment, and technical staff to produce breeder seed in quantities of between half-a-ton to two tons per variety.</td>
</tr>
<tr>
<td>University is Anchor for Large Research Institutions, Drawing Funding and Infrastructure</td>
<td>Several national research organizations (i.e. Agri-Food Canada Research Station &amp; National Research Council) are located on the University of Saskatchewan campus and support university research programs. The National Research Council (NRC) funds researchers that contribute to organizations outside of NRC, such as the Global Institute for Food Security, and allows its research labs and equipment to be used by researchers at the University of Saskatchewan. Agri-Food Canada partners with CDC to conduct regional varietal testing for pulse varieties. System-wide collaboration allows for the additional benefits of infrastructure and capital (people and funding) brought in by these national research organizations to be best utilized.</td>
</tr>
</tbody>
</table>
**Demand Planning and Operations**

<table>
<thead>
<tr>
<th>Key Success Factors</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse Growers Association is Responsive to Farmer-Member Needs and Market Dynamics</td>
<td>SPG advocates for the interest of pulse growers and seeks to anticipate and respond to market dynamics. In 2016, when pulse acres were up and production was higher than forecasted, SPG gave growers the option to lower the current levy, allowing growers to capture more of the profit from the increased production. When neighboring provinces decided to discontinue agreements with SPG that formerly allowed growers royalty-free access to CDC varieties, SPG entered into agreements with two seed companies to ensure outside growers access to the CDC varieties.</td>
</tr>
<tr>
<td>Select Seed Growers Match Supply to Demand and Establish Certified Seed Pricing</td>
<td>SPG builds safety stock assumptions into its annual breeder seed production plan to hedge against demand variability. SPG determined that the potential net loss of overproduction is worth the larger gain of having enough breeder seed available each year to satisfy the market. SPG produces breeder seed on a cost-recovery basis, but being the sole producer of improved pulse varieties in the Canadian market provides a captive demand that must be met year-to-year, even considering that certified seed only accounts for 20% of planted pulse acreage in Saskatchewan.</td>
</tr>
<tr>
<td>Pulse Growers Association Hedges the Risk of Breeder Seed Stockouts by Maintaining Safety Stocks</td>
<td>A highly-networked group of hundreds of seed growers resolve supply and demand tensions through a decentralized seed system in which each actor develops individualized demand forecasts, makes seed production and demotion decisions over multiple planting seasons, and sets their certified seed price.</td>
</tr>
<tr>
<td>Collaborative Demand Planning Process Between Breeding Program &amp; Growers Association</td>
<td>For more than 20 years, SPG and CDC have collaborated to determine breeder seed amounts for new varieties. This collaboration is made up of a series of meetings leading up to the introduction of new varieties between the two groups and is run similar to how a seed company would meet to plan for demand. This long-standing process has proven successful for the system in the past, however, the programs are open to evolving this system to include a seed company to assist in this process.</td>
</tr>
<tr>
<td>Vertically Integrated Seed Growers‘ Overproduction Risk Is Mitigated by the Ability to Plant Own Seed</td>
<td>There are a few hundred Select Growers eligible to buy CDC breeder seed, and for even the most popular varieties, an average of 30-40 growers are actually buying an improved variety at one time. Many of these growers will multiply the breeder seed all the way through the certified seed stage (which is the commercial level of pedigreed seed). The ability for these growers to save seed and plant it in their own fields the next year or sell to neighboring growers helps mitigate their risks related to overproduction.</td>
</tr>
</tbody>
</table>
## Main Actors in EGS Deployment System Have Clearly Defined Roles

Each step of the seed deployment model has one main actor with a few defined roles associated with the success of that step. Breeder seed is produced by CDC before it is handed off to SPG for release to Select Growers. SPG is responsible for the sales of breeder seed, allowing CDC to focus solely on producing improved varieties. Individual growers are responsible for subsequent multiplication steps and seed sales, assuming all risk during multiplication. CSGA is the group responsible for certifying seed and for choosing Select Growers to grow breeder seed. All of these actors depend on each other for success, but their defined roles allow for greater specialization and efficiency in seed deployment.

## Close Proximity of Actors & Trust-Based Relationships

The University of Saskatchewan’s campus acts as a central hub for important actors in this system. The main organization involved in new variety development and testing (CDC), the provincial commodity association (SPG), the key bridging organizations (Ag-West Bio, Food Centre), and national research organizations (NRC, Agri-Food Canada) are all located either on the university campus or within a 15-minute drive. The campus is located in the heart of the main pulse-growing region in Saskatchewan. A strong level of trust has been built between these key system actors, which is facilitated by their close proximity and ability to meet in-person, formally or informally.

## Bridging Organizations Exist as Local Glue For Industry and Catalysts to Create Strong, Trusted Networks

Bridging organizations (i.e. Saskatchewan Food Industry Development Centre Inc., Ag-West Bio), exist as the main conduits to bring industry together on a regular basis to discuss key industry issues, in both formal and informal settings. Not only are these groups all located in close proximity to each other and to Saskatchewan industry leaders, they also often exist as government mandates and draw their funding from the provincial or federal government. These groups act as the bridge between research organizations (University of Saskatchewan (public), POS Bio-sciences (private)) and business and enterprises (producers, processors, traders).

## Federal and Provincial Government Incentives Exist to Encourage Several Levels of University and Industry Collaboration

At both the federal and provincial levels, incentive programs exist to encourage collaboration between pulse system actors, both for combining industry and university efforts and within different university programs. An example of this is the Federal Supercluster Initiative, Protein Industries Canada, that uses significant federal monetary investments to create an industry-led program to increase the visibility and viability of alternative protein sources made from Canadian Pulses. Industry is tasked by the government to lead the charge, and match federal investment dollars, while the university breeding programs support varietal development.

## Strength of Pulse Industry Is Driven By Long-Term Planning and Solutions

A current focus of the pulse industry is the development of value-added products, including non-meat alternative protein sources, as well as sustainable ways to produce these items. Several groups exist in this system that provide services that help system actors plan for future uses of pulses in pilot testing capacities and also provide input on the viability of different uses of pulses. The Food Centre and POS Bio-sciences both provide space for innovators to test out new pulse product ideas, but will not approve the testing unless the products are marketable and profitable. These downstream information sources help with industry planning and contribute to the success of alternative pulse uses, potentially increasing overall demand for pulses.
### Saskatchewan Pulses EGS System

#### 1900-1949
- **1899**: Competition (funded by the Canadian Commissioner of Agriculture) begins for farm children to select the best heads of wheat and barley on their farms.
- **1902**: Seed plot competition expanded through a private donation of 10,000 CAD and runs for several more years.
- **1900s**: As a result of the seed plot competitions, farm families realize the benefits of quality seed and become the first original members of the Canadian Seed Growers Association; this marks the beginning of the Canadian seed industry.
- **1904**: The Canadian Seed Growers’ Association established; leadership was only made up of officials from the Federal Government.
- **1926**: Canadian Seed Growers’ Association elects first grower President.
- **1928**: The Saskatchewan Seed Growers Association incorporated as a non-profit organization to support pedigreed seed growers.

#### 1950-1999
- **1984**: Check-off collection begins at the request of growers; 0.05% is collected from each grower in Saskatchewan based on their value of production that is marketed for food, feed, or seed.
- **1971**: Crop Development Centre founded at the University of Saskatchewan; funded by the Canadian National Research Council (NRC) for the first three years of operation.
- **1997**: Saskatchewan Pulse Growers Variety Release Program began.
- **1970s**: Saskatchewan Pulse Crop Growers Association was the forum for growers to share market information and growing experiences.
- **1984**: Saskatchewan Pulse Crop Development Board (and current SPG) est. under federal and provincial legislation to collect check-off funds.

#### 2000-Present
- **2004**: Saskatchewan pulse grower levy increased to 1% of farm gate value.
- **2016-2017**: SPG lowered the pulse grower levy from 1% to 0.67% in response to increased pulse production.
- **2018**: Canadian government and SPG invest $18 million to fund a research cluster focused on improving pulse crops, exploring nutrition, and enabling universities and research institutions to undertake new research.
- **2016**: The Pulse Brand is created to market pulse products around the world as part of the International Year of Pulses.
- **2015**: All new PBR-protected varieties become protected under new legislation that conforms to UPOV 1991 convention.
- **2015**: Canadian government and SPG invest $18 million to fund a research cluster focused on improving pulse crops, exploring nutrition, and enabling universities and research institutions to undertake new research.
- **2018**: SPG licensed distribution rights outside of Saskatchewan to SeCan for a 10-year period on 2018 pulse varieties.

#### Financial Leves | Royalties
- **2000**: SPG Board est. Transportation Committee to concentrate on railway and government transportation policy.

#### Enabling Environment Policies | Stakeholders
- **2016-2017**: SPG lowered the pulse grower levy from 1% to 0.67% in response to increased pulse production.
- **2018**: Canadian government and SPG invest $18 million to fund a research cluster focused on improving pulse crops, exploring nutrition, and enabling universities and research institutions to undertake new research.
- **2018**: Canadian government and SPG invest $18 million to fund a research cluster focused on improving pulse crops, exploring nutrition, and enabling universities and research institutions to undertake new research.
- **2018**: SPG licensed distribution rights outside of Saskatchewan to SeCan for a 10-year period on 2018 pulse varieties.
Saskatchewan Pulses EGS System Key Takeaways

• In 1899, the Canadian commissioner of Agriculture donated $100 for prizes to junior farmers to collect the best hundred heads of wheat and barley on their fathers’ farms. The following year, Sir William C. Macdonald of Montreal donated $10,000 CAD to continue the program and develop a larger seed plot competition for farm children. The competition lasted three years and developed a strong following including the parents of the children involved in the competition. After the completion of the competition, the parents of those children expressed a desire to continue the work of selecting better seed. As a result, the Canadian Seed Growers’ Association (CSGA) was established in 1904 and those parents would eventually become the first original members of the Association. (From CSGA Rooted in History)

• Saskatchewan Pulse Growers are willing to adjust levy amounts as province-wide pulse production fluctuates. SPG operates as a non-profit organization and when growers were seeing record production, the levy was lowered to cover only SPG operational costs, allowing growers to keep their increased profits from additional production

• Saskatchewan growers pushed for the development of the check-off fund following increases in pulse production in 1970. Pulse growers wanted more control over the uses of the check-off funds than they would have if the funds went directly to the government. Federal and provincial support enabled the creation of a Board to collect and distribute the funds to the grower-desired projects once they were collected
Market Dynamics
Canada is the World Leader in Pulse Trade and Pulse Production is Spread Across the Provinces

**World Pulse Trade Share**
(By Quantity)

- Canada - 41%
- Australia - 12%
- USA - 10%
- Myanmar - 11%
- Russia - 4%
- China - 7%
- France - 3%
- India - 3%
- Ethiopia - 3%
- Turkey - 2%
- Argentina - 2%
- UK - 2%

**Canadian Pulse Growing Regions**

- BEANS
- CHICKPEAS
- LENTILS
- PEAS

Sources:
- Canada is the World Leader in Pulse Trade and Pulse Production is Spread Across the Provinces
- World Pulse Trade Share (By Quantity)
- Canadian Pulse Growing Regions

Sources:
- http://www.pulsecanada.com/about-pulse-canada/growing-regions/
Canada is the World Leader in Lentil & Dry Pea Production

<table>
<thead>
<tr>
<th>Pulse Class</th>
<th>Production (in tonnes)</th>
<th>Share of Total Global Production</th>
<th>Global Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentils</td>
<td>3,233,800</td>
<td>51.2%</td>
<td>1st</td>
</tr>
<tr>
<td>Dry peas</td>
<td>4,611,100</td>
<td>32.1%</td>
<td>1st</td>
</tr>
<tr>
<td>Chickpeas</td>
<td>106,900</td>
<td>0.1%</td>
<td>11th</td>
</tr>
<tr>
<td>Dry beans</td>
<td>249,400</td>
<td>0.1%</td>
<td>19th</td>
</tr>
</tbody>
</table>

Exports of dry peas, lentils and chick peas accounted for almost 80% of the annual production in 2016.

