MARKET ANALYSIS REPORT | FALL 2018

GLOBAL PULSE MARKET, PART II

FOOD OF THE PAST ... AND FOR THE FUTURE

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INDIA

India is the world's largest producer, consumer, and importer of pulses. India drives – and disrupts – the global pulse market. In the past year, as a consequence of two factors – significant production increases by domestic Indian growers, and India's imposition of import tariffs on dry peas, lentils and chickpeas – India's imports of pulses are down materially, and the global pulse market is in a state of flux, as exporters around the globe search for other markets to which they can sell their products.

India has two primary growing seasons – rabi (winter sowing, spring harvest) and kharif (late spring sowing, fall harvest). Different varieties of pulses grow in the different seasons, but the aggregate yields from the two seasons are similar. India saw a material jump in total pulse production from 2016 through 2018, with total pulse production growing more than 30% to 23.1 MMT in 2016/17 and 24.5 MMT in 2017/18. Early forecasts for kharif pulses in the 2018/19 season are only slightly behind the prior year because of some adverse weather and an apparent reduction in planting.

India Pulse Production (measured in millions of metric tons) (Agr. Ministry of India)

	2015/16	2016/17	2017/18
Chickpeas	7.1	9.4	11.1
Arhar/tur	2.6	4.9	4
Black matpe	1.9	2.8	3.2
Green gram	1.6	2.2	1.7
Others	3.1	3.8	4.5
Total	16.3	23.1	24.5

In addition to growth in aggregate yields in 2017, India also imported a record level of pulses in the 2017 – in excess of 5.5MMT, according to India's Agriculture Ministry. The recent growth in India's pulse imports has also been impressive, as demonstrated below.

India Pulse Imports (2012-16) (metric tons) (FAOSTAT)

	2012	2013	2014	2015	2016
Beans, dry	788,811	885,754	840,831	778,797	727,583
Chick peas	471,974	538,329	381,314	688,125	873,542
Lentils	441,264	679,662	729,759	1,161,802	753,566
Peas, dry	1,497,913	1,230,249	1,964,010	2,144,437	3,061,899
	3,199,962	**3,333,994**	**3,915,914**	**4,773,161**	**5,416,590**

This dual growth in domestic production and imports has suppressed prices below what the Indian government has determined as sufficient to allow India's domestic growers to earn a minimum level of profit. To combat this downward price pressure, the Indian government-imposed tariffs on the import of peas, lentils and chickpeas in the fall of 2017 and continuing throughout 2018.

Notwithstanding the recent oversupply of pulse products in India and the fact that India is, by a wide margin, the world's largest producer of pulses – especially chickpeas, dry edible beans, dry peas, lentils and pigeon peas – due to a combination of poor agricultural yields, a huge and growing population, and insatiable

consumer appetite, India will also continue to be the world's largest importer of pulses, including the single largest importer of dry peas, dry beans, lentils and chickpeas.

Notwithstanding the surge in Indian production and the new trade barriers imposed by New Delhi, imports of pulses into India have exceeded 5 MMTs in each of the past two years. Exporters from Canada, Australia, USA, and the Black Sea Region, however, are battling for India's market share in a restrictive environment.

CHINA

In the last 60 years, China's population has grown from 650 million to more than 1.4 billion people. During that same period, the country's annual production of its two primary pulse crops – dry peas and dry beans – has fallen from more than 6 million metric tons to less than 2.5 million metric tons in recent years, a result of a rapidly changing economy and dietary preferences.

China Pulse Production (metric tons) (2012-16) (FAOSTAT)

	2012	2013	2014	2015	2016
Beans, dry	1,126,098	1,013,858	1,061,769	1,112,765	1,139,866
Broad beans, horse	1,612,000	1,456,000	1,428,700	1,500,000	1,608,903
Peas, dry	1,278,000	1,266,000	1,350,000	1,267,000	1,194,131
	4,016,098	**3,735,858**	**3,840,469**	**3,879,765**	**3,942,900**

Notwithstanding this downward trend over several decades, in recent years Chinese consumption of pulses has stabilized and even begun to increase. China is currently the world's third largest producer and second largest importer of dry peas. China is a top-10 producer of dry beans (comparable volumes to the United States) and has also developed a robust dry bean export market.

China Pulse Imports (metric tons) (2012-16) (FAOSTAT)

	2012	2013	2014	2015	2016
Beans, dry	80,407	65,451	72,100	99,576	84,387
Broad beans, horse	2,356	3,044	3,034	2,833	3,911
Chick peas	537	602	727	895	779
Lentils	1,132	867	1,005	985	2,183
Peas, dry	689,347	1,053,518	799,879	923,327	1,022,876
	773,779	**1,123,482**	**876,745**	**1,027,616**	**1,114,136**

NORTH AMERICA

Total pulse production in North America is approximately 12 million metric tons, representing approximately 15% of worldwide pulse production. With respect to dry peas and lentils, however, North America (primarily Canada) is the largest producer in the world and represents 37% and 55%, respectively, of total world production.

Pulse Production (By Commodity, By Country, in metric tons, 2016 data) (*FAOSTAT*)						
	Dry Beans	**Dry Peas**	**Lentils**	**Chickpeas**	**Other Pulses**	**TOTAL**
North America						
Canada	249,400	4,611,100	3,233,800	106,900	0	**8,201,200**
United States	1,269,916	782,388	255,061	107,542	25,945	**2,466,797**
Mexico	1,088,767	2,438	2,110	121,567	157,089	**1,408,941**
	2,608,083	**5,395,926**	**3,490,971**	**336,009**	**183,034**	**12,076,938**

Two-thirds of Canadian production is earmarked for export markets. Approximately half of U.S. production goes into export markets. Almost no Mexican product is exported.

Pulse Exports (By Commodity, By Country, in metric tons, 2016 data) *(FAOSTAT)*				
	Dry Beans	**Dry Peas**	**Lentils**	**TOTAL**
North America				
Canada	336,154	3,136,682	2,053,528	**5,526,364**
United States	473,975	542,200	299,280	**1,315,455**
Mexico	32,892	551	1,289	**34,732**
	843,021	**3,679,433**	**2,354,097**	**6,876,551**

CANADA

Canada is the world's largest producer of dry peas and lentils, yielding more than 4.5MMT of dry peas and more than 3MMT of lentils in recent years. Approximately 95% of Canada's pulse production is concentrated in the provinces of Saskatchewan and Alberta.

Canada Pulse Production (metric tons) (2012-16) (FAOSTAT)					
	2012	**2013**	**2014**	**2015**	**2016**
Lentils	1,537,900	2,261,700	1,987,000	2,540,500	3,233,800
Peas, dry	3,340,800	3,960,800	3,810,100	3,200,700	4,611,100

Most of Canada's production is exported. While Canada's dry peas are primarily exported to China and South Asia (India, Pakistan, and Bangladesh), Canada's lentils are exported very broadly around the world, and no single country purchases more than 20% of Canada's exported lentils.

