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United States and Canadian Agricultural Herbicide Costs: Impacts on North Dakota Farmers

Richard D. Taylor
Won W. Koo

Northern Plains Trade Research Center
Department of Agribusiness and Applied Economics
North Dakota State University
Fargo, ND 58105-5636

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Abstract

Pesticides have become a major farm production cost over the past 25 years. There are price and label differences for agricultural herbicides between the United States and Canada. Trade names are different in some cases, label restrictions vary, and weights and measures are different. The reasons for the price differences are unclear. Whether they are due to increased costs in labeling requirements, different levels of competition and use, or market segmentation is not determined. The largest total impact of using lower priced Canadian herbicide is on HRSW, followed by durum and corn. The largest per acre impact is for canola, corn, and HRSW. Herbicides with the largest total impact are Puma, followed by Roundup and Fargo. Net farm income for large, medium, and small size representative farms would increase 3.8%, 4.6%, and 5.2%, respectively, if Canadian priced herbicides could be used in the United States. The statewide impact is $1.46 per acre, but regional or individual impacts could be much greater depending on crops grown or the specific weed problem faced by the individual producer.

Key Words: Agricultural Herbicide Costs, Trade Harmonization, North Dakota Representative Farm, Land Value, Pesticides

Highlights

Pesticide expenses in the United States increased from 1.2% of total production expenses in 1965 to 5.1% in 1999. Pesticide expenses in North Dakota increased 1.7% of total production expenses to 8.1% over the same time period.

A controversy between the United States and Canada began in late 1997 when it became apparent that some pesticides were substantially lower priced in Canada than in the United States, and many pesticides that were labeled in Canada were unavailable in the United States.

Many herbicides carry different trade names in Canada than they do in the United States. For example, Basis in the United States is Prism in Canada, Fargo in the United States is named Avadex BW in Canada, and Harmony in the United States is Refine Extra in Canada.

There is a wide range of cost differences between the two countries. Cost per acre for Liberty in the United States is $9.64 higher than in Canada, while that for Pursuit in Canada is $3.63 higher than in the United States. Stinger, Dual, Fargo, and Assert are also higher priced in the United States. Treflan is lower priced in the United States than in Canada, along with Harmony, 2,4-D, and MCPA.

The largest impact of higher herbicide prices in the United States is on hard red spring wheat, $11.6 million, followed by durum, $4.6 million. The impact on corn and canola is $2.9 million and $2.8 million, respectively. The total impact is $23.9 million, or $1.46 per acre.

Puma would have an $11.4 million impact if the price in the United States were lowered to match the Canadian price. Roundup would have almost a $6 million impact. Fargo and Stinger would each have a $4.1 million impact.

The North Dakota Representative Farm Model was used to estimate the impact of different herbicide prices. The savings in herbicide costs are $4,635 for the large size farm, $2,458 for the medium size farm, and $1,341 for the small size farm. As the savings were capitalized into land values, increases in net farm income fell throughout the time period estimated.

Land values were the same until 2001 when the land value under the Canadian herbicide price scenario began to increase. The land value under the Canadian herbicide price scenario increased to $510 per acre in 2009 compared to $488 under the U.S. herbicide price scenario. Cash rents also increased. The average cash rents in North Dakota increased by $2 per acre from 2004 through 2009.

United States and Canadian Agricultural Herbicide Costs: Impacts on North Dakota Farmers

Richard D. Taylor and Won W. Koo[1]

Introduction

Pesticide use became important for U.S. agriculture in the late1960s. In 1965 pesticide use was $5.2 million for North Dakota and $474.1 million for the United States. By 1970 the use of pesticides doubled to $11.2 million for North Dakota and $960 million for the United States and between 1975 and 1999 pesticide use grew 383% for the United States and 588% for North Dakota (Table 1). Pesticide use in North Dakota has followed the same trend as the rest of the United States (Figure 1). In 1965 pesticide expenses were 1.2% of total production expenses in the United States and 1.7% in North Dakota. By 1999, pesticide expenses had increased to 5.1% of the total production expenses in the United States and 8.1% in North Dakota.