Canada was the worldwide leader in production of lentils and dry peas in 2016.

The Canadian pulse industry's export value totaled $4.1 billion in 2016.

SOURCE: FAO, 2016

“Although wheat and canola continue to dominate field crop area, pulse area has increased significantly since the 1980s. Canada has become a leading producer and exporter of pulses worldwide. Several factors played an important role in this success story. The Canadian prairie soil and climate conditions, research for developing new varieties that resist lodging and disease or have a shorter growing season, agronomic and economic benefits when planted in rotation with other field crops and the growth of processing facilities all contributed.”

Pulses in Canada (2014)
Ellen Bekkering, Agriculture Division of the Government of Canada

SOURCE: https://www.statcan.gc.ca/daily-quotidien/180427/dq180427a-eng.htm
## CANADA: PULSES AND SPECIAL CROPS SUPPLY AND DISPOSITION

**February 16, 2018**

<table>
<thead>
<tr>
<th>Grain and Crop Year (a)</th>
<th>Area Seeded (thousand ha)</th>
<th>Area Harvested (thousand ha)</th>
<th>Yield (t/ha)</th>
<th>Production (thousand tonnes)</th>
<th>Imports (b)</th>
<th>Total Supply (thousand tonnes)</th>
<th>Exports (b)</th>
<th>Total Domestic Use (c)</th>
<th>Carry-out Stocks (thousand tonnes)</th>
<th>Stocks-to-Use Ratio (%)</th>
<th>Average Price (d)</th>
<th>Average Price (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dry Peas</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$/t</td>
<td>$/t</td>
</tr>
<tr>
<td>2016-2017</td>
<td>1,733</td>
<td>1,677</td>
<td>2.88</td>
<td>4,836</td>
<td>32</td>
<td>5,042</td>
<td>3,944</td>
<td>798</td>
<td>301</td>
<td>6</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>2017-2018f</td>
<td>1,656</td>
<td>1,642</td>
<td>2.50</td>
<td>4,112</td>
<td>8</td>
<td>4,421</td>
<td>2,500</td>
<td>821</td>
<td>1,100</td>
<td>33</td>
<td>240-270</td>
<td></td>
</tr>
<tr>
<td>2018-2019f</td>
<td>1,300</td>
<td>1,280</td>
<td>2.50</td>
<td>3,200</td>
<td>15</td>
<td>4,315</td>
<td>2,600</td>
<td>815</td>
<td>900</td>
<td>26</td>
<td>220-250</td>
<td></td>
</tr>
<tr>
<td><strong>Lentils</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$/t</td>
<td>$/t</td>
</tr>
<tr>
<td>2016-2017</td>
<td>2,254</td>
<td>2,221</td>
<td>1.44</td>
<td>3,194</td>
<td>98</td>
<td>3,365</td>
<td>2,455</td>
<td>595</td>
<td>315</td>
<td>10</td>
<td>575</td>
<td></td>
</tr>
<tr>
<td>2017-2018f</td>
<td>1,783</td>
<td>1,774</td>
<td>1.44</td>
<td>2,559</td>
<td>50</td>
<td>2,924</td>
<td>1,500</td>
<td>524</td>
<td>900</td>
<td>44</td>
<td>480-510</td>
<td></td>
</tr>
<tr>
<td>2018-2019f</td>
<td>1,300</td>
<td>1,280</td>
<td>1.56</td>
<td>2,000</td>
<td>50</td>
<td>2,950</td>
<td>1,800</td>
<td>400</td>
<td>750</td>
<td>34</td>
<td>455-485</td>
<td></td>
</tr>
<tr>
<td><strong>Dry Beans</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$/t</td>
<td>$/t</td>
</tr>
<tr>
<td>2016-2017</td>
<td>133</td>
<td>120</td>
<td>2.07</td>
<td>249</td>
<td>91</td>
<td>355</td>
<td>337</td>
<td>16</td>
<td>2</td>
<td>1</td>
<td>885</td>
<td></td>
</tr>
<tr>
<td>2017-2018f</td>
<td>135</td>
<td>131</td>
<td>2.45</td>
<td>322</td>
<td>110</td>
<td>434</td>
<td>345</td>
<td>29</td>
<td>60</td>
<td>16</td>
<td>710-740</td>
<td></td>
</tr>
<tr>
<td>2018-2019f</td>
<td>125</td>
<td>123</td>
<td>2.24</td>
<td>275</td>
<td>80</td>
<td>415</td>
<td>335</td>
<td>25</td>
<td>55</td>
<td>15</td>
<td>765-795</td>
<td></td>
</tr>
<tr>
<td><strong>Chickpeas</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$/t</td>
<td>$/t</td>
</tr>
<tr>
<td>2016-2017</td>
<td>62</td>
<td>44</td>
<td>1.86</td>
<td>82</td>
<td>27</td>
<td>129</td>
<td>108</td>
<td>16</td>
<td>5</td>
<td>4</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>2017-2018f</td>
<td>68</td>
<td>68</td>
<td>1.35</td>
<td>92</td>
<td>55</td>
<td>152</td>
<td>140</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>1170-1200</td>
<td></td>
</tr>
<tr>
<td>2018-2019f</td>
<td>80</td>
<td>79</td>
<td>1.84</td>
<td>145</td>
<td>45</td>
<td>195</td>
<td>125</td>
<td>20</td>
<td>50</td>
<td>34</td>
<td>1000-1030</td>
<td></td>
</tr>
</tbody>
</table>

**SOURCE:** Canada: Outlook for Principal Field Crops
The Size of Pulse Farms and the Number of Canadian Pulse Producers Has Increased Dramatically Since 1981

Total Number of Canadian Pulse Farms by Overall Farm Size, 1981 to 2011

Average Canadian Pulse Area By Overall Farm Size, 1981 to 2011 (Hectares)
Pulse Farm Receipts are Increasing as Average Farm Sizes Increase

According to the 2011 Census of Agriculture, the largest proportion of farms reporting pulses (25.5%) earned $250,000 to $499,999 in gross farm receipts. There were 1,715 farms reporting one million dollars or more of gross farm receipts. These million-dollar pulse farms represented 14.2% of farms reporting pulses and earned 53.2% of the total gross farm receipts for farms reporting pulses. Three decades earlier, these million-dollar farms made up less than 1% of all farms growing pulses. Smaller farms earning less than $100,000 dominated in those days, accounting for 54.7% of all farms reporting pulses.

Note: Farm size categories established with 2010 constant dollars.
Farms Producing Pulses Tend to Feature a Higher Number of Field Crops Than Farms Without Pulse Production

In 2011, 97.4% of farms that reported pulses also reported other field crop varieties, mainly wheat (62.6% of farms), canola (61.2%), and durum wheat and barley (both 33.4%). In general, farms that reported pulses also tended to produce a larger variety of crops, with 26.1% of all pulse-producing farms reporting four field crop types. Nearly 1 in 10 (9.6%) farms reporting pulses reported seven or more field crop types on an operation.

Note: All farms with field crops also include farms with pulses. SOURCE: Statistics Canada, Census of Agriculture, 2011
Crop Rotation and No-Till Seeding Are Common Practice Among Canadian Pulse Producers

Growing pulses in rotation with other grains and oilseeds can disrupt disease and insect cycles and also adds nitrogen to the soil, reducing the need for fertilizers. Due to these agronomic benefits tied to the economic benefit of spending less on inputs and being able to sell pulses at relatively good prices, pulses have gained popularity as a rotational crop. In 2011, 98.3% of farms with pulse areas reported using crop rotation. In 1991, they were only 44.8% of farm with pulses using rotation (Chart 2). The growth of conservation tillage methods may also have led their introduction into farmers' crop rotation systems.


Pulse Farms Utilize Herbicides, Insecticides, and Fungicides at a Higher Rate than Farms With Field Crops

Almost 9 out of 10 farms with pulses reported using herbicides or commercial fertilizers in 2011.\footnote{In contrast, more than half of farms with field crops reported using these inputs. The use of insecticides and fungicides was also more prevalent with farms growing pulses.}

Farms growing other intensively managed field crops, such as canola, also had similar proportions of input use (91.7% of farms growing canola reported using herbicides).
In 2010, Saskatchewan Represented Over 65% of the Total Pulse Farms on ~80% of the Total Pulse Area in Canada

<table>
<thead>
<tr>
<th>Region</th>
<th>Farms</th>
<th>Area</th>
<th>Pulse Share of Total Field Crop Area in Each Province</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number</td>
<td>hectares</td>
<td>percent</td>
</tr>
<tr>
<td>Canada</td>
<td>12,110</td>
<td>2,157,841</td>
<td>100</td>
</tr>
<tr>
<td>Maritime provinces</td>
<td>35</td>
<td>327</td>
<td>0.3%</td>
</tr>
<tr>
<td>Quebec</td>
<td>174</td>
<td>4,138</td>
<td>1.4%</td>
</tr>
<tr>
<td>Ontario</td>
<td>998</td>
<td>39,557</td>
<td>8.2%</td>
</tr>
<tr>
<td>Manitoba</td>
<td>491</td>
<td>49,133</td>
<td>4.1%</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>7,951</td>
<td>1,711,498</td>
<td>65.7%</td>
</tr>
<tr>
<td>Alberta</td>
<td>2,363</td>
<td>348,965</td>
<td>19.5%</td>
</tr>
<tr>
<td>British Columbia</td>
<td>98</td>
<td>4,223</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

Note: No pulse area was reported in Newfoundland and Labrador.