Canada Pulse Exports (metric tons) (2014-18) (StatPub)				
	2014-15	2015-16	2016-17	2017-18
Peas, dry	3,085,819	2,651,797	3,947,841	3,086,439
Lentils	2,180,711	2,144,883	2,456,121	1,539,514
	5,266,530	**4,796,680**	**6,403,962**	**4,625,953**

Canada Top Pea Export Nations (metric tons) (2014-18) (StatPub)				
	2014-15	2015-16	2016-17	2017-18
India	1,269,402	1,230,521	1,927,305	337,104
China	795,751	769,443	1,017,206	1,888,042
United States	186,785	102,382	114,879	355,041
Bangladesh	486,931	273,573	417,421	162,647
	2,738,869	**2,375,919**	**3,476,811**	**2,742,834**

Canada Top Lentil Exp. Markets (metric tons) (2014-18) (StatPub)				
	2014-15	2015-16	2016-17	2017-18
Turkey	386,029	387,398	363,361	256,270
Mexico	34,341	14,137	35,589	133,035
Algeria	73,308	67,782	62,102	82,902
Sri Lanka	78,308	98,491	86,700	76,136
	571,986	**567,808**	**547,752**	**548,343**

Because of Indian tariffs on pulse imports imposed in 2017 and that have continued in 2018, there has been significant disruption in trade flows over the past year. While Canada seemingly has a current lock on the lentil export market – representing approximately two-thirds of all world exports – Canada's recent dominance in the dry pea export market (representing 50%+ of the export market) – has recently seen significant increased competition from the Black Sea region (Russian and Ukraine) and to a lesser degree the Baltic States (Lithuania, Latvia and Estonia).

Notwithstanding these headwinds, Agriculture Canada raised its estimate for pea exports in the 2017-18 season that ended in July 2018 to more than 3 MMTs. As reflected in the above chart, Canadian exporters were able to increase pea sales into China and the United States, compensating some for the significant decrease in exports to India from the prior year.

In the most recent completed year (2017-18, July end), Lentil exports decreased by nearly 1 MMTs. The prospects are good for a stronger lentil export market in 2018-19.

UNITED STATES

The United States is a top 10 world producer of dry beans – it is a well-established crop across the northern states, featuring a broad array of varieties that are in demand around the world. The U.S. also has a strong niche grower base of dry peas, lentils and chickpeas.

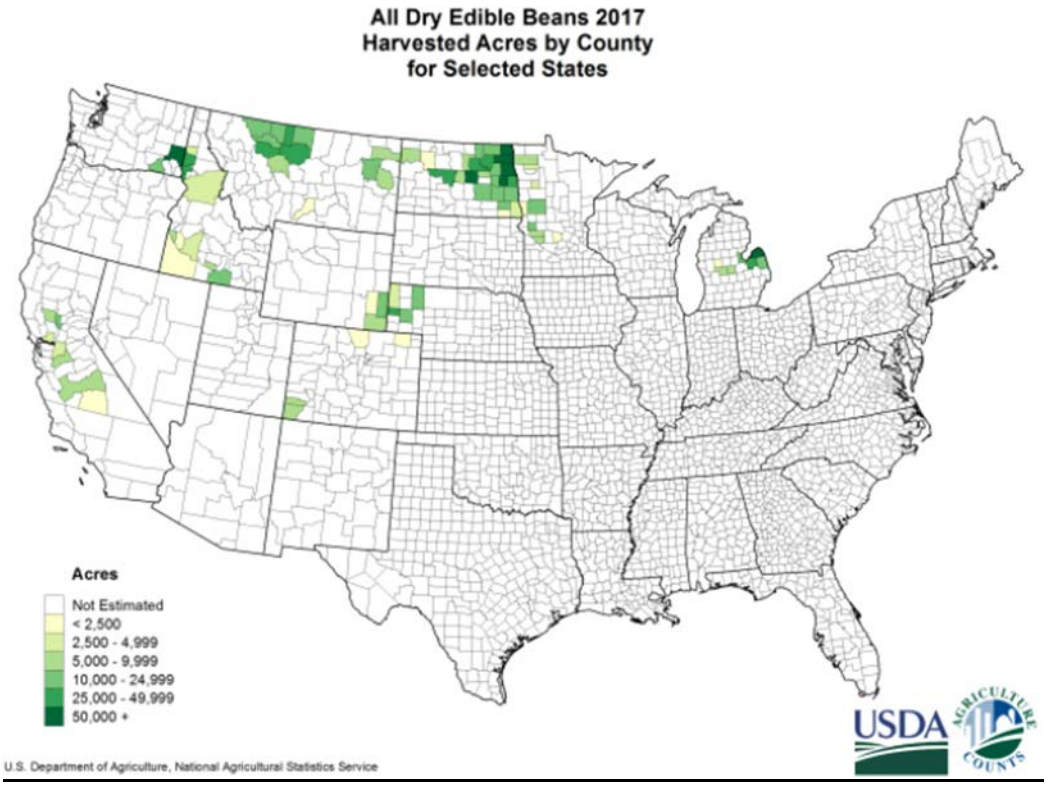
U.S. Pulse Production (metric tons) (2012-16) (FAOSTAT)					
	2012	2013	2014	2015	2016
Beans, dry	1,448,090	1,114,750	1,311,340	1,366,270	1,269,916
Chick peas	151,137	161,434	127,369	114,440	107,542
Lentils	240,490	227,660	156,310	239,320	255,061
Peas, dry	499,042	708,510	778,140	829,303	782,388

The majority of the U.S. dry bean production is consumed in the domestic market, with between 20% and one-third being reserved for exports. The other primary pulses – dry peas, lentils, and chickpeas – most U.S. domestic production is sold into export markets.

U.S. Pulse Exports (metric tons) (2012-16) (FAOSTAT)					
	2012	2013	2014	2015	2016
Beans, dry	487,800	453,247	483,863	428,603	473,975
Chick peas	77,767	53,670	52,249	46,491	120,118
Lentils	181,441	210,816	256,285	255,196	299,280
Peas, dry	357,461	441,451	584,881	473,379	542,200

Pea and lentil exports plummeted in the 2017-18 season over the prior period, again a function of Indian tariffs and other trade barriers that have disrupted global markets.

Because of the importance of the U.S. bean market, we spend some time examining it in further detail. The North American edible dry bean market is very large and diverse compared to other regions the world. The U.S. typically plants 1.5 million to 1.7 million acres each year. The figure below shows dry edible bean acres for critical states in the U.S.



U.S. acreage for 2018 is expected to finish 7% lower than 2017 levels, which were already slightly smaller than average. That is a decrease to 1.37 million acres.

U.S. dry bean exports dropped 14% to 16% (depending on various bean types included across multiple export lists) from 2016 to 2017. Several factors influence the export volume, including bean production and efficiency, weather patterns, availability, global political unrest, tariffs, and import volume. During 2017, one reason for the sharp drop in U.S. dry edible exports was the imposition of sanctions and tariffs on bean imports into the Dominican Republic. Pinto beans dropped nearly 42% between 2016 and 2017 after the Dominican Republic prohibited imports on beans for the first three months of 2017. The country recently issued news on tariff implications for 2018 and beyond, which include a current 11.8% tariff for the first 35,000MT and then a 50.4% tariff on all imports after that (USDryBeans.com). Tariffs should be fully lifted in 2020, but the pinto bean market in the Dominican Republic could be vastly different after another full year of crop production.

In addition, Argentina has become a stronger competitor in the global bean market, creating new competition to the U.S. in some markets where the U.S. has been a primary supplier of beans. Also, a stronger U.S. dollar has deterred importers from purchasing U.S. edible dry beans. The below chart shows all dry bean exports by bean class and the change in percent from 2016 to 2017.

