

STRUCTURAL DEVELOPMENTS IN THE CANADIAN GRAINS AND OILSEEDS SECTOR

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INTRODUCTION

The Canadian grains and oilseeds sector has undergone a large number of significant changes over the last 25 years. Crop farms have become larger in most parts of the country and use larger machines with less labour. Farming practices have evolved to incorporate modern technologies including less tillage, more selective herbicides, and, increasingly, seeds that have been manipulated genetically for resistance to specific diseases or chemicals. In Western Canada, producers have been adjusting their farming operations and cropping patterns to respond to massive changes in the grain transportation and handling system brought on by the forces of globalization and deregulation. In Central Canada, crop producers have responded to increased demands for feed grains and supplements from their growing livestock sectors by planting much more barley and corn in Quebec and soybeans in Ontario. They are even growing canola in Ontario on a regular basis. In the eastern provinces, producers have decreased their oats area in favour of barley, with steady areas of corn in Nova Scotia and soybeans in Prince Edward Island.

Although new trading rules established under the Canada-United States Trade Agreement (CUSTA) in 1989, the North American Free Trade Agreement (NAFTA) in 1994 and the World Trade Organization (WTO) in 1995 have spurred the pace of change in the Canadian grains and oilseeds sector, they have not been the only factors involved. The sector was ripe for massive structural change following decades of government assistance and regulation. As federal and provincial governments began to unravel the web of assistance programs and make key changes to the way regulatory bodies operated, producers responded by changing their cropping programs and resource usage. These factors, together with rapid technological changes and opportunities for off-farm employment, have radically altered the structure of the Canadian grains and oilseeds sector.

This paper examines the extent and the causes of the structural changes in the Canadian grains and oilseeds sector over the last 25 years. It begins with a brief description of changes in land use, export markets and production technologies. The structural changes have occurred from producers responding to developments in agricultural research, price signals, agricultural and transportation policies, international trade agreements, off-farm employment opportunities, and institutions. Each of these forces of change are reviewed in the following sections.

STRUCTURAL CHANGES

A modern definition of industrial structure was provided by McFetridge (1986), who stated that the most important elements of an industry's structure answer the following questions:

- what is produced and in what proportion?
- where is the output produced and what is its geographical distribution?

- what is traded and with whom? and
- how is the output produced?

Descriptive answers to these questions are provided below.

Land Use

The number of farms in Canada has continued to decrease. The 276,548 farms in Canada in 1996 (Table 1) are just over one-third of the number of recorded farms in 1951 (Statistics Canada 1997). The largest percentage loss in number of farms over this time has been in the Atlantic provinces and Quebec. Traditionally, these have been the provinces with the lowest farm incomes and smallest farms. In Western Canada, the loss in farm numbers has not been as great. In Alberta and British Columbia farm numbers actually have increased during the last decade.

There were 45.5 million hectares (ha.) in crops, improved pasture and summerfallow in Canada in 1996 (Statistics Canada, 1997). Of this, 34.9 million ha. were planted to crops, 4.3 million ha. were improved pasture and 6.2 million ha. were summerfallow. Manitoba, Saskatchewan and Alberta account for 38.4 million ha. (84 percent) of the total improved land area in Canada; Quebec and Ontario for 5.8 million ha. (13 percent); Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick for about one percent; and British Columbia for just under two percent.

The average farm size, as measured by land area, ranges from 59 ha. in Newfoundland to 466 ha. in Saskatchewan (Table 1). The farm sizes generally reflect the main types of farming in the different regions of the country. The largest farms are on the Prairies which is the major grain growing region of the country. Farms in all provinces except British Columbia have increased in size over the past twenty years.

Bollman et al. (1995) noted that the overall decline in farm numbers during the last 15 years was a result of decreases in the number of small farms. They found that the number of larger size farms with gross incomes of \$100,000 or more actually has been increasing, particularly in Western Canada.

Table 1. Summary Statistics on Canadian Land Area and Farms, 1996

<i>Province</i>	<i>Improved Land (thousand ha.)</i>	<i>Number of Farms</i>	<i>Ave. Farm Size (ha.)</i>	<i>Ratio of Farm Size 1996/1976</i>
Newfoundland	10	742	59.1	1.60
Prince Edward Island	183	2,217	119.6	1.49
Nova Scotia	138	4,453	96.0	1.06
New Brunswick	155	3,405	113.4	1.11
Quebec	1,945	35,991	96.0	1.24
Ontario	3,913	67,620	83.1	1.18
Manitoba	5,379	24,383	317.1	1.32
Saskatchewan	20,063	56,995	466.2	1.25
Alberta	12,897	59,007	356.3	1.08
British Columbia	844	21,835	115.8	0.92
Canada	45,529	276,548	246.1	1.22

Source: Canada Grains Council, Statistical Handbook 1996

Probably the most significant change to have emerged in cropping patterns has been the development of the canola sector. In the last 20 years, canola has more than tripled in area, increasing its share of land use from 4.8 to 14.0 percent (Table 2). The value of canola production has surpassed barley and now rivals wheat on the Prairies.

The other major change in cropping patterns on the Prairies has been the diversification into specialty crops such as mustard seed, lentils, canary seed, dry peas, potatoes, and niche crops like herbs, spices and berries. Although the area devoted to these crops is not large, the total world market is also not large. Canada has a significant market share in some of these crops.

Corn and soybeans are grown mostly in Central Canada. The area of both has increased, mostly at the expense of oats and mixed grains. Technology has contributed to this development as new varieties have allowed corn to spread north through Ontario into Quebec. The same has been true for soybeans where area devoted to this crop has increased by five times over the past 20 years.

Table 2. Area Under Crops in Canada, 1973-76, 1983-86 and 1993-96.

<i>Crop</i>	<i>Area in Hectares</i>			<i>Percentage of Total Crop</i>		
	<i>1973-76</i>	<i>1983-86</i>	<i>1993-96</i>	<i>1973-76</i>	<i>1983-86</i>	<i>1993-96</i>
Wheat (ex durum)	8,561.8	12,035.4	9,676.7	32.3	38.3	29.1
Durum	1,249.4	1,670.3	1,977.9	4.7	5.3	5.9
Oats	2,521.0	1,376.2	1,429.5	9.5	4.4	4.3
Barley	4,605.3	4,625.2	4,376.0	17.3	14.8	13.2
Rye	299.1	368.8	167.7	1.1	1.2	2.0
Flaxseed	516.1	661.4	665.2	1.9	2.1	2.0
Canola	1,288.1	2,717.3	4,648.3	4.8	8.7	14.0
Corn	620.7	864.5	1,000.3	2.3	2.8	3.0
Soybeans	167.2	396.5	805.9	0.6	1.3	2.4
Mixed Grains	732.6	477.2	233.0	2.8	1.5	0.7
Specialty	240.0	432.8	1,498.8	0.9	1.4	4.5
Tame Hay	5,368.0	5,361.6	6,610.4	20.2	17.1	19.9
Fodder Corn	419.2	340.9	168.8	1.6	1.1	0.5
S. Fallow	10,945.5	8406.3	6,755.7	29.2	21.2	16.9
Total Arable	37,502.3	39,734.3	40,014.2	100.0	100.0	100.0

Source: Canada Grains Council, Statistical Handbook. Various Years.

One measure of diversification is the Herfindahl Index¹. This index declines when more crops are grown and each has a relatively smaller share of the total. It is clear that diversification of crop production has been increasing over the last 22 years in all regions of Canada except in Eastern Canada and British Columbia (Table 3). Most of the diversification has taken place in the Prairies where the index has fallen by six points during the last 20 years. The index has remained fairly constant in Central Canada (Quebec and Ontario) but has risen in Eastern Canada and British Columbia where tame hay has replaced much of the crop area.

¹ The Herfindahl Index is $H = \sum S_i^2$, where S_i is the share of the i^{th} unit. Each unit represents one crop: durum wheat, other wheat, oats, barley, rye, canola, flax, corn, soybeans, specialty crops, fodder corn, tame hay, summerfallow.