Saskatchewan is the Dominant Pulse Producing Province of Canada; Leads the World in Lentil & Dry Pea Exports

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Saskatchewan</th>
<th>Manitoba</th>
<th>Alberta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentils</td>
<td>96%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>Field peas</td>
<td>72%</td>
<td>5%</td>
<td>24%</td>
</tr>
<tr>
<td>Dry beans</td>
<td>0%</td>
<td>75%</td>
<td>25%</td>
</tr>
<tr>
<td>Chick peas</td>
<td>92%</td>
<td>0%</td>
<td>8%</td>
</tr>
<tr>
<td>Canary seed</td>
<td>92%</td>
<td>6%</td>
<td>1%</td>
</tr>
<tr>
<td>Flax</td>
<td>70%</td>
<td>26%</td>
<td>4%</td>
</tr>
<tr>
<td>Oats</td>
<td>48%</td>
<td>20%</td>
<td>32%</td>
</tr>
<tr>
<td>Barley</td>
<td>40%</td>
<td>10%</td>
<td>50%</td>
</tr>
<tr>
<td>Winter wheat</td>
<td>40%</td>
<td>38%</td>
<td>23%</td>
</tr>
<tr>
<td>All spring</td>
<td>53%</td>
<td>17%</td>
<td>30%</td>
</tr>
<tr>
<td>Durum</td>
<td>84%</td>
<td>1%</td>
<td>15%</td>
</tr>
</tbody>
</table>

SOURCE: Statistics Canada

Saskatchewan Agri-Food Exports Ranked First in the World, 2017
(Value of Production, $ Million)

OVER 5 MILLION TONNES OF PULSES WERE EXPORTED FROM SASKATCHEWAN IN 2016, VALUED AT $3.5 BILLION

Global and Local Trends Affecting Pulse Demand & Supply

1. Pulses are Strong Rotational Crops
2. Consumers Are Seeking Out Gluten-Free Options¹
3. Consumers Are Seeking Out Alternative Protein Sources
4. Consumer Preferences For Non-GMO Products

Pulse Production in Canada
(thousand tonnes and hectares)


Saskatchewan Growers Leverage Pulses in Crop Rotations to Improve Soil Biodiversity and Nitrogen Fixation

**Past Saskatchewan Crop Rotations**
(1970s-1990s)

- Wheat
- Summer Fallow

This rotation resulted in poor soils and a backlog of wheat at grain elevators.

**Current, Improved Rotations**
(1990s-Present)

- Oil Crops
- Wheat
- Pulses

The addition of pulses to crop rotations increased soil biodiversity and potential for nitrogen fixation.
Changes to India’s Pulse Import Policies Have Adversely Affected Canada’s Pulse Industry

As of 2017, India Requires Any Country Exporting Pulses to the Country to Treat the Crop with Pesticides That Are Prohibited in Canada

**Issues for Canada**: The chemical required for the pesticide treatment is illegal in Canada

The pest at the source of the ruling does not exist in Canada

According to Saskatchewan’s minister of agriculture, this ruling has driven the price of lentils down by nearly half, as compared to normal prices

**Market Dynamics**

According to Saskatchewan’s minister of agriculture, this ruling has driven the price of lentils down by nearly half, as compared to normal prices.

**Pulse Industry Partnerships are Key to Ensuring Global Export Access**

1. **Pulse Canada** continues to work with and support the Government of Canada in reaching a long-term resolution in India, a key Canadian pulse export market.

2. SPG has partnered with grower groups from other provinces and pulse exporters through our national association, Pulse Canada to tackle issues such as transportation, maximum residue limits, and free trade agreements.

3. Representatives from Pulse Canada and SPG visited India to press for predictability and transparency in India’s trade policies relating to pulses, to ensure pulses already en route be exempt from policy changes, and that Canada not be required to fumigate pulse shipments, as there is no science-based risk associated with Canadian pulse shipments.

**Source**:
Leadership
University Breeding Program Enables the System

**Varietal Development & Seed Deployment**

**Varietal Development**
Varietal development for Saskatchewan pulses is conducted through the University of Saskatchewan's Crop Development Centre (CDC) and is supported by the Saskatchewan pulse levy, provincial government grants, and royalties on varieties marketed outside of Saskatchewan.

**Seed Multiplication**
Most pulse breeder seed produced at CDC is distributed and managed through licensing agreements with the Saskatchewan Pulse Growers (SPG). SPG manages a Varietal Release Program, through which Select Status growers can purchase CDC breeder seed varieties for multiplication as pedigree seed. These growers maintain decision rights over production, marketing, and pricing.

**Certified Seed Production**
Seed producers must be members of the Canadian Seed Growers Association, which is recognized by the federal Seeds Act and Regulations as the official Canadian pedigreed agency. Growers may choose to demote seed of any stage (e.g. select, foundation, registered) and have it certified without completing all multiplication steps.

**Farmer Production, Marketing, and Key Demand Segments**

**Farm Production**
Saskatchewan is home to 17,000 pulse growers, and in this system, commercial and seed growers are often one in the same. Most farms are large and family run, with 1,000 to 2,000 acres of production. Growers use pulses to improve soil nitrogen fixation in rotation with oil and cereal crops. Growers operate independently, with no co-ops present, but are connected through industry associations.

**Industry Advocacy**
The size of the Canadian pulse industry is complemented by a number of industry advocacy groups including provincial pulse grower associations; Pulse Canada, which manages the branding for pulses grown inside the country; Ag-West Bio, a bridging organization dedicated to industry growth; Saskatchewan Food Industry Development Centre, which provides pilot testing for value-added products; and the University of Saskatchewan, which helps bring research and industry together.

**Demand Segments**
Saskatchewan pulses are shipped internationally, with $3.6 billion exported in 2016. The demand for pulses worldwide is being driven by a few main factors, including consumer desire for alternative protein sources, doubling as value-added products, and consumer averseness to crops produced with GMO technologies. Pulses are also used widely as animal feed additives.

**Enabling Environment Stakeholders**

- Crop Development Centre
- Saskatchewan Pulse Growers
- Canadian Seed Growers Association
- Pulse Canada

**Source:**
(2) Saskatchewan Advantage PDF from Saskatchewan Ministry of Agriculture
CANADA SEED SYSTEM SCHEMATIC

Research and Plant Breeding
- Private companies
  - 135 Scientists
  - 227 Technicians
  - 100 Support staff
  - 155 Summer staff
- Universities (McGill, Guelph, Manitoba, Saskatchewan, Alberta)
- Agriculture and Agri-Food Canada
- Provincial Agriculture Departments

Seed Growers
- 3,500 Pedigree seed growers
- 1,800 Forage seed growers
- 400 Seed corn growers
- 370 Potato seed growers
*Includes pedigree and common seed growers

Seed Conditioners and Seed Labs
- Registered Seed Establishments (RSEs)
- 574 Approved Conditioners (AC)
- 851 Bulk Storage Facilities (BSF)
- 33 Accredited seed labs

Distributors, Brokers and Exporters
- 130 Canadian Seed Trade Association member companies

Seed Imports
- 84 Authorized Importers (AI)

Organizational Leadership by Value-Chain Step

Breeder
Foundation
Certified
Commodity

Pedigreed Seed Production

Hundreds of Select Status Seed Growers
Seed Certification (Canada Seed Growers Association)
Pulse Levy Collection (Saskatchewan Pulse Growers)

University of Saskatchewan
CROP DEVELOPMENT CENTRE
SaskSeed
CSGA
Saskatchewan Pulse Growers
### Organizational Value Chain Leadership Summary

<table>
<thead>
<tr>
<th>Organization</th>
<th>Value Chain Role</th>
<th>Major Funding Sources</th>
<th>Financial Sustainability</th>
</tr>
</thead>
</table>
| Crop Development Centre | • Varietal Development  
|                      | • Breeder Seed Production and Distribution             | • Licensing Fees from SPG  
|                      |                                                          | • University and Provincial grants  
|                      |                                                          | • Royalties from seed sales in provinces other than Saskatchewan                      | Financially Sustainable |
| Saskatchewan Pulse Growers | • Seed grower and pulse industry advocacy, coordination, and oversight  
|                      | • Variety Release Program                              | • Saskatchewan Pulse Levy                                                          | Financially Sustainable |
| Canadian Seed Growers Association | • Certification of pedigreed seed  
|                      | • Conferral of Select Seed Grower status               | • Membership Dues                                                                | Financially Sustainable |
| Saskatchewan Seed Growers Association | • Pedigreed seed grower advocacy, coordination, and oversight | • Membership dues                                                                | Financially Sustainable |
The Crop Development Centre (CDC) is the Respected Research and Breeding Arm for U of Sask

LEADERSHIP

CDC Mission:

“The Crop Development Centre is a field crop research organization which seeks to improve economic returns for farmers and the agriculture industry of Western Canada by improving existing crops, creating new uses for traditional crops, and developing new crops.” -CDC

About the CDC’s Founding:

The CDC was founded in 1971 to improve economic returns for growers and the agricultural industry in Western Canada.

The CDC began as collaboration between the University, the National Research Council (NRC) and the Saskatchewan Department of Agriculture.

For the first three years of operation, the NRC provided all funding for seven breeders and other support staff, with an initial budget of $324,000¹. Now, public and private partners have helped expand the CDC’s budget and capabilities.

About the CDC Today:

The CDC produces breeder seed of 65 different varieties of seed across 12 different crop types.

The CDC’s Breeder Seed Facility is a state-of-the-art, 10,000 square foot seed cleaning facility on the Kernan Research Farm in Saskatoon.