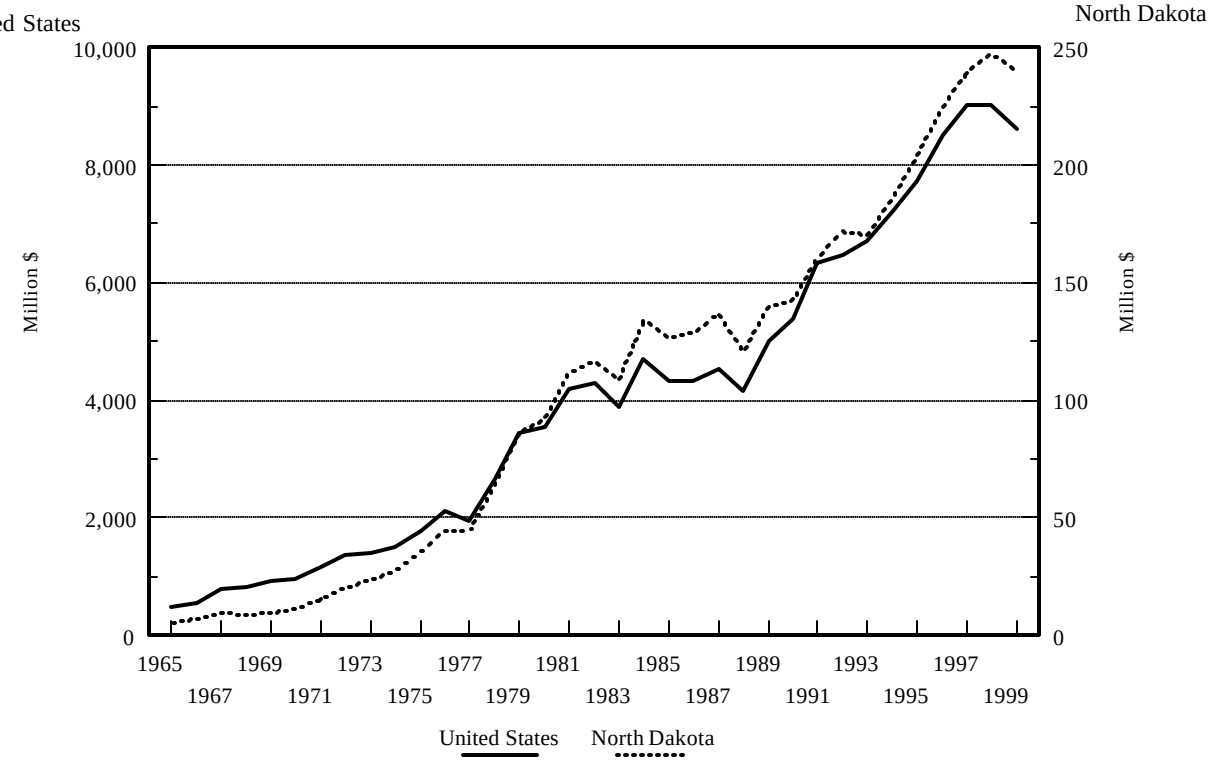

Figure 1. United States and North Dakota Agricultural Pesticide Expense

[1]The authors are research associate and professor, respectively, in the Department of Agribusiness and Applied Economics, North Dakota State University, Fargo. Koo is also Director of the Northern Plains Trade Research Center.

Table 1. Total Pesticide Cost in the United States and North Dakota

Year	United States	North Dakota
	--------- Million $---------	
1975	1,782.5	34.9
1976	2,107.8	44.6
1977	1,938.0	44.0
1978	2,656.3	64.5
1979	3,436.0	86.1
1980	3,538.6	91.3
1981	4,200.8	111.5
1982	4,282.2	116.9
1983	3,870.1	108.0
1984	4,687.8	133.8
1985	4,333.7	126.3
1986	4,323.7	128.7
1987	4,512.2	137.1
1988	4,147.7	120.7
1989	5,011.5	139.6
1990	5,363.2	142.8
1991	6,320.5	160.8
1992	6,470.6	171.6
1993	6,719.7	170.2
1994	7,219.6	185.8
1995	7,718.7	203.7
1996	8,518.4	223.9
1997	9,017.5	239.2
1998	9,017.8	247.2
1999	8,618.2	240.3

Source: USDA, ERS.