Table 10: U.S. dry bean calendar-year export volume [1/]

Bean class	2015	2016	2017	Change 2016-17
		1,000 cwt (bags)		*Percent*
Black	965.4	1,301.3	1,273.4	-2
Pinto	1,313.8	1,945.5	1,123.4	-42
Small red	302.4	130.0	182.1	40
Navy	2,819.4	2,163.2	1,996.2	-8
Dark-red kidney	945.0	798.8	997.7	25
Light-red kidney	100.2	247.2	200.0	-19
Other	613.4	763.0	2,386.6	213
Total	**8,478.4**	**8,401.0**	**7,237.9**	**-14**

1/ Excludes garbanzo beans. cwt =hundredweight, a measure of weight equal to 100 pounds.
Source: USDA, Economic Research Service using data from Department of Commerce, U.S. Census Bureau.

Expectations for the 2018 calendar year exports are up 11% from 2017 according to experts with the USDA Economic Research Service. The anticipated rebound is expected to come from increases in pinto bean exports and more normal regular weather patterns to allow for a robust supply. USDA's report was published in April 2018, with an update due in late October; there is some risk to those projections in light of the tumultuous trade environment around the world, with tariffs being threatened or actually imposed.

The following are key U.S. export destinations for its dry bean supply.

Table 11: U.S. dry bean calendar-year export volume, by selected destination [1/]

Destination	2015	2016	2017	Change 2016-17
	-------- 1,000 cwt (bags) -------			Percent
Mexico	1,670.8	1,973.2	2,266.1	15
Canada	1,464.5	1,436.9	1,566.5	9
United Kingdom	969.0	748.2	838.8	12
Dominican Republic	983.6	728.1	432.8	-41
Italy	695.6	572.0	1,042.6	82
France	265.3	212.4	128.6	-39
Japan	271.5	155.9	154.5	-1
Other	3,333.1	4,770.1	2,500.4	-48
Total [2/]	**9,740.8**	**10,675.8**	**9,021.0**	**-16**

1/ Includes commercial sales and movement under food aid programs such as P.L.480. 2/ Excludes garbanzo bean volume and includes seed. cwt = hundredweight, a unit of measure equal to 100 pounds.
Source: USDA, Economic Research Service using data from Department of Commerce, U.S. Census Bureau.

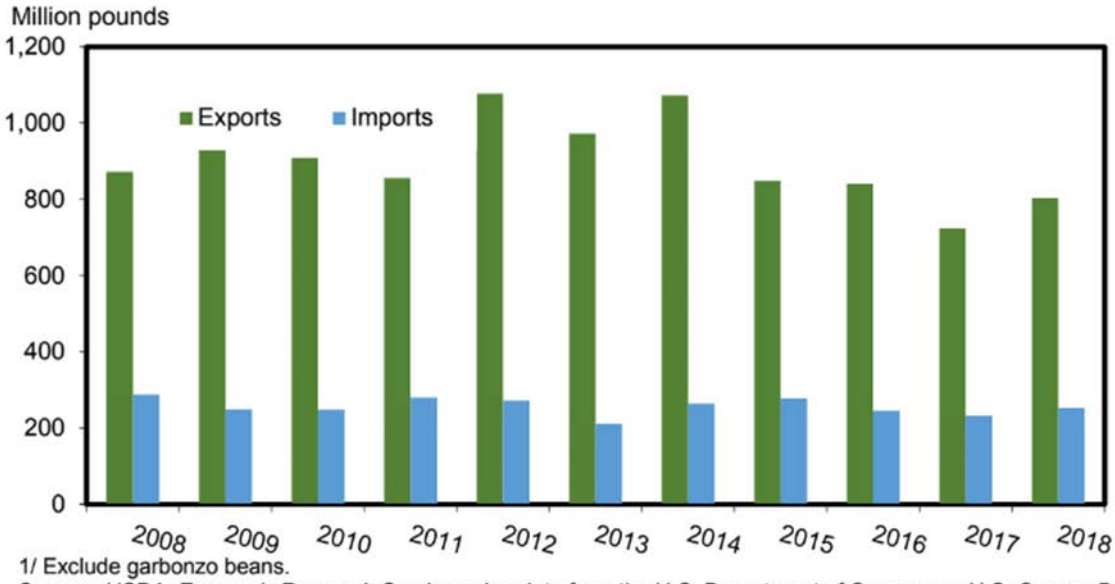
While the U.S. is a net exporter of dry beans, it also imports a significant volume of beans, especially because of growing U.S. consumption and appetite for a wide range of varieties not grown domestically. The following charts present some additional relevant on the import and export of dry beans by U.S.

Table 12: U.S. dry bean calendar-year import volume [1/]

Bean class	2015	2016	2017	Change 2016-17
	---------- 1,000 cwt (bags) ----------			Percent
Black	440.5	327.7	316.2	-4
Pinto	139.4	163.2	161.5	-1
Small red	109.1	120.9	126.2	4
Navy	39.9	58.3	57.7	-1
Dark-red kidney	150.0	62.8	53.7	-14
Light-red kidney	292.4	187.8	158.2	-16
Other	1,467.0	1,425.6	1,357.8	-5
Total	**2,778.8**	**2,456.9**	**2,331.8**	**-4**

1/ Excludes garbanzo beans. cwt = hundredweight, a unit of measure equal to 100 pounds.
Source: USDA, Economic Research Service using data from Department of Commerce, U.S. Census Bureau.

Figure 12
U.S. dry bean trade[1/]



1/ Exclude garbonzo beans.
Source: USDA, Economic Research Service using data from the U.S. Department of Commerce, U.S. Census Bureau.

MEXICO

Mexico is a net importer of pulses, especially beans, and especially beans originating in the United States. While Mexico produces a large volume of dry beans, it has relatively weak yields. Diets in Mexico include large amounts of beans.

AUSTRALIA

Pulse production constitutes an essential component of Australia's agricultural sector. Notably, Australia has been the world's second-largest producer of chickpeas (after India) for several years, but Australia is also a significant producer of several other pulse varieties, many of which are grown for export throughout Asia, including lentils and broad beans (fava beans). The below chart shows Australian pulse production through 2016.

Australia Pulse Production (metric tons) (2012-16) (FAOSTAT)

	2012	2013	2014	2015	2016
Broad beans	268,100	377,200	327,700	283,800	423,527
Chick peas	673,371	813,300	629,400	555,400	874,593
Lentils	264,017	164,220	238,120	230,500	181,638
Lupins	981,512	458,700	625,600	549,100	651,946
Peas, dry	342,500	319,700	342,100	290,400	311,793

Chickpea production remained strong in the 2017 harvest, but there is a precipitous decline in chickpea production in the 2018 harvest as a result of a severe drought and some growers moving away from chickpea production in the face of India's import duties. Recent growth in lentil production is not reflected in the above

chart. Australian lentil production in 2017 advanced to more than 400 KMT. The 2018 harvest will see lentil production higher than chickpea production.

Australia's pulse export market is pointed at India (chickpeas), Bangladesh (lentils) and Egypt (broad beans). Chickpea exports fell significantly in the last year, while lentil exports have increased. Australian chickpeas compete with several exporter nations that are closer in proximity to India, especially Russia. In the 2017-18 season (November through July), Australia's chickpea exports plummeted by 82%, lentil exports fell by 74%, and dry pea exports fell by 80%. Meanwhile, Russia boosted chickpea and lentil exports to India by 51% in the 2017-18 season.

Australia Pulse Exports (metric tons) (2014-18) (UkrAgroConsult)

	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19F
Lentils	302,000	208,000	193,000	897,000	380,000	440,000
Chickpeas	629,000	663,000	1,145,000	2,293,000	850,000	500,000

BLACK SEA REGION

The Black Sea nations (Russia and Ukraine) have become formidable competitors to Canadian, the U.S., and Australian pulse producers in the last couple of years. Both nations have climates and lands that are similar to Saskatchewan and Alberta, and under the right weather conditions, the Black Sea can harvest high-quality pulse crops, get them to market at very competitive prices, and save time and money on transportation.