CDC Professional Staff and Budget:

| Plant Breeders | 9 |
| Pulse Breeder Seed Growers | 2 |
| Pathologists | 2 |
| Staff Members & Graduate Students | 200+ |

$200+ million in Annual Expenditures

The CDC Has Released Over 450 Commercial Varieties of Various Crops in 40 Years

--- CDC’s Research Focus Areas ---

1. Develop improved crop varieties for growers and end users
2. Develop germplasm for use and exchange with breeding institutions
3. Develop new crop kinds and management practices
4. Pursue state-of-the-art scientific technologies to remain at the top of the game
5. Work in partnership with the public and private sectors
6. Supervise and train graduate students from around the globe
7. Provide leadership for agriculture in Saskatchewan
8. Work nationally and internationally to better agriculture

The lifespan of the average CDC variety is ~six to ten years, with high variability between varieties

--- CDC’s Focus Crops: ---

Spring Wheat, Durum, Canary Seed, Barley, Oat, Flax, Field Pea, Lentil, Chickpea, Faba Bean, and Dry Bean

--- CDC Impacts: ---

In Canada, CDC varieties account for 95% of lentil acres, 85% of dry pea acres, 83% of flax seed acres, & 75% of chick pea acres

Saskatchewan Pulse Growers

“Saskatchewan Pulse Growers is a Pulse Crop Development Board that is accountable to and funded by growers” –SPG

SPG Plays Integral Roles in Managing CDC Released Varieties for the Pulse System, including:
- Pulse Industry Levy Collection
- CDC Variety Marketing & Research Funding
- CDC Variety Release Program
- Pulse Market Development & Demand Building

SPG Leadership:
- Elected Board of Directors
- Administrative Staff
- Finance Staff
- Research and Development Staff
- Marketing & Promotion Staff

SPG has the exclusive commercialization rights for CDC pulse crop varieties

SPG prioritizes research as a portion of its budget, with funding being funneled toward CDC’s pulse research:

60% of annual budget invested in R&D

Breeding & Genetic Improvement
- Delivering improved varieties

Agronomy
- Reducing agronomic constraints such as weed & disease pressures

Processing & Utilization
- Developing new markets through new uses for pulse ingredients

Health Outcomes
- Building scientific evidence for marketing & health claims

Source: http://saskpulse.com/research/research-priorities/
LEADERSHIP

SPG Utilizes Several Digital Mediums as Part of Ongoing Industry Outreach Efforts

ACTIVE GROWERS, WHICH SPG DEFINES AS THOSE WHO HAVE PAID THE PULSE LEVY WITHIN THE LAST TWO YEARS, HAVE ACCESS TO THESE OUTREACH MATERIALS ON THE SPG WEBSITE

SOURCE: http://saskpulse.com/resources/media
The Canadian Seed Growers Association is the Sole Certifying Authority for the Saskatchewan Pulse Industry

“The Canadian Seed Growers’ Association (CSGA) is a non-profit organization representing the interest of Canadian seed growers. We provide leadership as the only Canadian organization to monitor and certify pedigreed seed for all agricultural crops in Canada except potatoes.” - CSGA

CSGA Advances the Canadian Seed Industry Through:

- **Promoting** the benefits of pedigreed seed throughout the seed industry and to end-users
- **Cooperating** with researchers, growers and processors to expand the use of pedigreed seed
- **Advocating** the use of the seed certification system as an integral part of identity preserved and quality assurance programs
- **Facilitating** transfer of end-use specific traits from research to commercial use through pedigreed seed

CSGA Provides Crop Certification Through:

1. Developing varietal purity standards and regulations for pedigreed seed crop production
2. Maintaining a verifiable seed certification system
3. Certifying the varietal purity of pedigreed seed crops

Annual membership fees of $200 per grower provide access to outreach materials, voting privileges, and industry educational events
Saskatchewan Seed Growers Association (SaskSeed)

“The Saskatchewan Seed Growers Association is a member-centric organization focused on enhancing pedigreed seed production and the growth of the seed industry in Saskatchewan.” - SSGA

SaskSeed Accomplishes this Mission Through:

- Serving as the Official Voice of members to industry and government
- Providing members with learning & networking opportunities
- Advocating for the issues and policies important to 550 members
- Building strong relationships with key industry partners
- SaskSeed’s total pedigreed seed industry is worth $710 million

SaskSeed provides yearly updated seed guides that offer pedigreed seed growers industry news updates, information on available varieties, and growing recommendations.

SaskSeed Advocates for the Use of Certified Seed through advertisements targeted to commercial crop producers.
## Canadian Seed Classifications

### Common Seed & Bin-Run Seed

- **Common seed** is a recognized grade in Canadian Seeds Regulations, with mechanical purity and germination requirements that must be met, including grading and labelling with a proper tag.

- Since Common seed has no third-party or official certification records to verify varietal purity & identity, it **cannot legally be sold by variety name**.

- **Bin-run** or **farm-saved seed** is commercial grain that has usually been cleaned by farmers for replanting.

### Pedigreed Seed

- **Pedigreed seed**, from which Certified seed is derived, is seed that is true-to-type and has been developed for a specific purpose.

- Pedigreed seed is **multiplied** from the small amount of **breeder seed** developed by plant breeders through the five multiplication stages.

- Following the certified seed multiplication stage, pedigreed seed **can be used for commercial production** after third-party official inspection.

### Certified Seed

- **Certified seed** is a class of pedigreed seed that has been inspected and has received a **crop certificate** from the CSGA.

- Pedigreed seed **is tested for compliance** with the germination and physical purity standards in Canadian Seeds Regulations.

- Certified seed can only be labeled with a variety name and an **official Certified blue tag** by CFIA-Accredited Graders if accompanied by a **CSGA crop certificate**.

---

**SOURCE:** [http://seedgrowers.ca/seed-growers/resources/frequently-asked-questions/](http://seedgrowers.ca/seed-growers/resources/frequently-asked-questions/)
Research & Varietal Development
# 7-Year Stage Gate Process from Cross to Breeder Seed Scale-Up

<table>
<thead>
<tr>
<th>Year</th>
<th>Breeding Phase</th>
<th>Varietal Testing Stage</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Genetic Crossing (F1 &amp; F2)</td>
<td>Crossing and Selection</td>
<td>Breeders at CDC are developing and selecting the earliest generations of potential new varieties</td>
</tr>
<tr>
<td>3-5</td>
<td>Varietal Selections (F3 - F5)</td>
<td>In-Field Yield and Quality Trials</td>
<td>Trials are done on land leased to CDC (about six locations per crop), and the number of testing locations increases with each generation. Most test fields are located in Saskatchewan, where breeders and technical staff frequently monitor test fields</td>
</tr>
<tr>
<td>6-7</td>
<td>Varietal Selection Concurrent with Breeder Seed Production (F6 - F8)</td>
<td></td>
<td>Beginning of breeder seed development (100kg) by CDC’s Breeder Seed Unit (two university employees) and continued varietal development and selection</td>
</tr>
<tr>
<td>8</td>
<td>Breeder Seed Scale-Up</td>
<td></td>
<td>Goal is to scale pre-breeder seed up to one to two tons, depending on varietal demand</td>
</tr>
<tr>
<td>9-10</td>
<td>Breeder Seed Made Available to Select Growers through SPG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Regional Pulse Variety Trials Are Enabled By CDC and SPG

Pulse Regional Variety Trials Occur Through Collaborations Between CDC, SPG, Agriculture and Agri-Food Canada Research Stations, Provincial Agriculture-Applied Research Management sites, & the Canadian-Saskatchewan Irrigation Diversification Centre.

Data is Collected At Several Sites Across Saskatchewan For Each Pulse Crop, Each Providing Multiple Data Points to Inform Grower Decisions:

- Pea Trials
- Dry Bean Trials
- Colored Faba Bean Trials
- Lentil Trials
- White Flowered Faba Bean Trials
- Chick Pea Trials

Pulse Crop Variety Data is Shared by SPG through the Seed Guide, posted on the Saskatchewan Seed Grower Association Website.

Regional Variety Testing in Saskatchewan relies on support from many organizations, including:

(2) http://saskseed.ca/2018-seed-guide/
Five Stages Precede the Distribution of Certified Seed

**Multiplication Phase**

- **Stage 1**: Breeder Seed (1-2 tons of seed from CDC's Breeder Seed Unit)
- **Stage 2**: Select Seed Production
- **Stage 3**: Foundation Seed Production
- **Stage 4**: Registered Seed Production
- **Stage 5**: Certified Seed Production

**Commercial Stage**: Distribution of Certified Seed

**Canadian Seed Growers Have Autonomy in Seed Production:**

- Select growers purchase breeder seed from SPG
- The subsequent stages are completed in succession by individual growers, who are often also commercial seed growers
- Growers have the option to certify seed before multiplying it through all five stages (Demotion)
As of December 2016, CDC Had Released 148 Varieties of Lentil and Field Pea

<table>
<thead>
<tr>
<th>Crop Type</th>
<th>Number of Varieties Released</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barley</td>
<td>93</td>
<td>20%</td>
</tr>
<tr>
<td>Lentils</td>
<td>79</td>
<td>17%</td>
</tr>
<tr>
<td>Field Peas</td>
<td>69</td>
<td>15%</td>
</tr>
<tr>
<td>Wheat, excluding durum</td>
<td>66</td>
<td>14%</td>
</tr>
<tr>
<td>Dry Bean</td>
<td>42</td>
<td>9%</td>
</tr>
<tr>
<td>Oats</td>
<td>35</td>
<td>8%</td>
</tr>
<tr>
<td>Chick Peas</td>
<td>24</td>
<td>5%</td>
</tr>
<tr>
<td>Flax</td>
<td>22</td>
<td>5%</td>
</tr>
<tr>
<td>Durum</td>
<td>11</td>
<td>2%</td>
</tr>
<tr>
<td>Canary seed</td>
<td>8</td>
<td>2%</td>
</tr>
<tr>
<td>Faba beans</td>
<td>7</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>456</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

The development and commercialization of pulse cultivars in Saskatchewan has occurred under two programs:

**SPG Variety Release Program (VRP)**

- SPG provides the CDC’s pulse-breeding program with an average of $1.8 million per year in order to receive **exclusive distribution rights** to all pulse varieties developed by the CDC.
- Total Number of Cultivars Released Through VRP since 1997: 95
  - Lentil Cultivars: 38
  - Pea Cultivars: 29
  - Chick Pea Cultivars: 20
  - Common Bean Cultivars: 7
  - Faba Bean Cultivar: 1

**Tender Release Program (TRP)**

- Specialty pulse cultivars are tendered to seed companies on a **royalty-based** commercialization scheme.
- Total Number of Cultivars Released Through TRP since 1997: 8
  - Bean Cultivars: 5
  - Lentil Cultivars: 3

Pulse cultivars released under the TRP are **differentiated by end use characteristics**, with private seed companies responsible for **managing the development** of the cultivar and the **collection of royalties** on seed sales.