A controversy between the United States and Canada began in late 1997 when it became apparent that some pesticides were substantially lower priced in Canada than in the United States. Also, pesticides that were labeled in Canada were unavailable in the United States. There are many possible explanations for the differences. The explanations differ depending whether you are hearing from the chemical industry, state government, political leaders, or farm organizations.

The chemical industry maintains that each country has separate labeling procedures and requirements. The registration process is about twice as expensive in the United States and requires about one more year than in Canada; therefore, the increased fixed cost of labeling plus the one lost year of potential sales must be added to the cost of the herbicide. Another rationale for higher prices

relative to fixed costs in the U.S. market is that the Canadian market for spring grown cereal grains is about twice as large as in the upper Midwest and about seven times larger for canola. Canadian producers also have a larger selection of herbicides than do the U.S. producers, which increases competition in Canada. Therefore, the chemical industry argues that the higher fixed cost of labeling and smaller market for certain crops in the United States and greater competition in Canada, justifies the price differences. Agricultural organizations and political leaders maintain that the chemical companies are using the Canadian border to segment the United States and Canada into two separate markets, allowing them to charge higher prices in the United States.

Another potential problem is that each country uses a different weights and measure system. Canada is on the metric system (liters and grams) while the United States maintains the English system (pints, gallons, and pounds). Application rates and label requirements are different between the two countries and would have to be converted before application.

Pesticides can be divided into three groups based on the target host. Herbicides are directed towards plants. Insecticides are used for insect control, and fungicides are used to control disease on leaves, seed, or final production. This study will examine herbicide costs in North Dakota.

The objective of the study was to estimate the total additional cost paid by North Dakota producers for agricultural herbicides for hard red spring wheat, durum wheat, barley, corn, soybeans, sunflowers, and canola compared to the cost of herbicides in Canada. In addition, the impact of each herbicide was estimated to determine which herbicides had the largest impact on North Dakota producers. The estimated cost saving for a North Dakota producer, if they could use Canadian herbicides, was estimated using the North Dakota Representative Farm Model which is operational at the Northern Plains Trade Research Center at North Dakota State University.

Several internal studies have been conducted by North Dakota farm organizations. The studies estimated the impact of higher herbicide prices on North Dakota producers, but they did not identify the impact on individual crops grown in North Dakota. Data were used from the *1998 Agricultural Chemical Use Estimates for Field Crops* and the *Agricultural Chemical Usage, 1999 Field Crops Summary* (USDA, NASS) along with the NDSU Extension Service publication *Pesticide Use and Pest Management Practices for Major Crops in North Dakota, 1996* to estimate herbicide usage in North Dakota. North Dakota prices were obtained from the NDSU Extension Service Publication *2001 North Dakota Weed Control Guide,* and Canadian prices were obtained from a herbicide cost calculator at the Alberta Agriculture, Food, and Rural Development website.

Method

A spreadsheet was developed to calculate herbicide costs for each county in the state, each crop in the study, and each herbicide with substantial use within the state. North Dakota and Canadian prices were used to estimate differences in herbicide costs. Application rates for Canadian herbicides were adjusted to equal U.S. application rates, i.e., pints per acre, pounds per acre. Canadian prices in Canadian dollars were converted into U.S. dollars using the exchange rate on March 26, 2001, and

Canadian measures were converted into U.S. weights and measures, liters were converted into U.S. gallons.

Herbicides which were not labeled in North Dakota were not part of the study. Also, several herbicides labeled for corn and soybeans were not labeled in Canada. In the second part of the study, the Canadian price of each herbicide was used to estimate the impact of that price on North Dakota herbicide costs.

It was assumed that the usage of agricultural herbicides did not change when the Canadian prices were incorporated into the model. Data that would indicate substitution rates between competing herbicides were not available. The substitution would increase the cost savings under the Canadian scenario because farmers would shift usage towards lower priced herbicides and away from the higher priced herbicides. Also, different herbicides provide different effectiveness for weed control which would change yield potential. It was further assumed that herbicide use was constant throughout the state and between the large, medium, and small size representative farms.