Table 3. Diversification of the Canadian Crops Sector, Measured by the Herfindahl Index

<i>Date</i>	<i>British Columbia</i>	<i>Prairie Provinces</i>	<i>Central Canada</i>	<i>Eastern Canada</i>	<i>Canada</i>
1975	41.0	21.6	26.6	41.7	17.5
1985	33.2	19.4	23.4	41.0	17.2
1995	46.0	15.8	23.8	43.8	14.2
1997	58.1	15.6	25.0	45.8	13.9

Source: Estimated from Canada Grains Council, Statistical Handbook. Various years.

Trade

The composition of trade in Canadian grains and oilseeds has changed significantly over the last 20 years. Both external and internal factors have contributed to the changes in trade patterns. Changes in political regimes (especially in the former Soviet Union and Eastern Europe), as well as in trade policies and programs in the United States and European Union, have been major factors. Changes in the relative profitability of the various crops as a result of technical developments and changed trade patterns have contributed to changes in Canada's export composition.

The Canadian grains and oilseeds sector is very dependent on trade. As a percentage of production, exports in the 1993-96 period were: 70 percent of common wheat, 82 percent of durum, 22 percent of barley, 38 percent of oats, 83 percent of flaxseed, 52 percent of canola and 25 percent of soybeans. In 1973-76, Canada was a net importer of soybeans but by 1993-96 Canada had become a net exporter of nearly a half million tonnes per year. Canada's annual net deficit in corn has shrunk from 750,000 tonnes in 1973-76 to less than 400,000 tonnes in 1993-96, despite much more corn being consumed within Canada. Over the twenty years, Canadian corn production increased from 3.2 to over 7 million tonnes annually.

The destination of Canadian wheat exports has shifted markedly. In 1973-76, about 14 percent of Canada's wheat exports went to Western Europe. This had fallen to 3 percent by 1993-96. In 1983-86, 28 percent of Canada's wheat exports went to the USSR but these countries imported virtually none during 1993-96. China became an increasingly important customer, taking 22 percent of the wheat exports in 1993-96. Iran emerged as a major buyer as did the United States and Japan.

The durum export pattern shifted from a large dependence on Europe (Italy) to China and the United States. Algeria, Brazil and Japan are now important customers with Algeria taking 37 percent of durum exports in 1993-96. Four countries (Saudi Arabia, the United States, China and Japan) are the major purchasers of Canadian barley, together taking almost 80 percent of exports.

In 1973-76, when Canada's canola industry was in its infancy, Japan took 80 percent (636,000 tonnes) of Canadian exports. In 1993-96, Japan imported an average of 1.7 million tonnes per year, but this was only 53 percent of Canadian canola exports. The United States, Mexico and Western Europe have become important markets for Canadian canola. Europe has remained the major destination of Canadian flaxseed; it took 60 percent of Canadian exports in 1993-96. Other major buyers were Japan (10 percent) and the United States (17 percent).

Production Technology

One of the key factors behind structural change in any industry is technological change. Bollman et al. (1995, p. 16) stated that “technology ... is a fundamental driving force in the change in the size distribution of agricultural business units”. Grain and oilseed production technology has changed enormously over the past 25 years.

One of the most noticeable changes in technology has been the large reduction in summerfallow in Western Canada (from 29 to 17 percent of arable land in twenty years). From the mid 1970s to the mid 1990s, arable crop land increased by 2.5 million ha. and, coupled with the decrease in summerfallow of 4.2 million ha., land under crops increased by 6.7 million ha. (Table 2). Two-thirds of the decrease in summerfallow area occurred in Saskatchewan. Information on the harmful effects of this practice has spurred farmers in all soil zones to adopt more crop intensive rotations.

Farming methods have changed enormously over the past 20 years. There has been a huge increase in the use of inorganic fertilizers (particularly nitrogen) and pesticides (especially more selective herbicides). In Saskatchewan, the percentage of total cropped area where commercial fertilizer was applied increased from 57 to 70 percent between 1991 and 1996; in Alberta, it increased from 75 to 81 percent (Table 4). Three-quarters of the cropped area in Saskatchewan (two-thirds in Alberta) were treated with herbicides (Table 4).

With increased knowledge of the deleterious effects of tillage on soil conditions, there has been a rapid movement towards longer rotations using fewer tillage operations. Between 1991 and 1996, the area using tillage methods which left most of the residue on top (a recommended conservation practice) increased from 25 to 31 percent of total cropped area in Saskatchewan and from 23 to 29 percent in Alberta (Table 4). Since the total crop area increased over the five year period in both provinces, this represented a 32 percent increase in total area where this practice was applied in Saskatchewan and a corresponding 29 percent increase in Alberta. Conversely, the former practice of incorporating most of the residue into the soil decreased from 62 to 42 percent of total cropped area in Saskatchewan and from 68 to 50 percent in Alberta (Table 4). The area of no-till practice increased from 10 to 20 percent of total cropped area in Saskatchewan between 1991 and 1995, and from 3 to 9 percent over that time period in Alberta (Table 4). This is a remarkable shift in farming techniques that seems to be continuing.

Table 4. Application of Selected Technologies as a Percentage of Total Area Cropped

	<i>Saskatchewan</i>		<i>Alberta</i>	
	<i>1991</i>	<i>1996</i>	<i>1991</i>	<i>1996</i>
	%			
Common Fertilizer Applied	57	70	75	81
Herbicides Applied	75	75	67	69
Tilled With Most Residue Left on Top	25	31	23	29
Tilled With Most Residue Inc. in Soil	62	42	68	50
No Till	10	20	3	9

Source: Statistics Canada, Census of Canada 1997

Pesticide use as a percentage of total farm expenditures approximately doubled in the prairie provinces between the 1970s and the 1980s (Table 5). Proportionate expenditures on pesticides continued to increase into the 1990s, though at a slower rate. Similarly, expenditures on fertilizer as a percentage of total costs in the prairie provinces grew rapidly between the 1970s and 1980s (more than doubling in Saskatchewan). This situation was reversed in Eastern Canada.

Table 5. Farm Pesticide and Fertilizer Expenditures as a Percentage of Total Gross Operating Expenditures: 1973-76, 1983-86, 1993-96

	<i>PEI</i>	<i>NS</i>	<i>NB</i>	<i>QUE</i>	<i>ONT</i>	<i>MAN</i>	<i>SASK</i>	<i>ALTA</i>	<i>BC</i>	<i>Canada</i>
Pesticides										
1973-76	4.24	1.49	3.82	1.39	2.77	3.67	3.70	2.28	1.77	2.63
1983-86	5.24	1.73	3.52	1.51	3.40	7.20	7.20	4.67	1.53	4.33
1993-96	6.75	1.81	3.74	1.51	3.45	8.28	8.69	4.83	1.48	4.73
Fertilizer										
1973-76	13.30	5.18	8.81	5.88	7.34	10.46	5.04	8.00	3.50	6.93
1983-86	10.58	4.07	6.54	6.04	6.74	13.96	10.59	10.73	3.61	8.67
1993-96	10.85	3.38	6.30	5.01	6.20	13.85	11.99	9.60	4.09	8.39

Source: Statistics Canada, Census of Agriculture, annual.

Farmers have continued to substitute larger sized farm equipment for labour which has allowed them to farm larger areas (Table 1). Increasingly, they have turned to new machines like air drills to facilitate adoption of more crop intensive rotations, and no or fewer tillage operations. Greater use of direct combining (rather than swathing first), and natural and hot air driers have reduced labour constraints during critical time periods at harvest. Increased use of steel bins with hoppers rather than the old wooden framed variety has also reduced demands on labour. Bollman et al. (1995) found that the capital/labour ratio of agriculture in Canada increased from below 1.0 in the early 1970s to above 1.5 by the late 1980s.

FORCES OF CHANGE

Goddard et al. (1993) suggested a number of factors that can affect the structure of agriculture. Based on their suggestions, this paper examines the influences of seven important factors on the emerging structure of the Canadian grains and oilseeds sector: agricultural research, prices, agricultural policies, transportation policies, international trade agreements, off-farm employment, and institutions and organizations. These are discussed in the following sections.