*Source: R. Regier, personal communication, Saskatchewan Pulse Growers, Saskatoon, Saskatchewan.*
Between 1997 & 2016, SPG Released More Than 110 CDC Pulse Crop Varieties Through SPG’s Variety Release Program

"Through Saskatchewan Pulse Growers (SPG) Variety Release Program (VRP), breeder seed varieties developed by the Crop Development Centre (CDC) are made available to eligible Select Status seed growers in Saskatchewan royalty-free."-SPG

Variety Release Program Details:
- Included crops: Pea, Lentil, Chick Pea, Bean, and Faba Bean
- Select Status Grower certification is conferred by the Canadian Seed Growers Association (CSGA) and must be achieved before purchasing breeder seed from the SPG Variety Release Program
- Any nationally recognized Select Seed Grower whose provincial pulse grower organization has an agreement with SPG is eligible to apply for breeder seed through this program
- 197 Select Status Growers currently are a part of the SPG VRP

SGP Released Varieties:
- Levies paid by growers in Saskatchewan to SPG ensure royalty-free access to CDC varieties
- SPG also enables a seed-royalty system for CDC varieties sold outside of Saskatchewan
- SeCan and SeedNet have Canadian marketing rights for CDC varieties outside of Saskatchewan for 10 years per variety
- Unauthorized sales of seed are in violation of the Plant Breeders’ Rights

Sources:
2. SOURCE: http://saskpulse.com/growing/varieties/select-seed-growers-program/
Information About New Pulse Varieties Is Shared With Growers Through Industry News Articles

New pulse crop varieties for 2016

These new pulse varieties are hitting the market for the first time this spring

“The most widely grown yellow pea varieties in Saskatchewan in 2015 were CDC Meadow (also the top variety grown in Manitoba) and CDC Golden, but two new varieties — CDC Saffron and CDC Amarillo — have gained rapid adoption by growers. Production of these varieties is expected to increase substantially.

**CDC Saffron** has high yield potential, good lodging resistance and attractive medium-to-large smooth, round seeds with medium protein content and good cooking quality.

**CDC Amarillo** has been one of the strongest yielding varieties in registration and regional trials over the past six years. CDC Amarillo is relatively tall with one of the best lodging resistance ratings among pea varieties. CDC Amarillo also has good resistance to fusarium wilt. Its seed weight is slightly less than that of CDC Saffron. It is round with medium protein content and good cooking quality.

**Abarth** yellow pea, available from FP Genetics, offers competitive yield, good disease resistance, and larger seed size. Abarth has medium maturity with very good resistance to powdery mildew, and fair resistance to mycosphaerella blight and fusarium wilt. It has good lodging resistance with best in class standability for ease of harvesting.

**AAC Lacombe** is a high-yielding, medium-large seeded yellow pea with excellent standability that should be available by the fall of 2016.

**CDC Inca** should be commercially available in 2018. CDC Inca has strong yield potential in southern Saskatchewan and good lodging resistance. It has medium seed size, round seed shape, medium protein content and good cooking quality.”
Green peas

“CDC Striker” has been the most widely grown green pea variety in Saskatchewan for the past eight years. The next most widely grown varieties in 2015 were CDC Patrick, CDC Raezer, CDC Sage, and CDC Limerick. With certified seed of CDC Raezer and CDC Limerick now available, area of production for these varieties is expected to grow substantially in 2016.

CDC Raezer has good yield and lodging resistance and is powdery mildew resistant, like most new varieties in Western Canada and has good resistance to fusarium wilt. Seed size, shape, and bleaching resistance are very similar to CDC Striker.

CDC Limerick is the highest yielding green pea variety currently on the market and has good lodging resistance. CDC Limerick has smooth, round seeds with good bleaching resistance and higher protein content than most pea varieties on the market.

In 2017, look out for CDC Greenwater. This variety has strong yield potential and good lodging resistance, with medium seed size and round seed shape. AAC Royce and AAC Radius should have seed available by 2018.”

SOURCE: https://www.grainews.ca/2016/02/25/new-pulse-crop-varieties-for-2016/
Small Red Lentils

“Small red lentils are the most popular class grown in Saskatchewan and the most widely grown varieties for 2015 were the imidazolinone tolerant, CDC Maxim, CDC Dazil, CDC Imax and CDC Impact.

Limited supplies of commercial seed for a new variety, CDC Cherie, may be available in 2016. This variety was released in 2012 and is not imidazolinone tolerant, but is high-yielding.

There are a few new varieties, all higher yielding than CDC Maxim, which will be commercially available in a few years. They include imidazolinone tolerant varieties, CDC Impulse (IBC 479) and CDC Proclaim (IBC 550) and the non-imidazolinone tolerant, CDC Redmoon (3646-4).”

1 SOURCE: https://www.grainews.ca/2016/02/25/new-pulse-crop-varieties-for-2016/
Research Spotlight

Economic Impact of Plant Breeding at the Crop Development Centre Final Report, November 2016

JRG Consulting Group and SJT Solutions
Dr. John Groenewegen, Dr. Shelley Thompson, Dr. Richard Gray
### Measured Increases in Yields Attributed to Plant Breeding

Compounded average annual growth rate of yields for CDC developed varieties in Saskatchewan, by crop type (1991-2015)

<table>
<thead>
<tr>
<th>Crop Kind</th>
<th>Saskatchewan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lentils</td>
<td>0.74%</td>
</tr>
<tr>
<td>Field peas</td>
<td>1.99%</td>
</tr>
<tr>
<td>Dry beans</td>
<td>0.29%</td>
</tr>
<tr>
<td>Chick peas</td>
<td>0.65%</td>
</tr>
<tr>
<td>Canaryseed</td>
<td>0.26%</td>
</tr>
<tr>
<td>Flax</td>
<td>0.48%</td>
</tr>
<tr>
<td>Oats</td>
<td>0.39%</td>
</tr>
<tr>
<td>Barley</td>
<td>0.39%</td>
</tr>
<tr>
<td>Winter wheat</td>
<td>0.45%</td>
</tr>
<tr>
<td>All spring</td>
<td>0.46%</td>
</tr>
<tr>
<td>Durum</td>
<td>0.50%</td>
</tr>
</tbody>
</table>
Lentil production increased in Saskatchewan from a few thousand acres in the 1970s to over five million acres in 2016. Dr. Al Slinkard developed the large-seeded Laird lentil variety registered in 1978, which was the dominant variety in the 1990’s. By 2002, CDC Blaze was the dominant variety, which was replaced by CDC Maxim by 2010, as illustrated in Figure 2.7, with 51% acreage share in 2015. A large number of the 79 lentil varieties released by the CDC are planted by Saskatchewan pulse growers, with CDC varieties capturing more than 98% of planted acreage, aside from the 1998 to 2004 period when the Crimson variety (from Washington State) was used. Saskatchewan production on 3.0 to 5.0 million acres accounts for 95% of Canadian lentil production, and is the world’s largest exporter of lentils.
Acreage Shares of CDC Pea Varieties, Saskatchewan, 1991 to 2015

The first CDC pea variety was released in 1986 (CDC Bellvue), which captured 2.5% acreage share in 1992. CDC’s acreage share in Saskatchewan increased substantially from less than 1% in 2000 to 95% by 2015, as shown in Figure 2.8. This advance was led by CDC Mozart (released in 1999) and CDC Golden (released in 2003) with 40% of Saskatchewan acreage in 2009 and 2010, and CDC Meadow (released in 2006) with a 50% market share in 2015. Saskatchewan is also the world’s largest exporter of dry peas with 2.5 to 3.0 million acres in production.
Acreage Shares of CDC Dry Bean Varieties, Saskatchewan, 1991 to 2015

The CDC released its first dry bean variety in 1995, which was CDC Expresso and CDC Nighthawk. In 2002, when crop insurance data is first available for dry beans, CDC Pintium (released in 1999) accounted for all of the known dry bean varieties planted in Saskatchewan. In some years all acreage was to known varieties, with the CDC 2002 to 2015 average at 54%, with 2010 the exception where none of the varieties were reported on the insured acreage. CDC WM-1 (released in 2009) accounted for the majority of acreage in 2013 and in 2015. Production occurs on 5,000 to 15,000 acres each year in the province. The other two provinces produce more dry beans.
Demand Planning and Operations
# Early Generation Seed Deployment Model

<table>
<thead>
<tr>
<th>Who</th>
<th>Pre-Breeder Seed</th>
<th>Breeder Seed</th>
<th>Select Seed</th>
<th>Foundation Seed</th>
<th>Registered Seed</th>
<th>Certified Seed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop Development Center (CDC) University of Saskatchewan</td>
<td>CDC Breeder Seed Unit University of Saskatchewan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sector</th>
<th>Public</th>
<th>Public</th>
<th>Private</th>
<th>Private</th>
<th>Private</th>
<th>Private</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Input</th>
<th>Seed from Field Trials</th>
<th>100 kg of Pre-Breeder Seed</th>
<th>1 lb. of Breeder Seed from SPG</th>
<th>15 lb. of Select Seed</th>
<th>225 lb. of Foundation Seed</th>
<th>3,375 lb. of Registered Seed</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Output</th>
<th>100 kg of Pre-Breeder Seed</th>
<th>1 lb. of Breeder Seed</th>
<th>15 lb. of Select Seed</th>
<th>225 lb. Foundation Seed</th>
<th>3,375 lb. Registered Seed</th>
<th>50,625 lb. Certified Seed</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Capital Sources</th>
<th>Saskatchewan Pulse Growers</th>
<th>Saskatchewan Pulse Growers fund the production of breeder seed through the CDC’s Breeder Seed Unit</th>
<th>Certified seed sales</th>
<th>NOTE: Certified seed is planted on ~20% of acres in Saskatchewan. Some growers fund seed production by selling seed at stages prior to certification (i.e. one select seed grower sells foundation seed to another select seed grower for increase on their own farm). Growers may also choose to demote seed, which allows them to sell select, foundation, or registered seed as certified seed.</th>
</tr>
</thead>
</table>

Breeder Seed is Sold by SPG to Independent Select Seed Growers in Saskatchewan.
Select Seed Growers are the Only Growers Able to Purchase Breeder Seed of SPG-Licensed Varieties

“Through Saskatchewan Pulse Growers (SPG) Variety Release Program (VRP), breeder seed varieties developed by the Crop Development Centre (CDC) are made available to eligible Select Status seed growers in Saskatchewan royalty-free.” -SPG

The U of S Crop Development Centre develops improved pulse varieties and licenses them exclusively to SPG

CSGA is responsible for vetting and selecting Select Status Growers. Until seed growers have applied through CSGA, they are not able to access CDC varieties through SPG

SPG’s Variety Release Program makes CDC’s breeder seed available to Select Status Growers for multiplication and certification

Seed growers outside of Saskatchewan can obtain breeder seed and produce select and foundation seed of CDC varieties through SPG’s Variety Release Program as long as they are Select Status seed growers, verified through CSGA, and as long as their provincial pulse grower organization has an existing agreement with SPG.