Empirical Results

Analysis of Herbicide Prices

Table 2 shows the herbicide usage in North Dakota for small grains. The 2,4-D herbicide was used on 57% of HRSW acres, 62% of durum, and 45% of barley. MCPA was used on 63% of HRSW acres, 29% of durum, and 47% of barley. These older phenoxy herbicides are still the most widely used post-emergent broad leaf herbicide followed by Express, which was used on 25% of the acres of HRSW, 48% of durum, and 9% of barley. Banvel and bromoxynil were used as tank mixes with other herbicides except in durum. Puma had the largest use of any grass herbicide, 39% of HRSW, 34% of durum, and 18% of barley. Roundup use was minor except for durum (21%).

Table 2. Herbicide Usage in North Dakota for HRSW, Durum Wheat, and Barley

Trade Name	Active Ingredient	HRSW	Durum	Barley
		-------% of acres---------		
2,4-D	2,4-D	0.57	0.62	0.45
MCPA	MCPA	0.63	0.29	0.47
Bromoxynil	Bromoxynil	0.07		0.21
Banvel	Dicamba	0.03	0.09	
Stinger	Clopyralid	0.05		
Harmony	Thifensulfuron	0.09		0.06
Express	Tribenuron-methy	0.25	0.48	0.09
Treflan	Trifluralin	0.04	0.21	0.09
Puma	Fenoxaprop	0.39	0.34	0.18
Fargo	Triallate	0.08	0.07	0.12
Roundup	Glyphosate	0.03	0.21	0.01

Source: USDA, NASS; NDSU Extension Service.

Table 3 shows the herbicide use in North Dakota for corn. Harness is used on 31% of the corn and is the most widely used herbicide for corn followed by Atrazine (23%) and Dual (13%). Accent (22%) is the most widely used post-emergent herbicide followed by Basis (17%) and 2,4-D (12%).

Table 3. Herbicide Usage in North Dakota for Corn

Trade Name	Active Ingredient	Corn
		-% of acres-
Harness	Acetochlor	0.31
Dual	Metolachlor	0.13
Frontier	Dimethenamid	0.11
Eptam	EPTC	0.03
Lasso	Alachlor	0.03
Atrazine	Atrazine	0.23
Python	Flumetsulam	0.05
Bladex	Cyanazine	0.04
Basis	Rimsulfuron	0.17
2,4-D	2,4-D	0.12
Banvel	Dicamba	0.11
Stinger	Clopyralid	0.09
Bromoxymil	Bromoxynil	0.08
Accent	Nicosulfuron	0.22
Beacon	Primisulfuron	0.06
Marksman	Dicamba, Pot.Salt	0.05
Roundup	Glyphosate	0.08

Source: USDA, NASS; NDSU Extension Service.

Table 4 shows the herbicide usage for sunflowers, canola, and soybeans. Sonalan is the most widely used pre-emergent herbicide for sunflowers and is used on 61% of the sunflower acres and 12% of the non-GMO canola acres, followed by Treflan, 28% of sunflowers and 10% of non-GMO canola. Treflan is the most widely used pre-emergent for non-GMO soybeans (23% of all soybean acres) followed by Prowl at 17%. Pursuit is the most widely used post-emergent herbicide on soybeans (60%). GMO seed are planted on 69% of canola acres and 49% of soybean acres. Roundup is used on 55% of the canola acres and 42% of the soybean acres.

Table 4. Herbicide Usage in North Dakota for Sunflowers, Canola, and Soybeans

Trade Name	Active Ingredient	Sunflowers	Canola	Soybeans
		----------% of acres----------		
Sonalan	Ethalfluralin	0.61	0.12	
Prowl	Pendimethalin	0.11		0.17
Treflan	Trifluralin	0.28	0.10	0.23
Assert	Imazamethabenz	0.10		
Poast	Pendimethalin	0.14	0.08	
Muster	Ethalfluralin		0.08	
Stinger	Clopyralid		0.10	
Pursuit	Imazethapyr			0.60
Basagran	Bentazon			0.20
Flexstar	Fomesafen			0.06
Cobra	Lactofen			0.05
Fusilade	Fluazifop-P-butyl			0.08
Classic	Chlorimuron-ethyl			0.09
Roundup	Glyphosate	0.05	0.55	0.42
Liberty	Glufosinate		0.07	
Raptor	Imazamox		0.07	0.07

Source: USDA, NASS; NDSU Extension Service.