Black Sea Pulse Production (metric tons) (2013-17) (UkrAgroConsult)

	2013	2014	2015	2016	2017
Dry Peas - Russia	1,350,000	1,503,000	1,716,000	2,199,000	3,286,000
Dry Peas - Ukraine	270,000	360,000	378,000	745,000	1,050,000

Canada reduced its exports of major pulses (peas, lentils, and chickpeas) to India's market by 82% in the 2017-18 season (August-July) compared to the previous season. This included drops in pea and lentil exports to 337 KMT (-82.5%) and 163.7 KMT (-83%), respectively. Canada remains the top pea supplier to the Indian market – in spite of this drop. Supplies of major pulses from the U.S. to India decreased 81%

The Black Sea region (Russia and Ukraine) was able to defend (and actually) improve its market position vis-à-vis other pulse exporter nations that saw demand for their products in the face of Indian tariffs. Because of its ability to deliver at a competitive price, Russian exporters managed not only to retain their market position but also to increase its presence in the dry pea segment of India's market in the 2017-18 season.

BALTIC STATES

The Baltic States (Lithuania, Latvia, and Estonia) are small countries but have a suitable climate and terrain to produce high yielding pulse crops. In particular, Lithuania is a significant producer of dry beans and dry peas, and it experiences high yields in its production.

Lithuania had a bumper crop during 2017 but struggled to export surplus product and decreased total year-over-year exports in 2018. Nearly 90% of Lithuania's pulse exports went to India during the 2016-17 season, but only 55% of its exports during the 2017-18 season went to India.

FRANCE

France has remained a stable competitor in the global dry pea market. France also has one of the better agricultural production yields compared to other pulse producing nations. During 2015, France produced over 37,000 HG/HA, and in 2016 that number fell to around 25,000 HG/HA – still some of the best yields among the sizeable dry pea producing nations, as evidenced by the following chart.

Dry Pea Yields by Country (hg/ha) (2012-16) (FAOSTAT)

	2012	2013	2014	2015	2016
Canada	22,649	29,798	23,999	21,776	27,169
China	15,491	13,326	14,211	14,906	14,323
Ethiopia	12,790	13,792	14,854	16,100	16,381
France	40,288	39,737	37,101	37,030	24,927
India	9,329	11,016	9,614	9,463	9,272
Lithuania	20,167	21,083	24,719	28,800	26,758
Mexico	11,022	11,645	12,661	13,332	12,824
Russia	14,308	13,978	16,756	18,627	21,150
Ukraine	16,583	15,583	23,390	22,403	31,262
USA	19,842	21,967	21,376	18,915	19,439

France has natural outlets based on geographic location and relationships with the EU to ship dry peas. Like other dry pea export nations, France was heavily oriented towards supplying the Indian market, but in the 2017-18 season, France was able to mitigate the declines in its export volumes by increasing sales to other member EU nations.

EAST AFRICA

Tanzania is a large producer of dry beans, producing approximately 1.1 MMT to 1.2 MMT of dry beans per year. On a global scale, Tanzania only exports about 100,000 metric tons of that production.

Ethiopia is the world's second largest producer of fava beans and ranks highly in the production of chickpeas, dry peas, and dry beans; however, most of that production is consumed domestically. That said, some close market watchers see Ethiopia as eyeing new markets for export of its fava beans, kidney beans, and chickpeas.

WEST AFRICA

The West African nations of Niger, Nigeria, Cameroon, and Burkina Faso are some of the largest producers of cowpeas (black-eyed peas) in the world, representing much of total world production of cowpeas. However, production yields in this region are terrible, and the crops are disfavored in some markets – notably the EU – because of questions around some of their use of pesticides. Nevertheless, there have been recent efforts by India and the United States to help these nations enhance their agricultural practices and develop a place in the world pulse market. Thus, in the coming decade, this region is one to monitor as a potential competitive force in the world pulse market.

MYANMAR

Myanmar is the single-largest producer of dry beans in the world. Myanmar consumes a lot of the volume it produces, but it also exports a significant portion and is the largest exporter nation of dry beans.

Dry Bean Exports (2012-16) (FAOSTAT)					
	2012	2013	2014	2015	2016
Argentina	346,864	104,114	255,260	380,973	436,055
Brazil	37,668	33,147	64,626	119,958	45,049
China	944,106	800,872	507,059	464,486	590,564
Ethiopia	147,683	225,058	227,633	201,947	184,276
India	2,162	3,682	4,312	8,171	9,516
Myanmar	1,285,000	1,370,000	867,866	721,602	604,713
Uganda	24,494	28,465	35,698	145,902	5,266
Tanzania	16,210	6,166	84,657	51,723	97,936
USA	487,800	453,247	483,863	428,603	473,975

Most dry bean statistics aggregate all varieties of dry beans for comparison purposes. However, Myanmar primarily produces and consumes mung beans, which is a variety preferred in South Asia and is not produced nor imported in any statistically significant manner in the Western Hemisphere.

LATIN AMERICA

Argentina's activity in the world pulse market is centered around its dry bean production, but its total production is only approximately 30% of U.S. production. Most of that production has been earmarked for export in recent years. The US Dry Bean Council posted an article in the spring of 2018 noting an increase in Argentine bean exports. Argentina has increased bean production and increased exports by nearly 7% compared to the prior year. Argentina is a competitive threat to the Mexican and Dominican Republican markets the US serves. Mexico had not been a primary place of exports for Argentina until the 2017-18 season.

Brazil is a very large producer of beans, but mainly for its own domestic consumption. Brazilians eat beans in their diets often and import some level of black beans.

CONSUMPTION

OVERVIEW

Once removed from pods and dried, pulses can be stored without refrigeration for over a year and can be consumed directly by the household without undergoing processing. Dry beans, peas and chickpeas need to be soaked for approximately twelve hours before cooking, which itself requires between 45 minutes and 1.5 hours to complete. Other pulses, such as lentils and split peas, generally do not need soaking and require much less time to cook, anywhere between 10 and 40 minutes.

Per capita consumption of pulses varies wildly across the globe.

- Approximately 7 kg of pulses are consumed worldwide per person per annum, supplying 65 calories and 4.0 g of proteins per person per day.
- At the country level, dietary shares are the highest in Rwanda and Niger, accounting for as much as 13 percent of all calories consumed … greater than 25 kg per person per annum.
- In North America, pulse consumption is approximately 3.5 kg per person per annum.

Pulses currently play a substantial role in diets in many of the world's least developed countries (LDCs). Indeed, the role of pulses in the diets of economically vulnerable countries has grown in importance in recent decades, and significant pulse consumption is a feature of many regions in the developing world. Dietary shares at the regional level still remain relatively minor, but the long-term trend of declining consumption witnessed in earlier decades as LDCs develop appears to be in reversal.

The same cannot be said of developed regions, particularly Europe and Northern America – but also even China as it develops – in these regions, pulse consumption per person growth has been negligible, or in the case of China, has fallen. The lack of convenience, preferences and access to affordable animal proteins underpin these trends.

Given that mono-diets are associated with poor nutritional outcomes, the inclusion of pulses can contribute to improving the nutritional balance of food intake. They represent an important, and often a first step towards dietary diversification in resource-poor and subsistence agriculture contexts. Their inclusion in the diets of people is facilitated by the significant price advantage they have over animal-based products, given that pulses are a much cheaper staple source of protein, especially for low-income consumers around the world, and more so in societies that do not consume animal protein.