These growers pay a royalty fee on any varieties grown from CDC, as they do not participate in the Saskatchewan pulse levy system.
CDC and SPG Collaborate In Demand & Supply Planning- A Practice Unchanged for 20 Years

CDC and SPG Plan for Breeder Seed Production Through a Series of Meetings Regarding the Expected Success of a New Variety & it’s Implications on Previously-Released Varieties’ Market Shares

SPG and CDC Leaders Discuss the Expected Success of a New Variety

Breeder Seed is Produced by the CDC’s Breeder Seed Unit (two university employees)

0.5 to 2 tons of breeder seed made available to SPG

SPG Sells Breeder Seed to Select Status Growers

Select Status Growers Have Complete Discretion Over Seed Production

Breeder Seed Production amounts vary based on chance of varietal success, shared knowledge of the industry, and perceived demand

SPG pays for varietal development at CDC separately from the contracted breeder seed production at the Breeder Seed Unit

The amount of breeder seed produced by CDC is based on varietal demand

For a popular variety, SPG sells to 30-40 Select Growers

Breeder Seed Cost: $20-25/kg

Higher initial cost of breeder seed investment is offset by lack of royalty payments

For all pulse classes (except peas) CDC is the only breeding program releasing improved varieties, providing captive demand for CDC varieties, but not premiums on the varieties. Other pea breeding programs have criticized the CDC for releasing pea varieties without royalty requirements, stating that the lower prices of CDC breeder seed (due to lack of royalty) create unfair market advantage. However, Saskatchewan growers pay comparatively higher breeder seed costs than other growers and contribute to a pulse levy that enables the CDC to make improved varieties available royalty-free.
Breeder Seed Demotion Allows Growers Autonomy in Seed Production

Breeder Seed Can Be Demoted And Sold as Foundation, Registered, or Certified Class Seed With Varietal Purity Inspection and Certificate

A significant number of growers choose to demote seed in this production system to realize the returns on selling certified seed sooner than the 5-stage process allows

Growers typically will not demote seed until the Foundation stage in order to have enough production from multiplication to realize the greatest gains on their sale of seed

Growers that choose to demote seed are still required to complete all steps of a typical seed certification
The Canadian Seed Value Circle Shows the Interconnectedness of the Agricultural Industry
Financial Sustainability
A Levy is Assessed on Saskatchewan-Grown Pulses at their Point of Sale

Who pays the levy?
- Buyers
- Processors
- Brokers
- Assemblers
- Exporters
- Marketers

How much is the levy?
- 0.67% of the gross value of sale

The levy was previously set at 1% of the gross value of sale, but due to an increase in pulse acres and market demand, SPG reduced the pulse levy for the 2017 season. This reduction is held in place, by SPG member vote, for the 2018 season.

What does the levy fund?
- Research and breeder seed production by the Crop Development Centre
- Access to improved seed for Saskatchewan Select Status seed growers
- Research funding, marketing, operations, and administration

(1) SOURCE: http://saskpulse.com/about/levy/
A Majority of the Saskatchewan Pulse Levy is Used to Fund Research & Development at CDC

$11,000,000 For Research & Development Funding
$400,000 Breeder Seed Production

Pulse Levy Collection $22,000,000

Breeder
Foundation
Certified
Commodity

Pedigreed Seed Production

Hundreds of Select Status Seed Growers
Pulse Growers

Select | Foundation | Registered
Economic Impact of Plant Breeding at the Crop Development Centre

ECONOMIC IMPACT ASSESSMENT

In 2016, the CDC commissioned JRG Consulting Group and SJT Solutions to assess the economic impact of its plant breeding activities.


SELECTED TAKEAWAYS

On-Farm Value Creation: CDC’s Annual Expenditures are ~$20 million, but provide $230 million in benefits to producers

Opportunity Cost: For every $1 million not invested in the CDC, the production sector foregoes $11.5 million in future benefits

Economic Impact: Funding of CDC’s activities have increased farm productivity, leading to the creation of 5,900 new jobs and $1.5 billion in additional economic activity
Crop Development Centre at the University of Saskatchewan Funding (All Crops)

CDC is funded by a combination of public and private sector funding sources, which highlights its status as a Public Private Partnership.

**Saskatchewan Ministry of Agriculture**
- Provincial funding is geared toward: Strategic Research Programs, CDC Program Budgets, special project funding, capital contributions for infrastructure
- Province provided more than $100 million in funding in past 30 years

**Saskatchewan Pulse Growers (SPG)**
- Funding from growers and industry
- A 15-year agreement increased funding every five years since 2005

**Western Grain Research Foundation (WGFR)**
- Industry funding for wheat and barley research through check off programs
- Has contributed $2 million annually for the past 10 years (2006-2016)

**Royalties on CDC Varieties Sold Outside of Saskatchewan**
- Funding from growers and industry outside of Saskatchewan
- Royalty income has progressively increased over the last 5 years from $1.7 million to $2.9 million annually (2011-2016)

**Other Sources**
- Includes private sector sponsored research from Quaker Oats, Viterra, FP Genetics, SeCan

Between 2006 and 2015, CDC’s funding averaged $13.9 million, with the following allocation by source:

- Saskatchewan Ministry of Agriculture: 40%
- SPG: 9%
- WGRF: 14%
- Royalties (net): 10%
- Other Sources: 27%

**SOURCE:** Economic Impact of Plant Breeding at the Crop Development Centre Final Report, November 2016
Saskatchewan Pulse Growers Collects Royalties on Breeder Seed Sold Outside of Saskatchewan

**New agreements** between Saskatchewan Pulse Growers (SPG) and provincial pulse grower associations in 2016 resulted in the establishment of the **breeder seed royalty system**

Through this system SPG collects these royalties, through SeCan and SeedNet, and **retains them for SPG use**

However, the **amount of royalties that CDC receives** has increased in recent years, even without receiving the royalties from outside seed sales.

**Royalty Income that Funds CDC Breeding Activities has increased 71% over Five Years**

<table>
<thead>
<tr>
<th>Year</th>
<th>Royalty Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>$1.7 million</td>
</tr>
<tr>
<td>2016</td>
<td>$2.9 million</td>
</tr>
</tbody>
</table>

**New Model Launched for Access to CDC Pulse Varieties**

Pulse licensing system gives Alberta growers access to CDC new varieties, but will raise seed costs for farmers.

In early 2016, the Alberta Pulse Growers pulled its research funding from the University of Saskatchewan’s Crop Development Centre (CDC). Since then, members of the Alberta Seed Growers (ASG) have been concerned about access to new varieties of pulses, as there was only a limited amount of seed released to Alberta each year.

“When the research funding was pulled, many seed growers were left at a disadvantage for access to new varieties,” notes ASG national board member Ron Markert.

Things have changed, and the seed growers in Alberta have formal access to CDC varieties once again.

Saskatchewan Pulse Growers (SPG) has licensed the distribution rights for select CDC pulse varieties in provinces outside of Saskatchewan to SeCan and SeedNet for a 10-year period.

“This is a significant development for Alberta seed growers and farmers,” says Markert.

Here are the basic implications of the deal, which takes effect for the 2018 growing season.

**It involves a royalty system and seed growers must be members of SeedNet or SeCan to access the seed.**

By licensing the distribution of select varieties for sale in provinces outside of Saskatchewan, SPG is ensuring that growers in other provinces also pay for access to CDC varieties through a seed-royalty system. Licensing the distribution rights will not impact Saskatchewan growers’ ability to access these varieties royalty-free.

For seed growers outside Saskatchewan that are interested in accessing the varieties that have been licensed for distribution outside Saskatchewan, they can contact SeCan and SeedNet for more information.

Seed growers who are not a part of SeCan and SeedNet and have not previously purchased seed of the licensed varieties may contact each company regarding the potential to join and have the opportunity to access these varieties.

Seed growers in Saskatchewan are not permitted to sell seed of CDC-developed varieties to seed growers or commercial producers outside of Saskatchewan without an agreement in place with either SeCan or SeedNet.
## Commodity Levy Funds Saskatchewan Pulse Growers’ Operations

### SPG Revenue

<table>
<thead>
<tr>
<th>Industry Revenue</th>
<th>2016 Actual</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levy</td>
<td>$22,099,540</td>
<td><strong>93%</strong></td>
</tr>
<tr>
<td>Industry partnerships</td>
<td>$125,481</td>
<td><strong>1%</strong></td>
</tr>
<tr>
<td>Variety commercialization</td>
<td>$530,701</td>
<td><strong>2%</strong></td>
</tr>
<tr>
<td>Advertising</td>
<td>$93,248</td>
<td><strong>0%</strong></td>
</tr>
<tr>
<td>Sponsorships</td>
<td>$51,650</td>
<td><strong>0%</strong></td>
</tr>
<tr>
<td><strong>Total Industry Revenue</strong></td>
<td><strong>$22,900,620</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Government Funding

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Amount</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture and Agri-Food Canada – Cluster</td>
<td>$254,800</td>
<td><strong>1%</strong></td>
</tr>
<tr>
<td>Government of Saskatchewan</td>
<td>$51,125</td>
<td><strong>0%</strong></td>
</tr>
<tr>
<td><strong>Total Government Funding</strong></td>
<td><strong>$305,925</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Other Revenue

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest and Dividends</td>
<td>$530,947</td>
<td><strong>2%</strong></td>
</tr>
<tr>
<td>Unrealized Gains (Losses)</td>
<td>$63,303</td>
<td><strong>0%</strong></td>
</tr>
<tr>
<td>Other Revenue</td>
<td>$12,174</td>
<td><strong>0%</strong></td>
</tr>
<tr>
<td><strong>Total Other Revenue</strong></td>
<td><strong>$23,812,969</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Over 60% of SPG’s Budget Was Used to Fund Pulse Research and Varietal Commercialization in 2016

<table>
<thead>
<tr>
<th>SPG Expenses</th>
<th>2016 Actual</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research and Development</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse Breeding</td>
<td>$5,553,990</td>
<td>27%</td>
</tr>
<tr>
<td>Agronomy and Sustainability</td>
<td>$1,433,806</td>
<td>7%</td>
</tr>
<tr>
<td>Genetic Improvement</td>
<td>$1,449,289</td>
<td>7%</td>
</tr>
<tr>
<td>Processing</td>
<td>$1,165,593</td>
<td>6%</td>
</tr>
<tr>
<td>Health Outcomes</td>
<td>$1,090,939</td>
<td>5%</td>
</tr>
<tr>
<td>Strategy Development and Support</td>
<td>$994,296</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$11,687,913</td>
<td>58%</td>
</tr>
<tr>
<td><strong>Market Promotion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadian Lentil Awareness</td>
<td>$2,465,996</td>
<td>12%</td>
</tr>
<tr>
<td>International Market Promotion</td>
<td>$38,120</td>
<td>0%</td>
</tr>
<tr>
<td>Product Utilization, Feed, and Other Promotion</td>
<td>$801,460</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$3,305,576</td>
<td>16%</td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grower Communications</td>
<td>$805,345</td>
<td>4%</td>
</tr>
<tr>
<td>Industry and External Communications and Support</td>
<td>$399,960</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$1,164,905</td>
<td>6%</td>
</tr>
<tr>
<td><strong>Pulse Canada</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategic Initiatives</td>
<td>$1,385,433</td>
<td>7%</td>
</tr>
<tr>
<td>International Year of Pulses</td>
<td>$765,500</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$2,150,933</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Variety Commercialization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breeder Seed</td>
<td>$422,179</td>
<td>2%</td>
</tr>
<tr>
<td>Extension Activities and Support</td>
<td>$106,350</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$528,529</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Leadership and Management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Board of Directors</td>
<td>$201,426</td>
<td>1%</td>
</tr>
<tr>
<td>Management and Administration</td>
<td>$1,161,667</td>
<td>6%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$1,453,093</td>
<td>7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$20,290,949</td>
<td>100%</td>
</tr>
</tbody>
</table>
SPG Contracts the CDC to Produce Breeder Seed of its Licensed Varieties, Which it Sells to Select Status Seed Growers At or Around Its Cost of Production.