Table 5 shows the trade names and typical per acre cost for North Dakota and Canadian priced agricultural herbicides. Many of the herbicides carry different trade names in Canada than they do in the United States. For example, Basis in the United States is Prism in Canada, Fargo in the United States is named Avadex BW in Canada, and Harmony in the United States is Refine Extra in Canada. There is a wide range of cost differences between the two countries. Cost per acre for Liberty is $9.64 higher in the United States than in Canada, while Pursuit is $3.63 higher in Canada than in the United States. Stinger is $7.95 per acre higher in the United States, Dual is $7.71 higher, Fargo is $4.45 higher, and Assert is $3.33 higher. Treflan is $2.02 lower in the United States than in Canada, Harmony, 2,4-D, and MCPA are $0.51, $0.41, and $0.11 lower, respectively.

Table 5. Herbicide Trade Names and Estimated Per Acre Herbicide Costs in North Dakota and Canada

Trade Name			Typical Cost Per Acre		
North Dakota	Canada	Active Ingredient	North Dakota	Canada	Difference
			----------US$/acre----------		
2,4-D	2,4-D	2,4-D	1.40	1.81	-0.41
Assert	Assert 300-SC	Imazamethabenz	7.50	4.17	3.33
Atrazine	Atrazine	Atrazine	2.65	2.53	0.12
Banvel	Banvel	Dicamba	10.30	9.92	0.33
Basagran	Basagran	Bentazon	13.50	12.77	0.73
Basis	Prism	Rimsulfuron	5.45	3.73	1.72
Bladex	Bladex	Cyanazine	15.00	12.27	2.73
Bromoxynil	Buctril M	Bromoxynil	6.90	4.58	2.32
Dual	Primextra Light	Metolachlor	21.90	14.19	7.71
Eptam	Eptam	EPTC	20.30	19.57	0.73
Express	Express Pack	Tribenuron-methy	4.40	3.95	0.45
Fargo	Avadex BW	Triallate	10.00	5.55	4.45
Fusilade	Fusilade II	Fluazifop-P-butyl	9.40	9.49	-0.09
Harmony	Refine Extra	Thifensulfuron	3.15	3.66	-0.51
Liberty	Liberty	Glufosinate	21.90	12.21	9.64
MCPA	MCPA	MCPA	1.75	1.86	-0.11
Poast	Poast	Sethoxydim	8.15	7.43	0.72
Puma	Puma 120 Super	Fenoxaprop	9.00	6.04	2.96
Pursuit	Pursuit	Imazethapyr	9.45	13.08	-3.63
Raptor	Odyssey	Imazamox	14.10	11.26	2.79
Roundup	Roundup	Glyphosate	6.90	4.07	2.83
Sonalan	Edge	Ethalfluralin	9.18	8.59	0.59
Stinger	Lontrel	Clopyralid	24.00	16.05	7.95
Treflan	Treflan	Trifluralin	6.25	8.27	-2.02

Source: NDSU Extension Service; Alberta Agriculture, Food, and Rural Development.

Table 6 shows the impacts of higher herbicide prices on North Dakota producers. The impact was calculated using the USDA's estimated herbicide usage for each crop (% of crop) in the state, times the number of acres of that crop, times the average rates and prices in the two countries. The largest impact is on HRSW, $11.6 million or $1.86 per acre, followed by durum, $4.6 million or $1.45 per acre. The impact on corn and canola is $2.9 million and $2.8 million, respectively. Herbicide costs for soybeans are lower in the United States than in Canada. The total impact is $23.9 million, or $1.46 per acre, for these seven crops.