Agricultural Research

Agricultural research provides the basis for continued technological change in the grains and oilseeds sector. In Canada, much of the background research and extension necessary for the adoption of new technologies traditionally has been performed by the public sector. The Research Branch of Agriculture and Agri-Food Canada (AAFC) has been the most important agricultural research organization in the country. Guitard (1985) estimated that 50 percent of all agricultural research in Canada was conducted by the federal government, 35 percent by provincial governments and universities, and 15 percent by the private sector. In the three year period 1994-95 to 1996-97,

total research expenditures by provincial governments averaged \$143 million and \$292 million by the federal government (AAFC, 1998).

Klein and Kerr (1995) noted four major forces that have changed research priorities and resource allocation: globalization, international protection of property rights, innovations in research techniques, and fiscal pressures.

Globalization has meant that Canadian grain and oilseed producers have become more exposed than ever to competition from producers in other countries as well as providing more opportunities to access new markets. As a result, it has become more important to develop new agricultural technologies and new crop varieties that directly match the needs of the industry. Research administrators in AAFC have increasingly sought counsel from knowledgeable people in the private sector. Advisory committees, composed primarily of experts from the private sector, have been struck at all the major research centres as well as at national headquarters in Ottawa to provide both strategic and tactical advice on the various research programs at the centres.

The reduction in barriers to trade and the revolution in information and communication technology has made it more important to protect research information internationally. The passage of the Canadian Plant Breeders' Rights Act in 1991 and a supranational agreement in the new WTO gives much greater protection of intellectual property rights. By providing greater opportunities for profit, these institutional changes have stimulated investments in agricultural research by private sector firms.

There has been a revolution in research techniques which has affected agricultural research in recent years. The advent of laboratory-based biotechnological research has meant less national advantage from publicly supported research because foreign producers and consumers may reap many of its benefits. Although field testing will always remain location specific, new opportunities have been created for research laboratories to specialize internationally and "trade" their research resources and products.

Finally, fiscal pressures have left most governments with limited resources to protect and assist agriculture or any other industry (Hedley and Gellner, 1995). The Research Branch of AAFC has had to share major budget reductions with other Branches and Departments of the federal government. To maintain credible research programs in many areas, federal government scientists and their administrators have sought collaborative and cost-sharing arrangements with firms and institutions in the private sector. With increased financial contributions from the private sector has come increased private sector involvement in setting of agricultural research priorities.

During the past 25 years, provincial government research programs have been established in several provinces to supplement the work conducted by the federal government. The Alberta Agricultural Research Institute (AARI), established in 1987, annually allocates about \$6 million for research deemed to be of economic benefit to the agricultural industry in Alberta. The Saskatchewan Agricultural Development Fund supports applied research projects in Saskatchewan. Other provinces also have programs which support agricultural research activities.

Increasingly, matching grant programs (where the private sector provides at least half the funds) have been used to provide cooperative approaches to agricultural research. The public sector supplements the funds when the proposed projects fit within identified priority areas for agricultural research. The combination of private and public sector decision making for funding agricultural research ensures that market signals guide the allocation of research resources while still maintaining benefits to the Canadian taxpayers.

Nearly all commodity organizations have begun to fund agricultural research in recent years. This has been in response to governmental exhortations to the private sector to contribute financially to public sector research programs as well as a growing appreciation by those in the private sector of the benefits from agricultural research. Generally, the funds are raised by deductions on sales of the farm produce, with provision for refunds upon application. Applications for research funds normally are reviewed by committees that represent the commercial interests of the organization and decisions are approved by the Board of Directors.

In 1981, 12 farm organizations banded together to form the Western Grain Research Foundation (WGRF). It uses the interest earnings on a \$9 million fund (residual from a prairie wide program disbanded several years ago) to support grain-related research on the Prairies (Peterson, 1997). Beginning in the 1993-94 crop year, newly passed legislation allowed the Canadian Wheat Board (CWB) to deduct from the final payment \$0.20 for each tonne of wheat and \$0.40 for each tonne of export barley sold. This money goes into the account of the WGRF for the funding of wheat and barley research. An expert committee, composed of researchers and active farmers (50 percent each), makes recommendations about the distribution of these funds.

Although Canadian farmers have been quick to adopt new technologies as they became available, the highly regulated system for licensing new varieties of grains and oilseeds in Canada may have slowed the rate of technological growth in the sector. Canada has chosen to maintain high quality standards of hard red spring wheats (Dexter, 1993), preferring to concentrate on the high protein and gluten strength that the northern arid climate of the Canadian prairies makes possible. Candidate cultivars are required to go through three years of cooperative tests where they are grown under the same conditions as previously licensed varieties. Any new variety of wheat must fit the Canadian grading system and meet or surpass previous varieties on a wide array of characteristics, including agronomic merit, end use suitability, kernel characteristics and disease resistance. Failure to meet any one of the standards results in disqualification of the candidate cultivar.

Hughes (1986, p. 490) noted that development of new wheat varieties "in western Canada has been characterized more by gains in disease resistance, maturity and quality factors than in yield". Indeed, maximum yield potentials of hard red spring wheat have increased at the relatively low rate of only 0.23 to 0.40 percent per year (Depauw and Thomas, 1986). The process is costly as well as slow: of 151 candidate cultivars tested between 1973 and 1982, only seven (5 percent) were licensed (Hughes, 1986).

Passage of the Plant Breeder Rights Act in 1991 allows plant breeders to patent new varieties and collect royalties on their sales. This has created an important new incentive for plant breeders and has resulted in a much faster pace of new variety introductions: 15 new varieties of spring wheat were licensed during the four-year period 1991-94 as compared to 14 in all of the 1980s, 10 in the 1970s

and 6 in the 1960s (DePauw et al., 1995). However, very small yield improvements have been made to date.

Prices

Grain and oilseed producers are known to respond to changes in overall price levels and changes in commodity and input price ratios. Average prices for wheat, barley and canola for the mid 1970s, mid 1980s and mid 1990s are shown in Table 6. While the nominal prices for these commodities have risen over this twenty year period, their real prices (measured in relation to the Consumer Price Index) have fallen. This pattern of declining real prices over time is a continuation of a downward trend observed throughout this century (Fulton et al., 1989). The downward trend is a result of adoption of new technology that decreases average costs of production in a very competitive sector.

Table 6. Selected Commodity Prices, Nominal and Real (1992 dollars)

	<i>Wheat</i>		<i>Barley</i>		<i>Canola</i>	
	<i>Nominal</i>	<i>Real</i>	<i>Nominal</i>	<i>Real</i>	<i>Nominal</i>	<i>Real</i>
	<i>\$/tonne</i>					
1973-76	135.36	391.30	103.00	298.55	262.91	762.06
1983-86	148.00	197.33	110.25	147.00	298.25	397.67
1993-96	165.33	158.97	122.67	117.95	351.33	337.81

Source: Saskatchewan Agriculture and Food. Agricultural Statistics.

While the real prices of all commodities have fallen over the past twenty years, some have fallen more quickly than others. The price of canola has risen against both wheat and barley (Table 7). This helps to explain the increase in canola area at the expense of area in wheat and barley (Table 2). Large increases in producers' costs of transportation since the mid 1980s strengthened that effect. Barley and wheat have much lower values per tonne than does canola resulting in an additional economic advantage from growing canola. This also applies to other high value, low volume crops that increasingly have been grown in Western Canada.

Table 7. Product Price Ratios

	<i>Canola/Wheat</i>	<i>Canola/Barley</i>	<i>Wheat/Barley</i>
1973-76	1.94	2.53	1.31
1983-86	2.01	2.70	1.34
1993-96	2.12	2.86	1.35

Source: Saskatchewan Agriculture and Food. Agricultural Statistics.