The recognized health benefits of pulses have led to their being an integral part of nutritional programs in many countries. This, plus the need to respond to consumer needs – especially in reducing their lengthy cooking time – has fostered the development of more than 350 commercially known pulse-related value-added products, including pulse flour, starch, noodles, bread, breakfast cereals, dumplings and baked/fried whole pulse snacks. Pulses are also used in pet and animal feed preparations. While commonly thought of in a vegetarian context, pulses are also used as meat binders, extenders and stabilizers. The absence of gluten and the high-quality protein content constitute an additional advantage that makes pulses particularly suitable as an alternative to wheat in breads, pasta products, tortillas, bagels, crackers, flat breads, pizza crusts and cookies.

With food manufacturers becoming more concerned about the macro- and micronutrient composition of the products they offer, pulses have become a commodity of growing interest. This is due to their unique

protein composition profile which complements the protein composition of cereals, making pulse flours a natural companion ingredient for traditional cereal-flour-based foods.

While the majority of animal feed requirements are satisfied with oilseeds and coarse grains, pulses (peas in particular) can serve as a low-cost foodstuff alternative. Indeed, being an important source of amino acids – the building blocks of protein – as well as energy supplied by carbohydrates, pulses are also applied in animal diets. Typical animal feeding applications include pet food, aquaculture, and general livestock (poultry, swine and cattle). However, feed use of pulses at the global level has been waning over time. The share of feed in total pulse use stood at 30% in the early 1990's but has fallen to approximately 20% in recent years.

Industrial uses of pulses are not extensive as of yet, although pulses are being used in adhesives and carbonless paper, and the potential for biofuel production from hulls and stalks is being explored.

TRENDS

There were over 27,000 new legume (which includes pulses, soybeans, and others) products placed on the global market between 2013 and 2017, according to Portugal Foods and Universidade Catolica Portuguesa. Many of the products claimed vegan status and many also claimed gluten-free status. The three product types that saw the most growth were meat-substitutes, pasta, and bean-based snacks. During that time, Europe saw meat-substitutes grow 451%, pasta 295%, and bean-based snacks 128%. The broad and highly explosive array of legume products took the market by storm amidst dietary changes in North America and Europe.

Bean Burger Lentil Pasta

(https://www.news-medical.net/news/20180212/Meat-substitutes-and-legume-products-prove-successful-in-European-market.aspx)

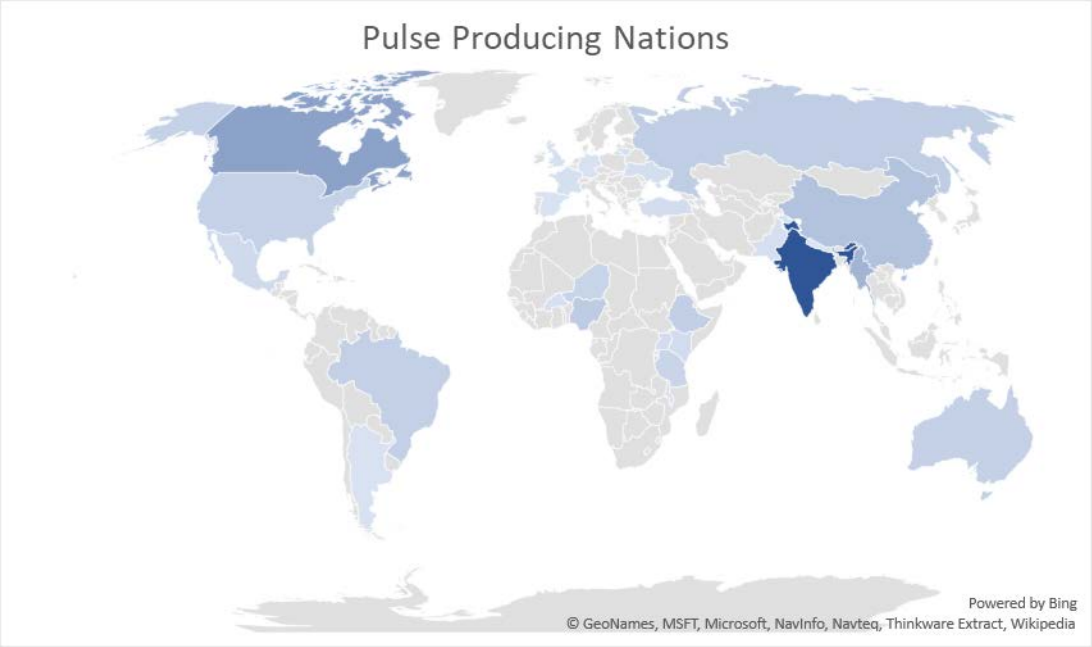
Pea proteins, bean flours, and other types of pulse-derived products have also surged in popularity as meat-substitutes and different kinds of pasta have become more popular. Unique snacks, such as bean dip and chocolate covered chickpeas, have contributed to changes in the snack food industry, making it a more competitive arena for new entrants and threatening previously established players. The beverage industry has recently gone through large shifts away from popular soda brands to more unique drinks that contain less sugar and provide some sort of health benefit. The snack industry is facing similar changes as the beverage industry has in recent years and will continue to disrupt traditional snack consumption patterns. The snack food industry may change the dynamic and demand for pulses, but snack-food in North American and European countries will play a relatively small global role in production compared to global pulse consumption habits.

COSTS

The most salient theme in the world pulse market in the past 18 months has been the disruptions that the market has experienced as a result of import tariffs imposed by the Indian government. The imposition of those tariffs caused exporter nations to scramble to place their supply. Why then, has Russia (in particular) been able to not only maintain its export volumes into India, but grow those volumes? The full answer to that question is beyond the scope of this study, but it is pertinent to understanding the interplay among what we view as the dominant factors at play in world pulse market and the ability of net exporters to compete successfully.

PRODUCTION COSTS

Production costs for the pulse industry vary on several factors including geographic region, efficiency, technology, irrigation, etc. The most significant contributor to production costs is the geographic region in which the pulses are produced. As shown below, pulses are restricted to specific areas. In more analysis based on yield volumes, it is notable the highest yields come from areas in which the climate is beneficial to pulses specifically. Examples would be cool, dryer places such as Canada and Australia. Regions with extreme temperatures and high rainfall reduce the yields on pulses, while cooler, dryer places promote healthy, natural growth and reduce costs.



Efficiency, technology, and irrigation all contribute to production costs. Countries with high labor costs, such as Canada and the US, have more expensive labor than countries in Asia, such as Myanmar and India. With labor costs as a high expense in developed nations, technology, efficiency, and irrigation become more critical to offset costs and keep prices competitive. Technology drives production as farmers in developed countries may use specific software, harvesting machines, etc., to get the best results in production and yields, thus lowering production costs per MT produced. Irrigation can spike production costs if the irrigation systems are inadequate or non-existent. Producers with efficient technology and irrigation systems are better equipped to handle changes in rainfall and drought conditions.

Other costs for the farmer include land costs, seed and water costs, soil treatments, herbicide, fertilizers, and machinery. Fertilizer and lime have increased in price in recent years. Seed prices for some pulses, such as beans, have risen as well.

Researchers have not engaged in a comprehensive comparative study (at least that has been published and made publicly available) of the production costs that pulse farmers around the globe incur, and the degree to which the variance from country to country of those production costs impacts the competitiveness of pulse products themselves.