Table 6. Impacts of Higher Herbicide Prices for North Dakota on Herbicide Costs for Various North Dakota Crops

	Total Herbicide Costs		Total	Per Acre
Crop	U.S. Prices	Canada Prices	Difference	Difference
	----------US$----------			
HRSW	58,693,633	47,047,332	11,646,301	1.86
Durum	31,626,330	26,954,510	4,671,820	1.45
Barley	11,193,188	9,054,548	2,138,640	1.28
Corn	24,256,999	21,325,461	2,931,538	2.84
Soybeans	26,478,663	27,514,851	(1,036,189)	-0.70
Sunflowers	18,977,556	18,217,330	760,225	0.41
Canola	8,606,524	5,783,256	2,823,268	3.30
Total	179,832,891	155,897,288	23,935,603	1.46

Table 7 shows which herbicides have the largest potential for cost savings if U.S. prices were lowered to match Canadian prices. Puma, which is a post-emergent grass herbicide, would have an $11.4 million impact if the price in the United States were lowered to match the Canadian price. Roundup, which is a non-selective herbicide, would have almost a $6 million impact. Fargo and Stinger would have a $4.1 million impact.

Table 7. Impacts of Higher Herbicide Prices for Individual Herbicides on North Dakota Total Herbicide Costs

Trade Name	Total Herbicide Cost	Impact
	----------US$----------	
Base	179,832,891	
Puma	168,482,564	11,350,327
Roundup	173,878,416	5,954,475
Fargo	175,709,699	4,123,192
Stinger	175,722,208	4,110,683
Bromoxynil	178,002,643	1,830,248
Express	178,365,243	1,467,648
Dual	178,797,665	1,035,226
Sonalan	179,168,156	664,735
Assert	179,217,840	615,051
Liberty	179,256,274	576,617
Raptor	179,378,594	454,297
Poast	179,506,991	325,900
Basis	179,530,886	302,005
Basagram	179,618,030	214,861
Banvel	179,675,194	157,697
Bladex	179,720,104	112,787

Representative Farm Analysis

The impact on individual North Dakota farms was estimated using the Representative Farm Model. Two scenarios were evaluated, (1) the base model where U.S. herbicide prices were used and (2) Canadian herbicide prices were used. Table 8 shows those impacts on state net farm income for small, medium, and large size farms. The net income differences for large, medium, and small size farms for 1999 were $4,635, $2,458, and $1,341, respectively. This implies that savings in herbicide costs are $4,635 for the large size farm, $2,458 for the medium size farm, and $1,341 for the small size farm. The increases in net farm income fell throughout the estimated time period because the herbicide cost savings were capitalized into land values. This implies that while the cost savings of lower priced herbicides remained the same, increased land values raised cash rents which offset some of the herbicide cost savings. The average increases in net farm income for the large, medium, and small size farm over the time period was $3,712, $2,084, and $1,232, respectively.

Table 8. State Average Net Farm Income for Representative Farms with U.S. and Canadian Herbicide Prices

	U.S.	Canadian	Diff	U.S.	Canadian	Diff	U.S.	Canadian	Diff
	Large			**Medium**			**Small**		
	US$								
1999	119,811	124,446	4,635	52,965	55,423	2,458	25,705	27,046	1,341
2000	101,296	105,977	4,681	45,420	47,903	2,483	15,282	16,637	1,354
2001	91,521	96,272	4,751	36,401	38,920	2,520	6,809	8,183	1,375
2002	97,347	101,696	4,349	40,533	42,881	2,348	8,962	10,277	1,315
2003	101,455	105,265	3,810	46,919	49,037	2,117	11,978	13,213	1,235
2004	103,601	106,780	3,179	47,205	49,051	1,845	11,811	12,950	1,139
2005	107,114	110,140	3,026	50,065	51,851	1,787	11,792	12,918	1,126
2006	110,184	113,188	3,003	51,460	53,245	1,785	12,562	13,695	1,133
2007	113,229	116,286	3,057	53,244	55,061	1,817	13,127	14,282	1,155
2008	114,830	117,960	3,130	54,483	56,340	1,858	13,485	14,663	1,178
2009	114,403	117,619	3,216	54,293	56,198	1,905	13,979	15,183	1,204
Average	106,799	110,512	3,712	48,453	50,537	2,084	13,227	14,459	1,232

Table 9 shows the estimated land values for North Dakota Representative Farms under the two different scenarios. Land values were the same until 2001 when the land value for the Canadian herbicide price scenario increased to $430 per acre compared to $415 per acre for the U.S. herbicide price scenario. By 2009 the land value for the Canadian herbicide price scenario increased to $510 per acre compared to $488 for the U.S. herbicide price scenario. Cash rents also increased. The average cash rents in North Dakota increased by $2 per acre by 2004.