While output price ratios affect which crops are produced, input price ratios affect how the crops are produced. The price of labour has been increasing faster than the price of capital, thus contributing to the decreasing use of labour. Between 1986 and 1996, the price of hired farm labour increased by 36 percent whereas the price of machinery replacement increased by 25 percent and the price index of machinery operation increased by 31 percent (Saskatchewan Agriculture and Food, Annual). But this is only part of the story. Schultz (1972) suggested that the relative increase in the price of farmers' own time (their opportunity cost) relative to the price of capital may explain more of the substitution than just the price of hired labour. Subsidies on capital such as the income tax

credit for farm machinery in the 1970s and 1980s further decreased the capital/labour price ratio, thus accentuating the trend.

The second major change in production methods in Western Canada has been the large increase in use of fertilizers and pesticides. Crop prices have been rising more quickly than have pesticide prices, helping to explain the increased use of pesticides. Fertilizer prices declined steadily from the mid 1980s until 1993 when they began to rise rapidly. By 1996, the fertilizer price index in Saskatchewan was 26 percent higher than it was ten years earlier; the pesticide price index also increased 24 percent over the ten year period but the crop price index increased even more: 40 percent (Saskatchewan Agriculture and Food, Annual). The use of these inorganic inputs has also increased because of the change to more crop intensive rotations in the prairie provinces: more fertilizers and pesticides are required for successful cropping on stubble than on summerfallow.

Agricultural Policies

Canada has a long history of government involvement in agriculture. Following World War II, both levels of government developed extensive agricultural programs in marketing, transportation, credit, price and income support, and input subsidies that were designed to alleviate income stresses on farms during periods of price or yield reductions. Many of those programs distorted economic signals and delayed adjustments in resource use on farms across the country. Since the late 1970s, many of the programs have been rationalized or dismantled. Total federal and provincial government support for agriculture was over \$9 billion in 1991-92; that had been cut in half five years later (AAFC, 1998).

Stabilization and Income Support Grain and oilseed production in Western Canada has been subject to extreme variations in both yields and prices. For this reason, increased stability of returns has been a primary focus of agricultural policies. In Canada, stabilization programs usually have been designed to provide a large measure of price or income support as well.

The Crop Insurance Act of 1959 makes all-risk crop insurance available to crop producers in all provinces. This program has provided insurance against reduced yields as a result of natural hazards like frost, drought, insects, diseases, and hail. In general, producer premiums have been matched by the federal government with the provincial governments paying for the administration costs. It is likely that crop insurance has resulted in some increase in input usage and crop output. During the 1960s and early 1970s, producer premiums slightly out-weighted payments from the insurance (Fulton et al., 1989). However, major reductions in yields during several years in the 1980s triggered very large payments to producers. During the four year period 1983-86, net crop insurance payments to producers (over and above producer premiums) averaged \$294 million per year, representing 3.47 percent of total crop receipts (Table 8).

The Western Grain Stabilization Plan (WGSP), introduced in 1976, sought to stabilize net margins above variable costs for the major grains and oilseeds grown in Western Canada. When the program started, it was agreed that producers would pay one-third of the costs and government would pay two-thirds. However, huge pay-outs of over \$3 billion in the four year period 1983-87 left the WGSP fund with a staggering deficit, most of which eventually was paid by the federal government. The program was ended in 1990.

Table 8. Net Payments From Crop Insurance as Proportion of Total Crop Receipts for Canada (Thousand Dollars):

	1973-76, 1983-86, 1993-96		
	1973-76	1983-86	1993-96
Net Farm Payments	15,997	294,530	171,173
Total Crop Receipts	4,111,113	8,496,041	11,854,080
Percent	0.39	3.47	1.44

Source: Statistics Canada, #21-603-UPE.

The WGSP increased and stabilized producer returns during its existence, especially when prices were depressed during the mid 1980s.* This may have supported land prices at higher levels. Miranda et al. (1994) found that the program increased area of eligible crops planted by over four percent, most of which was due to the risk reduction effect of the program.

A number of other *ad hoc* programs were made available to alleviate problems in particular years and regions. For example, crop assistance payments were made to crop producers in most provinces who were unable to plant a substantial portion of their intended crop due to cold, wet weather in 1974. In 1983, special assistance payments were made to crop producers in Quebec, Manitoba and Saskatchewan who suffered yield losses due to floods, winter-kill and drought. Under the Crop Drought Special Assistance Act of 1985, Saskatchewan crop producers were provided payments to compensate for yield losses. In 1986, crop producers in Saskatchewan, Alberta and British Columbia who suffered crop damage due to drought conditions received payments under the Crop Disaster Assistance Program. Farm income assistance was provided to grain and oilseed producers in Western Canada to improve incomes which were reduced as a result of the low international prices for grains.

The Special Canadian Grains Program was instituted as a temporary measure to provide cash payments to Canadian grain and oilseed producers who were negatively affected as a result of the grain subsidy war being waged by the United States against the European Union. Large payments were made during two years: \$1 billion in 1987 and \$1.1 billion in 1988. About 85 percent of the payments went to producers in Western Canada. Since the special programs were announced after crops had been planted and harvested, it is unlikely that they caused any changes in resource allocation. However, Fulton et al. (1989) argued that some producers may have altered their planting intentions slightly during the second year in anticipation of another payment. They stated that the extra cash undoubtedly assisted producers in the purchase of additional inputs (and to make debt payments), thus providing major benefits for input suppliers and the rest of the regional economy.

The Farm Support and Adjustment Measures Act (I and II) in 1990-91 provided interim support to grain and oilseed producers until new long-term safety net programs were fully implemented. The Farm Income Protection Act of 1991 spawned two new safety net programs: the Gross Revenue Insurance Plan (GRIP) and the Net Income Stabilization Account (NISA). The GRIP was really an extension of the crop insurance program in that it protected against reductions in

* Editor's Note: Boyd and Love (Using Commodity Options and Crop Insurance for Revenue Stabilization, 1994) showed that some government programs, including WGSP, had some destabilization effects on annual revenue.

revenues as well as yields. Producers paid one-third of the costs of the program and governments paid the other two-thirds. Revenue protection was based on the 15 year moving average of past market prices for each product and a producer's long term average yield. Large pay-outs occurred in the first couple years of the program because some very high prices from the late 1970s were included in the moving average. As the high price years were dropped from the moving average and replaced by lower price years in the 1990s, the program went out of favour and was discontinued in 1996 with small surpluses showing in accounts in most provinces.

Gray et al. (1991) concluded that the GRIP was structured in a way that affected cropping patterns, input usage and land use. They noted that 15 year average prices do not reflect current demand and supply conditions and the program provided farmers with inaccurate market signals that would change crop selection choices. Since the program's target revenue was higher than expected market revenue in the early years, producers had an incentive to reduce their use of fertilizer and other inputs, and accept a program payment. Also, since forage and pasture land were not included in the program, producers had an incentive to convert some of that land to annual crop production.

The Net Income Stabilization Account (NISA) is not commodity specific so is less likely to affect resource allocation. Under NISA, individual producers establish personal accounts at a financial institution where they can deposit up to three percent of their eligible net sales, which are then matched by government contributions. After receiving a competitive interest rate, the government adds an interest bonus of three percent. Withdrawals from the account are permitted when the producer's gross margin falls below the previous five-year average or taxable income falls below \$10,000. Spriggs and Nelson (1997) found that NISA increases disposable income and increases stability but they didn't study any possible impacts this may have on resource allocation.

Price Support The major program that provided price support for prairie grain producers was the two-price wheat program. It was introduced in 1967 to provide some level of stability to the price of wheat used for domestic consumption (around 10 percent of total production). The program was designed with a floor price which consumers were obligated to pay even when the world price declined to a lower level. Domestic consumers paid the international price if it was between the floor and ceiling prices, but no more than the ceiling price.