Our use of the term "Production Costs" includes (a) input costs (e.g., seeds, fertilizer, pesticides, equipment), (b) financing costs, and (c) labor costs. Assuredly, there are regional differences that impact competitiveness.

Input Costs. The general sentiment of the available research we reviewed is that there is not a measurable regional difference in the hard input costs that growers incur, though what inputs they use do vary.

Financing Costs. In terms of financing costs, beyond just the cost of money, there is a broad range of financing requirements and governmental support programs that support farmers – it seems to be universal that every nation has a policy in place to protect their farmers from the vicissitudes of agriculture. Importantly, India has in place an MSP (Minimum Support Price) system where the government will purchase pulses (or other agricultural commodities) from farmers at a minimum price below which the farmer would suffer a loss.

Labor Costs. It is axiomatic that the poorest nations on the earth also have the lowest wage rates in the world. Many of those nations are the biggest producers of pulses (e.g., India, Myanmar, Ethiopia, Nigeria), and would presumably be positioned to compete in the world pulse market for market share in the same manner than manufacturers have for decades been able to shift their manufacturing to low cost nations. But the advantage of low labor costs is negated because of the significant variance in yields between low cost labor nations and higher cost labor nations. See the discussion below on Production Yields.

PRODUCTION YIELDS

As mentioned above, there is a material variance between the production yields from country to country and commodity to commodity. There are controllable factors in driving yield improvements – such as rotation practices, mechanization, disease control – and there are factors that cannot be controlled, such as weather and terrain.

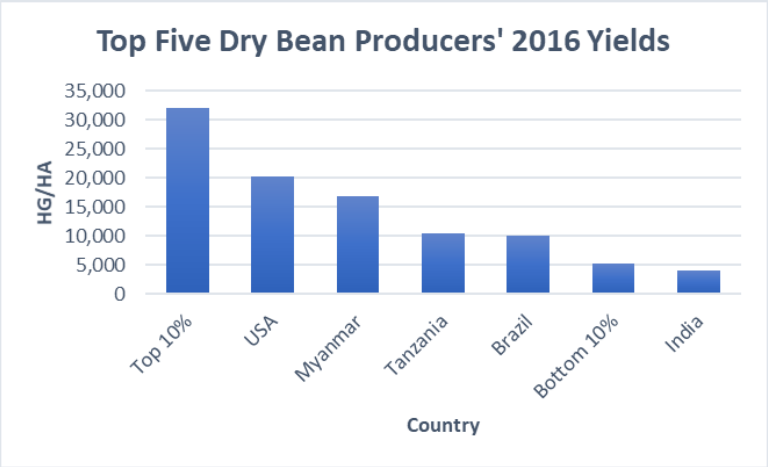
The following charts show differences in yields across countries of the primary pulse commodities. The bar charts shown for each category of pulses show the top producer nations' yields and also include the top and bottom 10% of yielders (typically small market participants) as benchmarks. The data serves as a comparison; the 10% threshold is used to eliminate outliers and countries with high yields that do not produce large volumes. The advantages that many low labor cost countries enjoy – especially India – they give up in terms of poor yields.

EDIBLE BEANS

The top producers of edible dry beans do not have the highest or lowest yields but fall somewhere in the middle. The U.S. and Myanmar are strong performers, and India is a weak performer. When looking at the

top area harvested, one can draw additional conclusions from the data. India harvests the most acres, produces the second most amount of dry beans, but has very low yields. Myanmar produces 33% more dry beans than India, but India allots 207% more acreage to dry beans than Myanmar does. Looking at different countries and their metric tons per hectare yields is important in understanding the world market of pulses.

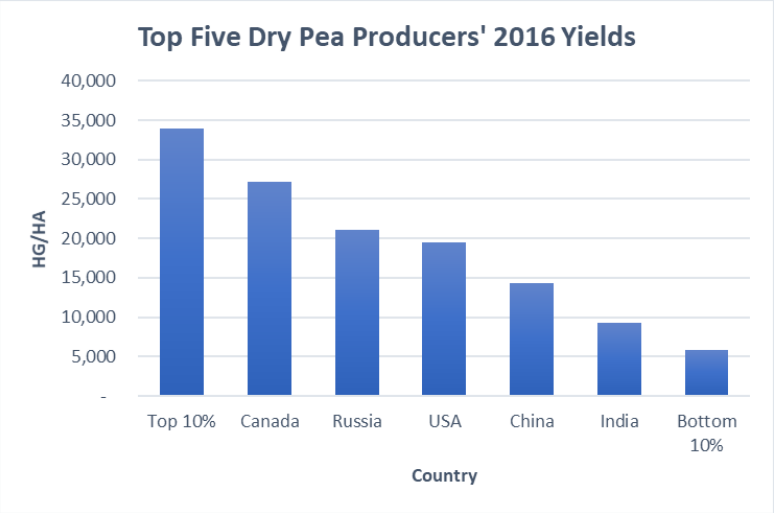
Top Producers	Produced (MT)	Hectares	Yields MT/HA)
Myanmar	5,189,977	3,080,789	1.68
India	3,897,611	9,466,833	0.41
Brazil	2,615,832	2,584,170	1.01
USA	1,269,916	630,743	2.01
Tanzania	1,158,039	1,118,406	1.04



DRY PEAS

Dry peas are largely produced in Canada and Russia, both countries with a large allotted land space as well as strong yields. India, similar to edible dry bean production, struggles with efficient yields and performance. The U.S. is efficient but plants less volume, as other crops in the U.S. may pose better yields and cash per acre returns.

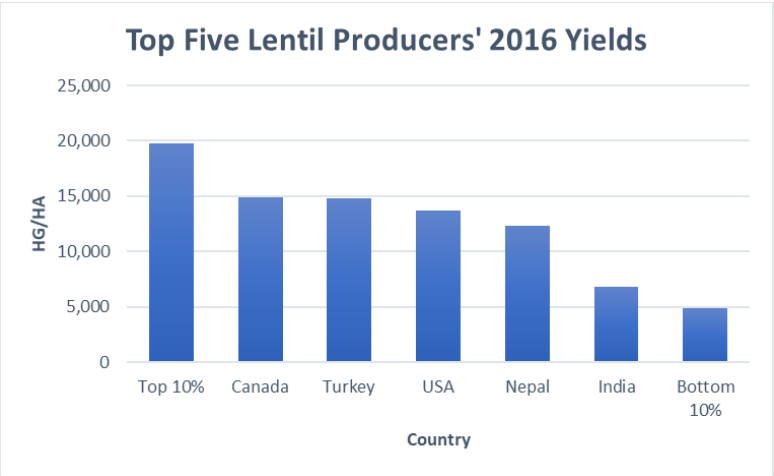
Top Producers	Produced (MT)	Hectares	Yields (MT/HA)
Canada	4,611,100	1,697,200	2.72
Russia	2,199,489	1,039,938	2.12
China	1,194,131	833,741	1.43
India	1,020,366	1,100,452	0.93
USA	782,388	402,488	1.94



LENTILS

The top lentil producers all have relatively similar yields. Canada is about the same as Turkey, and the U.S. and Nepal are not far behind. India, just as with edible dry beans and dry peas, is very inefficient. Canada's efficiency in lentil yields has helped Canada become the world's largest producer and exporter of lentils. Turkey's geographic location and yields pose a threat to Canada for global market share if Turkey decides to start producing more lentils. With a slightly better farming system, India could strengthen itself as a lentil producer and become more self-sustainable.