Table 9. North Dakota Land Prices and Cash Rents for Representative Farms with U.S. and Canadian Herbicide Prices

	U.S.	Canadian	Diff	U.S.	Canadian	Diff
	----------U.S.$/acre----------					
1999	435	435	0	35	35	0
2000	427	427	0	34	34	0
2001	415	430	15	33	33	0
2002	406	425	19	32	33	1
2003	404	425	21	32	33	1
2004	409	431	22	31	33	2
2005	431	453	22	31	33	2
2006	450	472	22	33	34	1
2007	464	486	22	34	36	2
2008	473	496	23	35	37	2
2009	488	510	23	36	38	2
Average	437	454	17	33	34	1

Conclusions

Pesticides have become a major part of agriculture over the past 25 years. North Dakota producers used more pesticides on average than do producers in the rest of the United States. There are price and label differences for agricultural herbicides between the United States and Canada. Trade names are different in some cases, label restrictions vary, weights and measures are different. The reasons for the price differences are unclear. Whether they are due to increased costs in labeling requirements, different levels of competition and use, or market segmentation is not determined.

Liberty, Stinger, and Dual have the largest price differences between the two countries while prices of Pursuit, Treflan, and Harmony are higher in Canada than in the United States. The largest total impact is on HRSW followed by durum and corn. The largest per acre impact is for canola, corn, and HRSW. Herbicides with the largest total impact are Puma, followed by Roundup and Fargo.

Net farm income for large, medium, and small size representative farms would increase 3.8%, 4.6%, and 5.2%, respectively, if Canadian priced herbicides could be used in the United States. Through the time period of the estimation, some of the cost savings would be capitalized into land values in North Dakota. In 2009 with Canadian priced herbicides, land value would increase 4.5% over land values with U.S. priced herbicides.

The statewide impact is $1.46 per acre for the 1999 crop year, but regional or individual impacts could be much greater depending on crops grown or the specific weed problem faced by the individual producer.

References

Alberta Agriculture, Food, and Rural Development, http://www.agric.gov.ab.ca/.

Jirava, Jerred, Nathan Kahnke, Sara Hoesel, and Mark Huso. *Agricultural Chemical Harmonization*. Paper developed for Dr. William Wilson. North Dakota State University, Fargo. October 5, 2000.

Koo, Won W., Richard D. Taylor, and Andrew L. Swenson. *2000 North Dakota Agricultural Outlook: Representative Farms 2000-2009*. Agribusiness & Applied Economics Report No. 446. Northern Plains Trade Research Center, North Dakota State University, Fargo. August 2000.

North Dakota Agricultural Statistics Service, USDA. *North Dakota Agricultural Statistics*, various issues. North Dakota State University, Fargo.

North Dakota State University Extension Service. *2001 North Dakota Weed Control Guide*. Circular W-253. Fargo, ND. January 2001.

North Dakota State University Extension Service. *Pesticide Use and Pest Management Practices for Major Crops in North Dakota, 1996*. Extension Report No. 43. Fargo, ND. September 1998.

Schmitz, Mindi. North Dakota Farmers Union. Personal communication. February 15, 2001.

Semler, Tim, Rueben Mayer, and John Corbey. "Durum Production - 2000." Presentation. Bottineau County Agent. 1999.

U.S. Department of Agriculture, Economic Research Service. *Agricultural Production Expenses*. http://www.ers.usda.gov/ .

U.S. Department of Agriculture, National Agricultural Statistics Service. *1998 Agricultural Chemical Use Estimates for Field Crops*. Washington, DC. May 1999.

U.S. Department of Agriculture, National Agricultural Statistics Service. *Agricultural Chemical Usage, 1999 Field Crops Summary*. Washington, DC. May 2000.