In the early years of the program, world prices were frequently below the floor price, so producers benefitted. During the late 1970s, world prices exceeded the ceiling prices for some time, so domestic consumers benefitted. However, a major upward revision in the floor price in 1986, coming at almost the same time as the worldwide plunge in wheat prices, set the stage for a major income transfer from consumers to producers. In 1987, the domestic price of wheat in Canada was \$257 per tonne, while the world price averaged only about \$95 per tonne. Fulton et al. (1989) estimated that a typical Saskatchewan farmer who produced 18,000 bushels of wheat in 1987 would have gained approximately \$10-12,000 in additional revenue from the two-price program. However, they argued that the program had minimal effect on resource allocation in the prairie region, primarily because it ended abruptly in 1988 when Canada signed a trade agreement with the United States.

Input Subsidies A plethora of subsidy programs have been used to reduce input costs (and indirectly increase output) in the Canadian grains and oilseeds sector. These include subsidies on:

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- Electricity (in Quebec, 1987-92);
 - Fuel (federal excise gasoline tax rebates to producers in all provinces, 1976-92; provincial fuel tax rebates to producers in Quebec 1981- date, Ontario 1975 - date, and Saskatchewan 1974 - date);*
 - Natural gas (in Alberta, 1985 - date);
 - Interest (several provinces, most since the late 1970s or early 1980s);
 - Fertilizer (in Nova Scotia since 1974, Quebec 1971-82, Alberta since 1985);
 - Lime (in Nova Scotia, New Brunswick, Quebec, Alberta and British Columbia—all programs now ended);
 - Pesticides (in Alberta to assist with grasshopper control 1985-87);
 - Property taxes (in Quebec since 1973, Ontario since 1971, Manitoba 1971-88, Saskatchewan 1971-86);
 - Wages (assistance in all provinces since 1992 under the Summer Experience Wage Assistance Program).

Marketing The Canadian Wheat Board (CWB), a federal agency, has dominated grain marketing in Western Canada since it became the compulsory marketing agency for wheat grown in the prairie provinces in 1943. The government added oats and barley to its responsibilities in the 1948-49 crop year. It was responsible for all sales of these grains outside of the prairie region and across provincial boundaries.

The extensiveness of the power of the CWB eventually led to changes. A new feed grain policy was introduced in the 1973-74 crop year which took away the exclusive power of the CWB to sell feed grains within Canada. Oats was removed from the Board's authority in 1989. It has never marketed oilseeds although it regulated flows of flax, canola and rye in the grain handling system by delivery quotas and car allocation. Although the CWB may grant other firms permission to export, it controls the marketing of wheat and barley for export and for human consumption within Canada.

The CWB is based on pooling returns where the producer receives an initial payment at time of delivery to one of the grain companies that serve as agents of the CWB. The revenue pooling accounts operate over an August 1 to July 31 crop year. When the accounts are closed (usually in October) unsold grain is transferred to the new account, deductions are made to cover the CWB's costs and a final payment is issued to producers. If the account has incurred a deficit the losses are covered by the federal treasury. This has happened only rarely in CWB history, and most frequently on barley.

* Editor's Note: On the prairies, provincially untaxed (purple) farm fuel has existed for years.

Recently a number of changes have been made to the CWB to make the grain marketing agency more market responsive for a globalized economy.

- Grain for human consumption within Canada has been priced off United States markets to ensure competitive pricing for Canadian millers and bakers.
- Since 1993, the CWB has provided forecasts to producers through monthly publication of pool return outlooks. This has allowed producers to make more informed production and marketing decisions.
- The pooling system was changed at the beginning of the 1995-96 crop year to correct an internal pricing distortion. Formerly, all producers in the CWB area pooled the costs of grain transportation beyond Thunder Bay to the lower St. Lawrence River from where the grain was loaded onto ocean-going vessels for export. Since the change, individual producers have to pay for all freight charges to either Vancouver or the lower St. Lawrence River, whichever is less expensive. This has made farm level prices in Manitoba and eastern Saskatchewan the lowest on the prairies and increased prices somewhat in Alberta.
- Legislative changes to the way the CWB is organized and run have been passed by the Canadian Parliament. Governance will be under the control of a 15 person board of directors, 10 of which will be elected by producers. The changes will also increase operational flexibility of the organization by allowing it to purchase grain at spot prices outside the pool. Other changes are likely to be made.

The Ontario Wheat Producers' Marketing Board, a provincial marketing board, has controlled marketing of wheat in that province. Domestic use is much more important for Ontario than prairie wheat. It has operated under similar principles to the CWB but allowed no buy-back option like that available in western Canada. Producer delegates recently voted to end its export monopoly. If implemented, this change would provide producers the option of selling all their wheat to the Board or exclusively in the export market.

Credit Provincial and federal governments have been active in providing credit to agricultural producers throughout Canada. The programs often have been directed towards smaller producers or new entrants who faced difficulties in securing credit from regular commercial sources. Many of the provincial government programs were directed towards encouraging particular kind of enterprises, e.g., expansion of livestock or specialty crops. Some provided subsidized credit for the purchase of inputs. Many of the programs offered subsidized interest rates though the extent of subsidization has not been great in recent years.

The vast majority of funds extended by the federal program (Farm Credit Corporation) were to finance transfers of land. Fulton et al. (1989) argued that the programs likely had only minor impacts on overall resource allocation and quantity of output. In a study of the effects of four provincial agricultural credit programs (loans provided by la Société de Financement Agricole du Québec (SFAQ), the New Brunswick Agricultural Development Board, the Manitoba Agricultural Credit Corporation, and FarmStart and the Agricultural Credit Corporation in Saskatchewan), where the effective subsidies ranged from an average of 3.31 percent in Manitoba to 5.43 percent in New

Brunswick, Gunjal et al. (1996) found evidence that the subsidies did have a small effect on land values but didn't mention any possible effects on resource allocation.

Since 1957, the federal government also has provided interest-free cash advances on stored grains under the Prairie Grains Advance Payments Act. The program was stopped in 1989 but a new program was begun in 1990 to restore interest-free cash advances.

United States Policies The major United States policy affecting the Canadian grains and oilseed sector has been the Export Enhancement Program (EEP) which was part of the Food Security Act of 1985. Its stated purpose was to increase United States exports by meeting subsidized competition from the European Union. EEP subsidies have been paid in certificates which can be exchanged for an equivalent value of grains held in government stocks. Most of the EEP subsidies (more than 70 percent) were provided for sales of wheat, including durum (Anania et al., 1992).

The main effect of the EEP was to lower world prices because competing countries, such as Canada, had to match the lower prices. Although one of the stated objectives of the EEP was to compete only in countries where the European Union (EU) was making subsidized sales and to not harm other exporters, Anania et al. (1992) found that the EEP harmed other exporters far more than it harmed the EU. A further effect of the EEP was that it increased prices of grain within the United States because the subsidy was paid only if it was exported to specified countries. This led to increased exports of Canadian grain to the United States since it diverted "...United States supply offshore and made more of the lucrative United States market available to Canada" (Alston, et al., 1997, p. 1309).

Transportation Policies

Statutory Freight Rates Canada had a system of regulated rates for transporting western Canadian grains and oilseeds to export terminals that lasted for nearly 100 years, from 1897 until 1995. Freight costs increased rapidly during the inflationary 1970s. By 1981 it was estimated that shippers of statutory grains paid less than twenty percent of the costs of moving grain. Due to losses sustained in transporting grains and oilseeds, the railroads had little incentive to replace or maintain the grain transportation network. As the transportation system for grain deteriorated, the results were lost grain sales, additional on-farm storage costs and outdated grain handling and transportation technology.

While it was not the sole policy responsible, the widening gap between the full cost of transporting grains to terminal positions and the cost paid by farmers contributed to a number of distortions in the market signals received by those involved in prairie agriculture. Artificially low freight rates meant higher grain prices at the farm level in Western Canada but had no such effect on grain prices in Central and Eastern Canada. The effect was to penalize the livestock and other value-added sectors in Western Canada. Canola crushing and feed processing firms all had to pay higher prices for their oilseed and grain inputs. The transportation subsidy provided an incentive to locate processing plants closer to centers of consumption which often were situated outside the prairie region and, in many cases, outside Canada.