SPG Produces Breeder Seed at a Cost Recovery Basis.

SPG Sells Breeder Seed to Hundreds of Growers- Average Revenue from Breeder Seed Sales is $400,000.
A $40M Certified Seed Industry Enables a Multi-Billion Dollar Pulse Market in Saskatchewan

Certified Seed Producers are often Large Pulse Growers Themselves

The Dry, Cool Agroecological Environment of Saskatchewan Enables Growers to Save Seed Which Reduces the Size of the Certified Seed Market

Estimated Annual Certified Seed & Farm-Level Commodity Revenue Under Three Scenarios

- Low Revenue
- Average Revenue
- High Revenue

Certified Seed Revenue
- $30
- $40
- $50

Commodity Revenue
- $3,000
- $3,500
- $4,000
- $4,500
- $5,000
Financial Sustainability by EGS Value-Chain Step

**VARIETAL DEVELOPMENT & BREEDER SEED PRODUCTION**
- **Public sector funding** from the Saskatchewan Ministry of Agriculture accounts for 40% of the Crop Development Centre budget; **Private sector funding** from industry groups and royalties accounts for the remaining 60%

**PEDIGREED SEED PRODUCTION**
- Managed by Private Sector
- 100% Financially Self-Sustaining

**CERTIFIED SEED PRODUCTION**
- Managed by Private Sector
- 100% Financially Self-Sustaining

SOURCE: Stakeholder Interviews with the Crop Development Centre, Saskatchewan Pulse Growers, and review of *Economic Impact of Plant Breeding at the Crop Development Centre Final Report, November 2016*
Enabling Environment
The Saskatchewan Pulse EGS Deployment Model is Supported by a High-Functioning Agricultural Innovation System

Agricultural Innovation System (AIS):
“A complex network of actors (individuals and organizations) and supporting institutions and policies that generate and bring existing or new agricultural innovations (technologies, practices, and processes) into social and economic use”


Rather than a LINEAR PUSH OF RESEARCH to users, AIS incorporates FEEDBACK LOOPS between key actors to inform the development of new technologies

AIS states that for successful innovation, stakeholders need TECHNICAL and FUNCTIONAL capacities:

<table>
<thead>
<tr>
<th>TECHNICAL:</th>
<th>FUNCTIONAL:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skills needed for successful performance in a given discipline (soils science, horticulture, economics, etc.)</td>
<td>Skills needed for partnerships to function (collaboration, reflect and learn, etc.)</td>
</tr>
</tbody>
</table>
Close Collaboration Among Stakeholders Exemplifies the Potential of a Successful Agricultural Innovation System

Public Private Partnerships span both long-term, informal relationships between the public and private sector (Ag-West Bio’s industry coordination function) and clear, formal agreements (15-year CDC funding agreement with SPG).

Employees working within the larger AIS system enjoy the ability to move between jobs, supporting an easy transfer of knowledge between actors and stronger networks. Employees may experience improved job satisfaction and motivation as a result of the job security and opportunities available within the system.

Stakeholders understand the need for all of the other stakeholders in their agricultural space, and they understand how other organizations benefited them. Credit for achievements are shared between actors and battles for turf are not obvious.

The public organizations involved in the PPP evolved over time, based on their sources of funding, roles/responsibilities, and ability to be profitable after initial public investments (e.g. Food Centre started with subsidies and is now a sustainable non-profit; POS Bio-Sciences was a public organization and now it is private).
The Close Proximity of System Actors Promotes Communication and Collaboration
SPG Releases a Yearly Grower Guide to Assist Pulse Growers in Choosing Effective Varieties

Cultivar Trial Results & Seeding Recommendations

Planting Recommendations

SASKATCHEWAN PULSE CROPS
Seeding and Variety Guide 2018

LEN TIL VARIETIES

Grown widely throughout the province. THey have green pods and are suited to areas with a long growing season. Some varieties are susceptible to powdery mildew. Most are adapted to the semi-arid conditions of the southern part of the province. LCM and LCM B are the two leading varieties in the province.

GREEN LENTILS

Grown widely throughout the province. THey have green pods and are suited to areas with a long growing season. Some varieties are susceptible to powdery mildew. Most are adapted to the semi-arid conditions of the southern part of the province. LCM and LCM B are the two leading varieties in the province.

Cultivar Trial Results & Seeding Recommendations


Ag-West Bio is a Key Bridging Organization Between University Research and Industry Leaders

**Governmental Mandate:** “To provide leadership, as a catalyst, to link existing capabilities and resources in order to strengthen the bio economy industry in Saskatchewan”¹

---

**Supporting business**
Ag-West Bio has been helping businesses grow for over 25 years.

Combining expertise and experience, we provide personalized input and a suite of services tailored to your company's unique commercialization needs.

We provide a centralized hub for linking private business with market knowledge, advisory input, mentoring and guidance. And we provide linkages to research and market networks.

We can help you develop a business plan based on opportunity and feasibility, which you can use to gain investors and strategic partnerships.

---

**Creating connections**
Keeping information moving is an important aspect of business development. In the bioscience sector, information must flow along many lines – from researchers to entrepreneurs, investors and consumers.

With good communication networks, entrepreneurs can discover potential partnerships and learn from others with more business experience. People who have already navigated the path to commercialization are usually happy to share their knowledge.

Ag-West Bio's website hosts blogs, videos and information about Saskatchewan's bioscience organizations and activities.

---

**Commercialization Fund**
Ag-West Bio can provide early stage capital and help secure matching funds for qualified start-ups, or for expanding bioscience companies.

Financing takes the form of flexible and patient risk capital, and supports promising technologies at the early stages of development, when risk is too great for traditional capital sources.

Funding is targeted to initiatives where a clear pathway to commercialization can be established, with suitable return on investment and significant benefit to Saskatchewan.

---

**Developing new opportunities**
Growing the bioeconomy requires continuous and strategic evolution.

By staying up-to-date with research, commercialization activity, and market trends in the bioscience sector, we are able to recognize opportunities when they arise. Ag-West Bio then acts as a catalyst, making connections and encouraging collaboration so the province can benefit from those opportunities.

The research and development cluster based in Saskatoon, Saskatchewan continues to grow. Exciting new technologies are emerging from this cluster, such as digital agriculture, imaging, biologicals, and the development of a 'protein highway' to harness the growth of the pulse industry in the province.

---

¹ SOURCE: http://www.agwest.sk.ca/about/what_we_do.html
(2)
Pulse Industry Bridging Organizations Further Enabled by Value-Added Industry Initiative

- For-profit company that provides pilot testing-scaled services to food entrepreneurs, including process development for new product ideas, custom processing services, and data and analytical services
- POS is open to any entrepreneur looking to produce value-added products, but will provide feedback on the perceived profitability of the product and advise the entrepreneur on their decision to enter the market
- Will reach out to university or industry partners if POS detects a market opportunity
- Current pulse projects include extraction of pea protein, reduction of water usage in wet processing, development of machinery for wet processing of pulses
- Began as a governmental mandate, but now acts as a sustainable non-profit

Saskatchewan’s Ministry of Agriculture set a goal to increase Saskatchewan’s total revenue from the value-added sector to $6 billion annually by 2020

SOURCE: (1) http://publications.gov.sk.ca/documents/20/100987-Agriview-June%202017.pdf
Growers Turn to CSGA for Information on Certified Seed Production

Online Tools, Available Through the CSGA Website, Allow Growers Access to All Documents Necessary for Starting and Continuing with Successful Certified Seed Production

New seed growers can learn about certified seed production through the CSGA step-by-step guide

Active certified seed growers can quickly access the database of approved seed inspectors that service their area.
CSGA Seed Certification Steps

1. Variety Development
2. Parent Seed Multiplication
3. Field Selection
4. Planting Equipment Sanitation
5. Isolation
6. Rouging
7. Field Inspection
8. Certification
9. Harvesting Equipment Sanitation
10. Harvesting
11. Separate Seed Storage
12. Testing and Grading
13. Bagging and Tagging
14. Commercial Farmer
15. Food Processor
CSGA’s Seed Locator Provides Access to Canadian Pedigreed Seed

Welcome to the CSGA Pedigreed Seed Locator

The Canadian Seed Growers’ Association (CSGA), which represents 3,700 seed growers, provides leadership as the only Canadian organization to monitor and certify pedigreed seed for all agricultural crops in Canada except potatoes. Use the Pedigreed Seed Locator to find Canadian pedigreed seed. Use the search menu below to find seed by province, crop kind and variety. Click on the ‘Search’ button at the top navigation menu to view the site in a format optimized for your tablet or smart phone, and access the same information while on the go. We want you find advertising and marketing information in the navigation bar.

Use the Pedigreed Seed Locator to find Canadian pedigreed seed.

Search by province, crop kind and variety name to find exactly what you are looking for. Looking for Certified seed, we've got you covered. Certified seed - you're planting success.

How to navigate the Seed Locator:

To find pedigreed seed anywhere in Canada, simply use the dropdown boxes below to select your search criteria.

Crop Kind:  
Variety:  

Search

Crop Kind:  
Variety:  

SOURCE: https://www.seedlocator.net/
Tax Credits Exist for Saskatchewan Farmers Who Pay the Pulse Levy

Growers who contribute pulse levy dollars to Saskatchewan Pulse Growers (SPG) are eligible to earn a federal investment tax credit through the Scientific Research and Experimental Development (SR&ED) program:

The tax credit is based on the amount of levy funds spent on research and development (R&D) that meet specific criteria set out by the Canada Revenue Agency (CRA).

For the 2017 tax year, 62% of the Saskatchewan pulse levy qualifies for the federal SR&ED tax credit.

All levy investment tax credit applied against taxes payable or refunded must be reported by the grower as income in the subsequent year.