Top Producers	Produced (MT)	Hectares	Yields (MT/HA)
Canada	3,233,800	2,175,200	1.49
India	1,055,536	1,548,106	0.68
Turkey	365,000	246,322	1.48
USA	255,061	186,079	1.37
Nepal	253,041	205,939	1.23



PROCESSING COSTS

Volume III of this study will examine the dominant pulse processors in each major pulse exporting country in the world. Our initial conclusions from the review of the financial statements of several of the publicly listed processors and discussions with several market participants is that while direct processing costs do vary, overall profitability of those processors – with the processors in the EU, Australia, U.S. and Canada experiencing the best profit margins in the sector – suggests that higher cost nations tend to operate far more efficiently than in lesser developed countries.

QUALITY

Canadian and U.S. pulse producers and processors emphasize quality and consistency of their products to provide an edge against overseas competitors whose transport costs into their key buying markets are considerably lower. According to a small study done by USDryBeans.com, the U.S. is a substantial exporter due to its high quality, consistency, good value, and reliability. The U.S. is known for producing food safe to eat, providing a similar if not homogenous crop production for consumers. Efficient productivity, a vast country that has different weather patterns, and a stable political system, ensure reliability in crop production and order fulfillment for national and international end-users. Due to these factors, the U.S. can sell edible dry beans a price that tends to yield a good return for its growers and processors.

TRANSPORTATION COSTS

The primary disadvantage that U.S., Canadian and Australian pulse exporters have is their long distance from the primary markets into which they sell their products. The below chart highlights the variance in ocean shipping costs based on origin and destination.

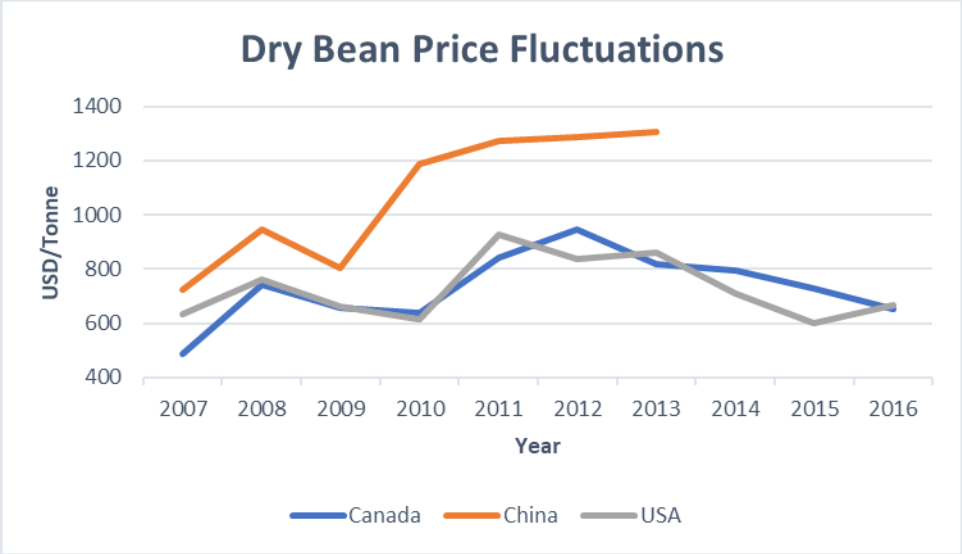
Estimated Shipping Costs		
	Range	
	Low	High
USA (Seattle) to		
India (Mumbai)	$ 2,900	$ 3,300
Mexico (Mazatlan)	$ 3,100	$ 3,400
USA (New York) to		
India (Mumbai)	$ 3,100	$ 3,450
UK (London)	$ 1,300	$ 1,500
USA (LA) to		
India (Mumbai)	$ 2,050	$ 2,300
Mexico (Mazatlan)	$ 2,850	$ 3,150
China (Shanghai)	$ 670	$ 750
Canada (Victoria) to		
India (Mumbai)	$ 2,980	$ 3,300
Mexico (Mazatlan)	$ 3,100	$ 3,500
China (Shanghai)	$ 740	$ 825
Canada (Sydney) to		
India (Mumbai)	$ 3,300	$ 3,700
UK (London)	$ 1,400	$ 1,600
Turkey (Izmir) to		
India (Mumbai)	$ 500	$ 550
China (Shanghai)	$ 770	$ 850
UK (London)	$ 1,800	$ 2,000
Ukraine (Mariupol) to		
India (Mumbai)	$ 1,100	$ 1,200
China (Shanghai)	$ 1,400	$ 1,550
UK (London)	$ 2,550	$ 2,800
Russia (St. Petersburg) to		
UK (London)	$ 1,500	$ 1,700
Russia (Nakhodka) to		
India (Mumbai)	$ 670	$ 770
Mexico (Mazatlan)	$ 3,350	$ 3,750
China (Shangai)	$ 360	$ 400

PRICES

Below we present a selection of pricing data for select countries that have large correlation and effect on the North American pulse market. For example, China has a large impact on U.S. pulses because it is a large purchaser of U.S. pulses, while Myanmar – although a significant producer and exporter of beans to India – does not have a direct or material impact on the U.S. market.

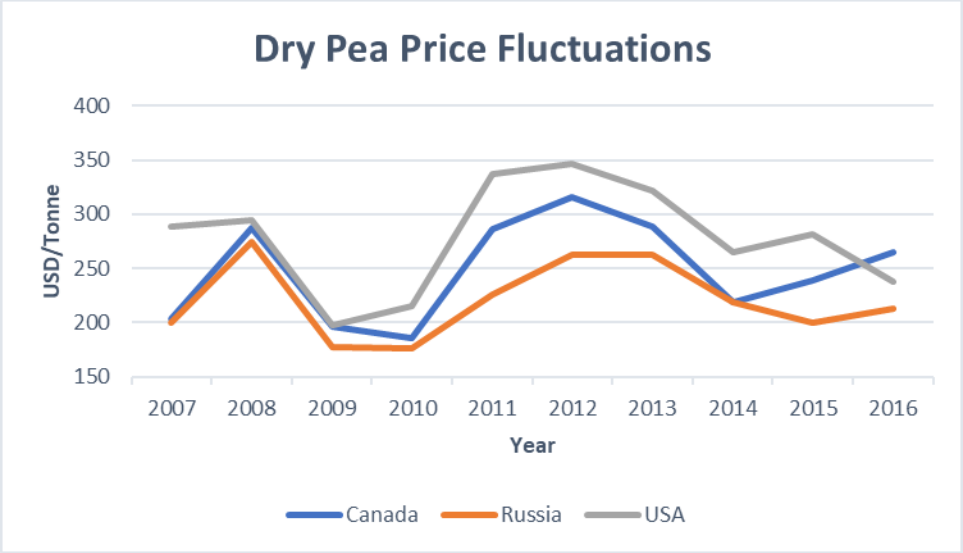
EDIBLE BEANS

Dry bean prices for Canada, China, and the U.S. are shown below. Data on China became unavailable on FAO Stat following 2013. As reflected in the graph, market participants live with a fair degree of pricing volatility. The bean market – with dozens of popular varieties enjoyed around the globe – is actually a series of small niche markets, but those markets have natural price ceilings based on available substitute commodities (e.g., navy beans for black beans). The bean market – as a general matter – tends to be very correlated and dependent on available market supply.