By the early 1980s, the federal government no longer felt obliged to make payments in the manner that had prevailed during the past 85 years. After prolonged debate, the Canadian Parliament

passed the Western Grain Transportation Act (WGTA) in November 1983 which replaced the fixed statutory freight rates on grain with rates that were meant to reflect changing costs of grain transportation. Although the WGTA limited government subsidies on transportation, the subsidies were paid directly to the railroads thus maintaining higher on-farm prices for grains and oilseeds. At the time of the demise of the WGTA (August 1995), western Canadian producers were paying about half the total estimated transportation costs.

The program ended with a \$1.6 billion payout to owners of prairie farmland, \$300 million adjustment assistance fund and \$1 billion in new export credit guarantees to help sales of agricultural products in world markets. Since then, prairie grain and oilseed producers have had to pay the entire cost of moving their products to export terminals (though maximum freight rates are still regulated by the Canadian Transportation Agency). The resultant lower farm prices have stimulated growth of the livestock sector in Western Canada and, with it, a movement away from production of crops for export and towards crops that can be fed or processed closer to home.

Feed Freight Assistance The Feed Freight Assistance (FFA) program also disappeared at the end of the 1994-95 crop year. Since 1941, it had paid part of the costs of transporting feed grains to feed deficit regions of Canada (most parts of British Columbia, eastern Quebec, Atlantic provinces, Northwest Territories and Yukon). Cost of the program at its dissolution was about \$15 million per year. A \$62 million adjustment fund is being paid over ten years to help develop agriculture in the affected regions.

Subsidization of transportation costs for feed grains discouraged feed grain production in many of the feed deficit provinces. Since 1976, most of Ontario and the St. Lawrence region of Quebec had not been eligible for the subsidy. The Yukon and Northwest Territories were added to the program in 1980. In 1984, locally grown grains became eligible for FFA payments, thus stimulating feed grain production in the eastern provinces. During the 1980s, the level of subsidization was reduced so that end users of prairie feed grains had to pay a greater proportion of the total transportation costs. By 1990, only about 25 percent of the transportation costs beyond Thunder Bay were paid by the FFA program.

International Trade Agreements

North America Free Trade Agreement Canada and the United States signed a trade agreement (CUSTA) which came into effect on January 1, 1989. Mexico joined in 1994 to make it a tri-national arrangement: the North American Free Trade Agreement (NAFTA). Although the outcome of the negotiations was significantly less than many had hoped, a number of important changes were made. The main features that affected the grains sector are described briefly below.

- Tariffs on most agricultural products were eliminated over a ten year period (by 1998), with tariffs on many products eliminated immediately when the Agreement took effect and others after a five year period.
- Prior to the signing of the CUSTA, the CWB (in conjunction with the Department of External Affairs) restricted the importation of grains from the United States through an import license requirement. To prevent retaliation by the United States for this trade barrier, exports of grains

to the United States were restricted voluntarily (Kerr, 1989). With the signing of CUSTA, Canada agreed to remove import licenses on wheat, barley and oats when United States support levels for these commodities became equal to or less than the Canadian support level. A formula was agreed to by which the support levels could be calculated and compared.

- Neither country was allowed to use direct export subsidies to ship products to each other. Canada agreed to stop subsidizing transportation costs of grain and oilseed products exported to the United States through west coast ports.

It is now almost ten years since CUSTA came into effect. Although many factors in the dynamic economies of the two countries affect year-to-year differences in trade, there is convincing evidence that trade in grains and oilseeds between the two countries has increased since the agreement took effect. Goodloe and Simone (1992) noted that, already by 1990, U.S. exports to Canada of grains had increased by more than 60 percent from their 1988 (pre-Agreement) levels and Canadian exports to the United States of grains and oilseeds had increased by more than 20 percent.

The two-price wheat program could not be sustained after CUSTA came into force because Canadian millers and bakers could not be prevented from importing wheat or wheat products. To save the Canadian domestic market for Canadian wheat producers, the Canadian government promptly announced the abandonment of the two-price wheat program effective with the start of crop year 1988-89. Producers received some assistance for the program's end under the Two-Price Wheat Compensation Act.

Since Canadian subsidies were lower than those in the United States at the time the CUSTA came into effect, Canadian grains and oilseeds were permitted into the United States immediately. Canada opened its border to United States oats in 1989 and wheat in 1991. Although the calculations still show United States subsidies on barley to be slightly higher than Canadian subsidies on barley, the tariff on imports of United States barley was suspended in late 1997.

Canada has increased its exports of grains and oilseeds (and their products) to both the United States and Mexico since NAFTA came into existence. In the period 1973-76 Canadian trade with the United States was 340,000 tonnes of which 268,000 was barley (less than two percent of total Canadian grain and oilseed exports). Trade with Mexico was virtually non-existent except for a small amount of wheat and canola. In the period 1983-86 (prior to CUSTA) Canadian exports to the United States increased only marginally to 481,000 tonnes (1.6 percent of Canadian exports), of which about half was wheat. Trade with Mexico had developed by the mid 1980s with exports of 359,000 tonnes.

This pattern changed sharply after the CUSTA came into force in 1989. By the 1993-96 period, Canadian exports to the United States had increased more than ten-fold to 4.4 million tonnes. By then, the United States was importing all commodities from Canada, including soybeans. The U.S. market for Canadian wheat (excluding durum) took 9.3 percent of Canadian wheat exports. Durum exports to the United States were 325,000 tonnes (compared to only 16,000 tonnes in 1983-86) representing 9 percent of Canadian durum exports. Oats exports averaged 983,000 tonnes (compared to 101,000 tonnes in 1983-86) which was 96 percent of Canadian oat exports. Barley exports were 1.2 million tonnes (compared to 90,000 tonnes in 1983-86) representing 33 percent of Canadian

barley exports. Canola and flaxseed exports averaged 339,000 tonnes (up from just 39,000 tonnes in 1983-86). Exports to Mexico increased significantly to 1.1 million tonnes, mostly wheat and canola. Together, trade with Mexico and the United States accounted for 22 percent of total Canadian grains and oilseed exports.

The granting in 1985 of “generally regarded as safe” (GRAS) status to low erucic acid rapeseed by the Food and Drug Administration in the United States permitted the marketing of canola oil in the United States. Canola oil has developed a reputation as one of the healthiest edible oils due to its low level of saturated fat and high level of monosaturated fat. In the period 1993-96 Canada exported an average of 332,000 tonnes of canola oil to the United States (compared to only 25,000 tonnes per year in the 1983-86 period). This constituted 86 percent of Canadian canola oil exports. Similarly canola meal exports have increased. The United States imported 637,000 tonnes per year during 1993-96, accounting for 60 percent of Canadian exports.

World Trade Organization With the successful conclusion of the Uruguay Round of GATT negotiations in 1994, Canada, like all other member countries, agreed to increase other countries’ access to Canadian markets, and to reduce internal support and export subsidies. All non-tariff import barriers were converted to bound tariffs which are to be reduced by an average of 36 percent (minimum of 15 percent) by the year 2001 (Brooks and Kraft, 1995). The tariff on wheat was set at 4.4 percent (decreasing to 1.9 percent by 2001) on the first 136,130 tonnes (rising to 226,003 tonnes by 2001). The over-quota tariff was set at 90 percent for common wheat and 57.7 percent for durum wheat (both to be reduced by 15 percent by 2001). A low tariff of 2.3 percent (decreasing to one percent by 2001) was set on feed and malting barley for the first 239,400 tonnes (rising to 339,000 tonnes by 2001). The over-quota tariff was set at 25.1 percent on feed barley and 111.4 percent on malting barley (both to be reduced by 15 percent by 2001).

The subsidy for transporting Western Canadian grains to export terminals was considered an export subsidy which Canada (and other signatories) agreed to reduce over the six year implementation period of the WTO. The Canadian government chose to remove the transportation subsidy (WGTA) altogether in August 1995 rather than reduce it gradually. Canada agreed to reduce the level of domestic internal supports (as calculated by an aggregate measure of support) by 20 percent from the 1986-88 base period. However, by the time the agreement went into effect, Canada had already exceeded the required level of cuts (Brooks and Kraft, 1995). Further reductions in internal support have taken place since that time.