30% of a grower’s total levy contribution is eligible to earn an investment tax credit:

- This resulting levy amount is eligible to earn an investment tax credit up to a maximum of 15% for individuals
- Corporations that are considered Canadian controlled private corporations are eligible for a maximum of 35%

SOURCE: http://saskpulse.com/vred-tax-credit/
Pulse Canada is the Commodity Association that Connects All Pulse Growing Regions in the Country

Mission:

“To contribute to the profitability of the Canadian pulse industry through programs designed to deliver innovative solutions that improve efficiencies and increase value.” –Pulse Canada

Strategy:

“In 2017, Pulse Canada established a target of creating new demand in new use categories for 25% of the industry’s productive capacity by the year 2025. To achieve “25 by 25”, Pulse Canada focuses resources on two areas of activity:

- Creating efficiencies within the transportation and marketing of pulses by eliminating barriers to trade and ensuring the industry has the necessary transportation capacity and service
- Creating sustainable demand for Canadian pulses by marketing the health, nutrition and environmental benefits of pulses to end users; accelerating research that removes barriers and creates incentives for pulse consumption; and collaborating with key private and public sector stakeholders to create food systems that prioritize health and sustainability” –Pulse Canada

The Canadian Pulse Brand:

The Pulse Brand was created during the International Year of Pulses in 2016. Companies and organizations that are members of the Pulse Brand Program can use the Pulse Brand logo on any of their communications materials, including websites, social media, and handouts to increase awareness of pulses and their nutritional benefits.
“In the area of market promotion, Saskatchewan Pulse Growers (SPG) is striving to increase consumer demand for lentils through showcasing the versatility and health attributes of lentils, focusing on protein and fibre, through SPG’s sub-brand Lentils.Org” -SPG
SPG Makes Strides in Transportation Improvements in Canada

“In partnership with pulse grower organizations across the country and with processors and exporters of pulses and special crops, SPG recognized the need for improved transportation system performance in 2006 and took action by making significant investments in transportation work at Pulse Canada.

Today, the pulse industry is viewed as a national leader in this area and has been successful in getting shippers of other products such as forestry, automotive, and mining working together to deal with transportation issues our industry cannot tackle alone. We are confident that the only way we can have impact at the national level is to work together with the pulse industry across the country as well as with grain and other rail shippers in Canada.

One advancement made in transportation as a result of SPG’s investments is establishing the right to service level agreements in legislation. Pulse Canada was the only shipper group in Canada to package industry recommendations and promote them in the form of a service level agreement to the Rail Freight Service Review Panel. This resulted in the introduction of legislation giving shippers a right to service level agreements and a process to establish one if commercial negotiations fail.”

Saskatchewan Crop Insurance Corporation (SCIC) Offers Crop Insurance for All Pulse Crops in the Province

“For most crops, customers may select coverage at 50, 60, 70 or 80 per cent of their average yield. The premium for this coverage is cost-shared at 60 per cent by governments, 40 per cent by producers. Coverage is only available up to 70 per cent for the following crops: alfalfa seed, caraway, chickpeas, coriander, dry beans, khorasan wheat, potatoes, timothy hay, honey, soybeans, hemp, camelina, grain colza, and wild rice.”

— Saskatchewan Crop Insurance Corporation
Privatization of Seed Crop Inspection

Canada’s Seed System – A Summary Description
Developed as part of the Seed Synergy Collaboration Project January 2017

Privatization of Seed Crop Inspection
Historically, the inspector has been an employee of the official seed certifying agency (e.g., the CFIA in Canada) but beginning in the mid-90s some jurisdictions began experimenting with private inspection under official supervision. In Canada, some hybrid seed corn inspections were permitted under a “first party” model (inspection by employees of the seed production company) in the late 90s followed by hybrid seed canola inspections under a “third party” model.

In total, these amounted to about 5 per cent of the acres/fields in certification. In 2012, the Canadian government decided that seed crop inspection should be largely privatized. Alternative service delivery (ASD) of seed crop inspection was one of 33 CFIA Deficit Reduction Action Plan (DRAP) projects. It was intended to save $1.8 million annually with a reduction of 20 full time equivalents (FTEs) beginning in 2014. As a result, the CFIA and the seed sector (as represented by the CSGA, the CSTA and the CSI) worked together to develop and implement ASD of seed crop inspection based on a third party model with 9 seed crop inspection regions across Canada. Authorized seed crop inspection services (ASCIS) employing licensed seed crop inspectors (LSCI) conducted 89 percent of the seed crop inspections in 2014, rising to 94 percent in 2015, and 96 percent in 2016.

## Canadian Plant Breeder’s Rights Aligned With UPOV 1991

in Feb. 2015, Aligning Canada With Other Countries

### Plant Breeder’s Rights

Authorization from the breeder is required to produce, reproduce, sell, clean/condition, stock, import or export seed of PBR-protected varieties.

If seed was obtained and used illegally or without the authorization of the breeder, the breeder can choose to seek compensation, including for lost royalty revenue; lost markets; and for court costs; on delivered grain produced from that seed.

### Farmer Privileges

The “Farmers’ Privilege” is entrenched in legislation and allows farmers to produce PBR 91-protected varieties for use as seed on their farms.

Farmers are allowed to clean grain from PBR-protected varieties for use as seed on their farm, market and advertise seed they have produced from PBR 91 seed, and exchange PBR 91 seed with other farmers.

### Seed Cleaner Responsibilities

Expanded breeders’ rights mean that cleaners may be liable for breaches of the breeder’s right.

Seed cleaners should take precautions to ensure the seed they are cleaning was obtained legally, and that farm-saved seed that they clean will only be used on the farm of the farmer who has brought it in for cleaning.

---

The United Nations Declared 2016 “The International Year of Pulses”

In 2015, the global pulse industry set a target of increasing pulse consumption and production by 10% by 2020 and the U.N. and Pulse Canada stepped in to help the industry reach that goal

- Pulse Feasts and Global Pulse Days in 36 countries
- North American Consumer Campaign
- Partnerships with Canadian Influencers
- Canadian School Programs
- Travelling Exhibit
- Food Literacy Program Support
- Launch of Global Pulse Nutrition Database
- Food as Medicine Initiative
- Sustainability Literature Review
- Canadian Governmental Advocacy Visits
- Development of the Pulse Brand
- Ingredient Workshops and Product Showcases

**2016 IYP Results**

- Transitioned the initial IYP market access coalition into a global, multicommodity and self-sustaining coalition that will continue Codex-related advocacy work into the future
- Messages about pulses being a healthy, sustainable and affordable food option reached billions of people including consumers, researchers and political leaders
- In a survey of consumers who have taken the Pulse Pledge, 75% indicated that they are eating more pulses and 99% said they plan to continue eating pulses
- IYP enabled the pulse industry to engage with food industry, researchers, media, healthcare organizations, NGOs, universities, governments, and many other players that are integral components of the food value chain

**Pulse Canada** has now set a new goal for the Canadian pulse industry to create new demand in new use categories for 25% of its productive capacity by the year 2025

Thank you for your time and support in the development of this Saskatchewan Pulses EGS profile!

**Stakeholders Consulted**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cara Spence</td>
<td>International Research Specialist</td>
<td>Office of the Vice President of Research, University of Saskatchewan</td>
</tr>
<tr>
<td>Dr. Tom Warkentin</td>
<td>Strategic Research Program Chair, Pulse Breeder</td>
<td>Crop Development Centre</td>
</tr>
<tr>
<td>Carl Potts</td>
<td>Executive Director</td>
<td>Saskatchewan Pulse Growers</td>
</tr>
<tr>
<td>Dr. Karen Chad</td>
<td>Vice President Research</td>
<td>University of Saskatchewan</td>
</tr>
<tr>
<td>Dr. Darcy Marciniuk</td>
<td>Associate Vice President Research</td>
<td>University of Saskatchewan</td>
</tr>
<tr>
<td>Dr. Shannon Hood-Neifer</td>
<td>Vice President Innovation and Technology</td>
<td>Saskatchewan Food Industry Development Centre</td>
</tr>
<tr>
<td>Dan Prefontaine</td>
<td>President</td>
<td>Saskatchewan Food Industry Development Centre</td>
</tr>
<tr>
<td>Dr. Wilf Keller, Mike Cey, Bev Stangeland</td>
<td>---</td>
<td>Ag-West Bio</td>
</tr>
<tr>
<td>Dr. Tim Sharbel, Dr. Dave Schneider, Dr. Leon Kochian</td>
<td>Research Chairs</td>
<td>Global Institute for Food Security</td>
</tr>
<tr>
<td>Dr. Diane Martz</td>
<td>Director, International Research &amp; Partnerships Office</td>
<td>University of Saskatchewan</td>
</tr>
<tr>
<td>Dr. Mary Buhr, Dr. Bob Tyler, Dr. Fran Walley</td>
<td>Dean, Associate Deans, College of Agriculture &amp; Biosciences</td>
<td>University of Saskatchewan</td>
</tr>
</tbody>
</table>
Acknowledgements

Thank you for your time and support in the development of this Saskatchewan Pulses EGS profile!

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dale Kelly, Justin White, Dr. Rick Green, Luke Driedger-Enns</td>
<td>---</td>
<td>POS-Biosciences</td>
</tr>
<tr>
<td>Murad Al-Katib</td>
<td>President and CEO</td>
<td>AGT Food and Ingredients Inc.</td>
</tr>
<tr>
<td>Dr. Stuart Smyth</td>
<td>Research Chair, Assistant Professor, Department of Food and Resource Economics</td>
<td>University of Saskatchewan</td>
</tr>
<tr>
<td>Dr. Albert Vandenberg</td>
<td>Research Chair, Pulse &amp; Special Crops Breeder</td>
<td>University of Saskatchewan</td>
</tr>
<tr>
<td>Gina Feist</td>
<td>Research Program Manager</td>
<td>Western Grains Research Foundation</td>
</tr>
<tr>
<td>Dr. Ron Ponterollo</td>
<td>President &amp; CEO</td>
<td>Genome Prairie</td>
</tr>
<tr>
<td>Dr. Johannes Dyring</td>
<td>Managing Director</td>
<td>Innovation Enterprises</td>
</tr>
</tbody>
</table>

Special thanks to the following group for the presentation of the University of Saskatchewan Ethiopia Case Study Meeting:
Dr. Carol Henry, Dr. Susan Whiting, Dr. Bob Tyler, Dr. Bruce Coulman, Dr. William Brown, Rob Norris
thank you

Mark Nelson
+1 607.592.4947

5550 Wild Rose Lane, Suite 40039
West Des Moines, IA 50266
P: 515.225.2204
F: 515.225.0039

www.contextnet.com