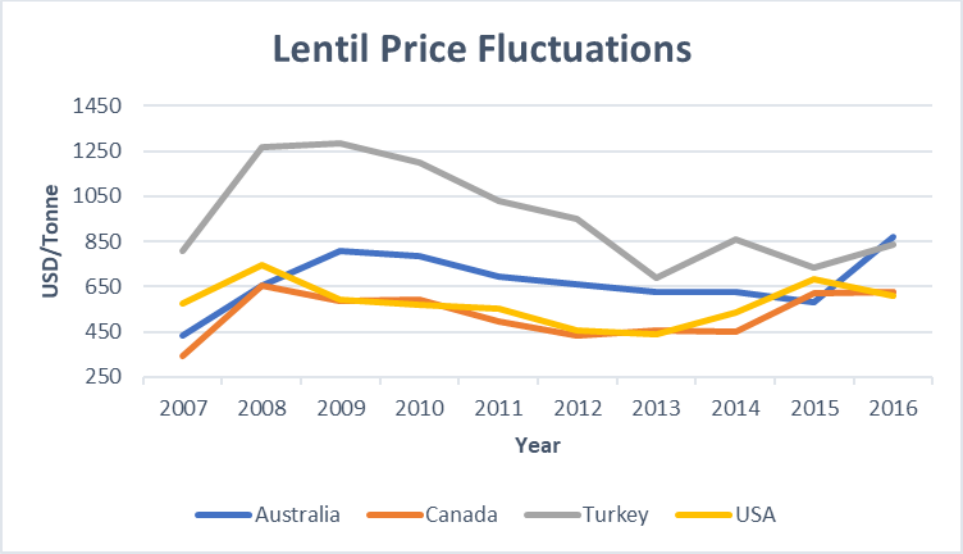
DRY PEAS

Dry pea pricing follows trends similar (to edible beans) from country to country. Prices fell during 2008, bouncing back up during 2010. Prices for peas started to level out in 2014.

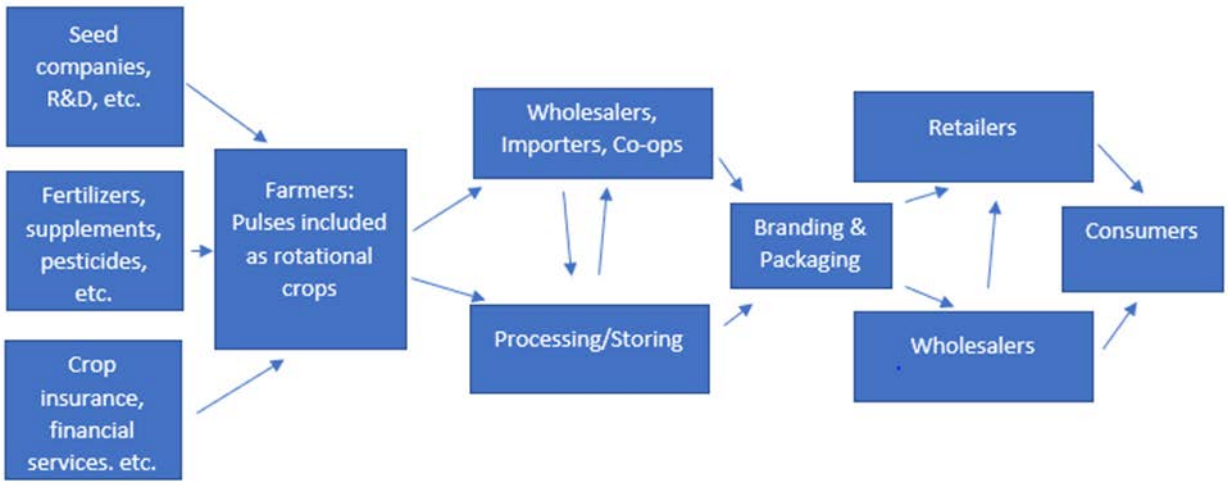


LENTILS

Because Canada controls so much of the world lentil market, some of the basis differentials that one sees when comparing exporter nations' pricing for edible beans and dry peas is less pertinent than for lentils.



SUPPLY CHAIN



FIRST SUPPLIERS

Median EBIT Margins: 15%

The pulses supply chain begins with the suppliers to farmers. Large R&D efforts drive the modification of seed types to become more weather resistant and produce better yields. Fertilizers, supplements, pesticides, and other products may lead to different (better) yields through providing innovative, value-added products to increase crop production and performance. Crop insurance and financial services such as lines of credit, banking, and advisory services may create economic sustainability and convenience for farmers but shrink farmers' margins by inserting friction costs to do business.

SECOND SUPPLIERS

Median EBIT Margins: 5%

Farmers are the second supplier in the pulse supply chain. Value can be added through strong irrigation, use of efficient seeds, crop rotation, fertilization, scalability, machinery and efficiency, and distribution methods. Pulse production requires less water than other major crops, but it also requires good drainage, so

strong irrigation systems are important. Using the right seeds, rotating crops, even when pulses are staple crops, and using adequate fertilization can all contribute to better yields. Better yields and a better crop add value and provide leverage when selling product. Farmers can achieve better margins and sell at a lower cost when scaled efficiently. Having enough land to put machinery and watering systems to full use will help optimize capital expenditures and increase margins. Efficiency with modern equipment and methods will contribute to the bottom line as well. Geographic location regarding distribution plays a role in effective and low freight costs. With a more efficient system for farmers, farmers may sell at the same price as competitors while adding value to the product and receiving higher margins.

THIRD SUPPLIERS

EBIT Margin Range: 0.5% to 5%

The third round of suppliers in the supply chain includes a range of market participants who straddle a few different roles. Trading companies often enter the market at this stage. Trading companies may ship unpackaged/branded pulses, or ship branded, packaged product ready for retailers. Farmers may join co-ops, joint ventures, etc., at this stage to pool resources to take advantage of scale and bargaining power. Local farmers may also ship out inventory to local storage facilities, which then will need to go to processors and packagers. Some farmers ship directly to processors and packagers. These companies will receive the pulses in bulk, store and process the crops, package the crops in large quantities, and typically ship them out to companies for branding and packaging. Some value is added during this stage through refining, splitting crops, cleaning, extracting specific parts, sorting, and more. This stage of the supply chain typically has high revenue and low margins, forcing companies in this part of the supply chain to utilize scale and volume.

FOURTH SUPPLIERS

EBIT Margin Ranges: 10%-20%

At this stage of the supply chain, food manufacturing and consumer packaged goods (CPG) companies enter the market. CPG companies may buy in bulk and then brand and package the pulses into small quantity bags and boxes for food retailers or food companies that sell into retail channels. Margins are typically higher in this part because of branding companies' ability to scale and food companies' ability to have name-brand products.

FIFTH SUPPLIERS

Median EBIT Margins: 5%

Retailers such as Walmart, Whole Foods, and Kroger all receive shipments from food companies, often wholesalers or branding/packaging companies. Wholesalers receive large shipments and sell in bulk for discounted prices. Wholesalers may be regional wholesalers or retail stores such as Costco and Sam's Club. This is the last step typically before reaching the consumer.

CONSUMER

The consumer is the beneficiary of a competitive market in the pulse industry. Commodity prices vary based on supply and demand, and the consumer can typically purchase pulses at an affordable rate. Consumer preferences, disposable income, and geographic location may affect which type of pulses are bought and whether the pulses are name-brand, natural/organic, processed, canned, pre-cooked, etc. The final product dictates the supply chain and price of the crop. An example would be a name-brand seasoned can of pinto beans versus a dried, unseasoned bag of generic pinto beans. The supply chain, value creation, and price would look slightly different at many of the steps for each type of bean.