Off-Farm Employment

The increase in availability of off-farm employment opportunities has countered, to some extent, the decrease in number of farms and the increase in average farm size. Off-farm employment, by bringing in wages and salaries, has permitted small farm producers to remain in business even though farm receipts do not always cover the living costs.

The higher educational levels among today's farmers has increased their opportunity costs and exposed them to a multitude of off-farm job opportunities. Farmers are now as well educated as their urban counterparts: average years of formal education among "classic farmers" (defined as farm operators with net farm income and a farm related job) in 1991 was 12.3 compared to 12.5 in the population as a whole (Statistics Canada, 1995). Off-farm income represented 59 percent of total income among the agricultural population in 1991 (Statistics Canada, 1995). Even the identified "classic farmers" obtained 25 percent of their total income from non-farm employment.

Brown (1989) noted that off-farm employment can be considered a form of diversification. Due to the inherent instability of grain and oilseed farms, producers have sought off-farm employment as a way of diversifying income sources.

Institutions and Organizations

A large number of institutions and organizations affect performance of the grains and oilseeds sector in Canada. Changes in regulations and institutional structures have been occurring rapidly in Western Canada during the past ten years. Changes in three major areas are discussed below.

Government Institutions After operating for decades under a highly regulated regime, many public services and institutions have been partially deregulated, privatized or under threat of major changes in the functions they perform. It is clear that the government intends to make grain handling and transportation in Canada more commercially oriented.

The Canadian Grain Commission (CGC) is responsible for, among other things, licensing country and terminal elevators under the Canada Grains Act. Until recently the CGC set maximum tariffs for handling grain. As part of a restructuring and partial deregulation of the CGC, grain companies have been freed to set their own rates for elevation, cleaning and storage. This has increased competitive behaviour among grain companies. Also, many of the inspection and grading services formerly provided by government have been fully or partially privatized. Where government employees still provide these services, users are now required to pay some portion of the costs.

The Grain Transportation Agency has been disbanded, thus getting government out of the business of coordinating rail transportation. The 1996 Canada Transportation Act removed regulations that prevented abandonment of branch lines. Formerly, 10,000 miles of prairie branch lines were protected by legislation. Now, the railroads can abandon any lines they find unprofitable after giving sufficient notice to affected parties. While this decision increases the profitability of the

railroads, it greatly increases transportation costs for producers who live close to these lines. They can be expected to alter their cropping patterns and resource use with the changed conditions.

Grain handling Major changes have occurred in the system for handling grains and oilseeds in Western Canada. The trademark “prairie sentinel” primary elevators (wooden structures built as long ago as 1900) have been disappearing at a staggering rate (Table 9). Some have been replaced by high throughput capacity inland terminals. Overall storage capacity has shrunk, but the volume of grain handled by each has increased sharply.

Associated with the rapid demise of small primary elevators has been the arrival of multi-national companies interested in establishing themselves in the business of handling grain in Western Canada. Cargill has owned a large number of primary elevators since purchasing the National Elevator company in 1975. In 1997, American corporate giant Archer Daniels Midland bought 45 percent of United Grain Growers; Marubeni, a Japanese trading company bought 5 percent. Another corporate giant, Con-Agra announced in 1997 that it was building three large elevators in Saskatchewan. Louis Dreyfus Canada Ltd. recently announced plans to open at least three high volume elevators in Western Canada, with the first in Tisdale, Saskatchewan (Ewins, 1998). The prairie wheat pools, particularly the Saskatchewan Wheat Pool, have begun (or announced) major investments to modernize their primary grain collection structures. As well, many smaller companies (including local groups of farmers) have invested in high throughput grain elevators on the prairies.

Table 9. Elevators and Capacities in Western Canada

	1965	1977	1997
# primary elevators	5,145	3,658	1,153
storage capacity	10.7 mt	9.2 mt	6.6 mt
# terminals	24	14	
terminal capacity	3.5 mt	2.6 mt	
# process elevators	30	24	
process capacity	0.58 mt	0.60 mt	
# transfer elevators	27	14	
transfer capacity	3.4 mt	2.4 mt	
Movement to west coast	8.3 mt	11.7 mt	
Movement to Thunder Bay	13.2 mt	8.8 mt	

Source: Canada Grains Council, Statistical Handbook. Various years.

Producer costs of transporting grains and oilseeds from the prairie provinces to export terminals have increased dramatically with the abandonment of subsidized freight rates and partial deregulation of the grain handling and transportation system (Table 10). This much higher cost has provided incentives for growth of the livestock sector, production of lower volume, higher valued crops, and more value-added activities in the prairie region.

Table 10. Posted Charges for Handling and Transporting Grains and Oilseeds from Mid-Prairie to Export Terminals*

	1987	1997
To St. Lawrence ports	45.54	76.33
To Pacific ports	24.72	53.80

* Includes charges for elevator handling, shrinkage, dockage, carrying, railway freight, terminal elevator, lake transportation (to St. Lawrence), transfer position, fobbing, and marketing.

Source: Canada Grains Council, Statistical Handbook, 1987 and 1997.

While the grain handling system remains heavily regulated with central car allocation and CWB planning, some discussions have occurred about changing to a completely deregulated system based on bargaining and contracts. Further deregulation could stimulate more extensive changes in the western Canadian grains and oilseeds sector.

Farmer Organizations A number of producer organizations representing various commodities have come into existence during the past 25 years. These were formed to help overcome perceived market and institutional failures of the existing market system. For the grains and oilseeds sector, a key problem has been insufficient investment in research and market development.

The Canada Grains Council was formed in 1969. Member organizations represent a cross section of Canada's grain and oilseed sector including handlers, transporters, merchants, trade associations, producer groups, financial institutions, governments and universities. Research has been conducted to address various issues and problems in the industry as seen by member organizations. The Council converted in the 1990s from primarily research functions to, now, almost exclusively an industry information function.

The oldest and possibly the most effective of the organizations has been the Canola Council of Canada. Formed in 1967 as the Rapeseed Association of Canada, the Council serves as an umbrella organization which brings together all groups which have a stake in canola. Its activities include market development through promotional programs, improvements in production through research and producer education, collection and dissemination of information to assist in decision making, and good public relations. Its market development efforts include seminars, feeding trials for canola meal, trade missions, advertisements, displays, and publications. Most importantly, the Council sets the research direction for the commodity and assists in the coordination of research activities. Production has been assisted in ways such as development of new varieties, testing of chemicals, and producer education to improve canola management.

The Western Canadian Wheat Growers Association represents producers who would like to see changes made in the way western Canadian wheat is marketed. In particular, they favour less regulation and more opportunities for private entrepreneurship in the marketing function. Organizations which represent producers of virtually all grains and oilseeds have been formed in Western Canada, including barley, flaxseed, potatoes, vegetables, and pulses. Efforts are underway to form producer organizations for rye and oats.

CONCLUSIONS

Major changes have occurred in the Canadian grains and oilseeds sector during the past 25 years. More canola and less wheat have been grown and exported in Western Canada. Corn and soybean areas and yields have increased in Ontario and Quebec. Major developments in production technologies have changed the ways these crops have been grown. A large number of factors have caused the changes, the most important of which have been:

- Agricultural research has become more focused on producer concerns as a result of greater private sector participation in setting of research agendas.
- Changes in price ratios favouring the growth of canola and the use of more specific inputs, especially fertilizers and pesticides.
- Reductions in agricultural subsidies which formerly distorted price signals.
- Scrapping of two major transportation programs that subsidized the movement of grains and oilseeds out of Western Canada, creating the conditions for greater value-added processing on the prairies.
- Bilateral and multilateral trade agreements that reduced barriers to international trade and directly exposed Canada's grain and oilseed producers to greater competitive pressures.
- Higher levels of education and larger machines allowing many producers to supplement their farm incomes by finding off-farm employment opportunities.
- Major changes in the institutions and organizations that serve the grains and oilseeds sector.

The structure of the Canadian grains and oilseeds sector continues to evolve. Evolution has been most pronounced in the 1990s to date. It is impossible to predict where it will go from here. It's likely that increased rail line abandonment will lead to some conversion of marginal crop land into pasture land.

The performance and costs of the CWB in marketing wheat and barley has come under increased scrutiny and debate over the last several years (Veeman, 1998). Many producers wish to retain the organization that has served them for over 50 years. Others want choice in marketing. There is some evidence that the new grain handling system may be over-built in certain areas which might necessitate consolidation and further rationalization.

The next round of multilateral trade negotiations are scheduled to begin in 1999. The Canadian grains and oilseeds sector has a huge stake in the outcome. Having become more market oriented and competitive as a result of less government involvement and continued technological improvements, the sector is in position to benefit from further relaxation of barriers to trade in all agricultural commodities.

REFERENCES

- Agriculture and Agri-Food Canada (AAFC). 1998. *Farm Income, Financial Conditions and Government Assistance*. Agriculture and Agri-Food Canada, Ottawa, February 1998.
- Alston, Julian M., Colin A. Carter, Richard Gray and Daniel Sumner. 1997. "Third-Country and Second-Best Grain Trade Policies: Export Subsidies and Bilateral Liberalization". *American Journal of Agricultural Economics* 79(4): 1300-1310.
- Anania, Giovanni, Mary Bohman and Colin A. Carter. 1992. "United States Export Subsidies in Wheat: Strategic Trade Policy or Expensive Beggar-Thy-Neighbor Tactic". *American Journal of Agricultural Economics* 74(3):534-545.
- Bollman, Ray D., Leslie A. Whitener and Fu Lai Tung. 1995. "Trends and Patterns of Agricultural Structural Change: A Canada—U.S. Comparison". *Canadian Journal of Agricultural Economics 1995 Special Issue*: 15-28.
- Brooks, Harvey and Daryl Kraft. 1995. "The Uruguay Round Agreement and the Canadian Grains and Oilseeds Industry". ed. Richard Gray, et al. *World Agriculture in a Post-GATT Environment: New Rules, New Strategies*. University Extension Press, University of Saskatchewan, Saskatoon: 203-224.
- Brown, William J. 1989. "Farm Enterprise Size and Diversification in Prairie Agriculture". Ch. 8 in ed. Andrew Schmitz. *Free Trade and Agricultural Diversification: Canada and the United States*, Westview Press, Boulder: 249-302.
- Canada Grains Council. Annual. *Canadian Grains Industry Statistical Handbook*. Canada Grains Council, Winnipeg.
- DePauw, R. M. and J. B. Thomas. 1986. "Spring Wheat Production in the Brown and Dark Brown Soil Zones of Western Canada". In ed. A. E. Slinkard and D. B. Fowler. *Wheat Production in Canada: A Review*, Division of Extension and Community Relations, University of Saskatchewan, Saskatoon.
- DePauw, R. M., G. R. Boughton and D. R. Knott. 1995. "Hard Red Spring Wheat". Ch. 2 in ed. A.E. Slinkard and D.R. Knott. *Harvest of Gold: The History of Field Crop Breeding in Canada*, University Extension Press, Univ. of Sask., Saskatoon: 5-35.
- Dexter, James E. 1993. "Quality Requirements of Western Canadian Bread Wheats". Ch. D-5 in *Grains and Oilseeds: Handling, Marketing, Processing, Volume II*. Canadian International Grains Institute, Winnipeg, MB: 697-722.
- Ewins, Adrian. 1998. "Dreyfus Enters Grain War in Crowded Tisdale". *The Western Producer*, Modern Press, Saskatoon, March 19, 1998: 20.

- Fulton, Murray, Ken Rosaasen and Andrew Schmitz. 1989. *Canadian Agricultural Policy and Prairie Agriculture*. Economic Council of Canada, Ottawa.
- Goddard, Ellen, Alfons Weersink, Kevin Chen and Calum G. Turvey. 1993. "Economics of Structural Change in Agriculture". *Canadian Journal of Agricultural Economics* 41: 475-489.
- Goodloe, Carol and Mark Simone. 1992. "A North American Free Trade Area for Agriculture: The Role of Canada and the U.S.-Canada Agreement". *Agriculture Information Bulletin #644*, Economic Research Service, U.S. Dept. of Agriculture, Washington.
- Gray, Richard, Ward Weinsensel, Ken Rosaasen, Hartley Furtan and Daryl Kraft. 1991. "A New Safety Net Program for Canadian Agriculture: GRIP". *Choices*. The American Agricultural Economics Association. Spring 1991: 34-35.
- Gray, Richard and Vincent H. Smith. 1997. "Harmonization and Convergence of Canadian and U.S. Grains and Oilseeds Policies: 1985-1996". In ed. R.M.A. Loyns, et al. *Harmonization/Convergence/Compatibility in Agriculture and Agri-Food Policy: Canada, United States and Mexico*. University of Manitoba, Winnipeg: 215-233.
- Guitard, A. A. 1985. "The Canadian Agricultural Research Institution". Ch. 3 in *Economics of Agricultural Research in Canada*, ed. K. K. Klein and W. H. Furtan. The University of Calgary Press, Calgary: 21-49.
- Gunjal, Kisan, Sarah Williams and Robert Romain. 1996. "Agricultural Credit Subsidies and Farmland Values in Canada". *Canadian Journal of Agricultural Economics* 44(1): 39-52.
- Hedley, Douglas D. and Jack A. Gellner. 1995. "How Policy Decisions Are Made in Canadian Agriculture". In ed. R.M.A. Loyns, et al. *Understanding Canada/United States Grain Disputes*. Winnipeg: Department of Agricultural Economics and Farm Management, University of Manitoba: 7-19.
- Hughes, G. R. 1986. "Testing of Candidate Wheat Cultivars for Agronomic Traits and Pest Resistance". Ch. 27 in, ed. A.E. Slinkard and D.B. Fowler. *Wheat Production in Canada: A Review*. Division of Extension and Community Relations, University of Saskatchewan, Saskatoon: 440-499.
- Kerr, William. A. 1989. "Diversification of Prairie Agriculture". Ch. 3 in, ed. Andrew Schmitz. *Free Trade and Agricultural Diversification: Canada and the United States*. Westview Press, Boulder: 37-87.
- Klein, K. K. and W.A. Kerr. 1995. "The Globalization of Agriculture: A View From the Farm Gate". *Canadian Journal of Agricultural Economics* 43(4): 551-564.
- McFetridge, D. G. 1986. *Canadian Industry in Transition*. University of Toronto Press, Toronto.

-
- Miranda, M. J., F. Novak and M. Lerohl. 1994. "Acreage Response Under Canada's Western Grain Stabilization Program". *American Journal of Agricultural Economics* 76: 270-276.
- Peterson, Lawrence. 1997. Personal communication. Western Grains Research Foundation, Saskatoon.
- Saskatchewan Agriculture and Food. Annual. *Agricultural Statistics*. Saskatchewan Agriculture and Food, Regina.
- Schultz, T. W. 1972. "The Increasing Value of Human Time". *American Journal of Agricultural Economics* 54: 843-850.
- Spriggs, John and Toby Nelson. 1997. "Effects of Enhancing NISA on Income Stabilization and Support". *Canadian Journal of Agricultural Economics* 45(2): 123-129.
- Statistics Canada. 1995. *People in Canadian Agriculture*. Catalogue 21-523E Occasional, Statistics Canada, Ottawa.
- Statistics Canada. Annual. *Agriculture Economic Statistics*. Catalogue 21-603-UPE. Statistics Canada, Ottawa.
- Statistics Canada. Selected years. *Census of Agriculture*. Statistics Canada, Ottawa.
- Veeman, Michelle. 1998. "Who will Market Western Canada's Grain". *Canadian Journal of Agricultural Economics* 46; 1-16.