
ACCESS TO PESTICIDES AS A SOURCE OF TRADE DISPUTE

Cameron Short and David Freshwater¹

INTRODUCTION

Pesticide use has two significant implications for trade disputes in agricultural products. The first is that SPS rules in trade agreements allow individual countries to establish the maximum allowable level of exposure for their citizens to pesticide residues in food by setting maximum residue levels (MRLs) or tolerances for various food products. This clearly provides an opportunity to set levels so low that they exclude imports from countries that may use either unapproved compounds or allow higher residue levels. This has obvious trade implications. The second mechanism is more subtle since it involves farm level production effects. If specific pesticides are available in one country but not in another, this can affect both crop yields and quality, and relative costs of production, thereby affecting the competitive position of a country.

Because pesticides can only legally be used in a specific country if they have a label that is approved by that country, it is virtually impossible for farmers or anyone else to import pesticides. An important consequence

¹ The authors express their thanks to Ken McEwan for sharing his data for this paper. Any errors are the sole responsibility of the authors.

of these government created barriers to trade is that they essentially encourage chemical companies to practice price discrimination. Thus the case of pesticides is also of more general interest because it illustrates how regulation and strong product differentiation can have the same effects in terms of market segmentation- -with differences in prices and product availability -- as tariffs and quantitative restrictions. Pesticide regulation is also of interest because it is one of the areas where there is extensive cooperation among the regulatory agencies in Canada, Mexico and the United States to bring about harmonization. So there is a clear effort by regulators to try to find ways to resolve the problems of differences in national regulatory standards. However these efforts, while addressing some of the current trade issues, are not likely to resolve all of them.

At present the most visible form of dispute stems from perceptions and specific observations by producers that certain pesticides cost more on one side of the border than on the other. Higher prices are seen as creating a competitive disadvantage relative to farmers growing the same crop for the same international market. Price differential issues tend to be mainly found for pesticides used on high volume crops that are sold as commodities, where controlling costs is a critical element in determining levels of profit among producers.

A somewhat less visible dispute area involves the availability of specific products. Some pesticides may not be available in one country but are in the other. On a more refined level, some may be available in both countries but are licensed for application on a different set of crops, once again creating access problems. In general, the current concern with access is more common for minor use pesticides, that is, uses where demand is relatively low and there is the possibility that the pesticide cannot be supplied on a cost effective basis under the standard regulatory scheme. However there are occasionally cases where a product is available for a specific use on a major crop in one country and not in others, often because of lags in the regulatory process. In the long run, access may become an even more important issue if regulation reduces the incentive for companies to develop and register pesticides in certain countries.

Because pesticides are an increasingly vital input for farmers, significant differences in availability or in prices will continue to cause complaints. As other trade barriers are dismantled SPS, decisions that influence pesticide regulation could create significant trade barriers. Our analysis suggests that the primary beneficiaries of barriers to the free flow of pesticides across national borders are the pesticide manufacturers. Such barriers to arbitrage create an ideal environment for price discrimination. Thus it should not be surprising to economists to see significant price differences in prices among countries. Harmonization of regulation is thus the first step in removing the regulatory barriers that create incentives for price discrimination by pesticide producers.

Background information, which provides a context for access to pesticides as a source of trade disputes, is presented in the next section. This is followed by a brief description of the regulatory process including a description of harmonization goals and steps being undertaken to achieve this goal. Price and availability issues are then described with conclusions presented in the final section.

THE CONTEXT FOR DISPUTES

The Role Of Pesticides

Pesticides are a class of compounds used in agriculture to enhance the quality and/or quantity of desirable species of plant or animals. Pesticides control pests by either killing or weakening them, or by making the treated product unattractive to the pest. Pests take the form of animals, insects, plants, fungi and nematodes, but the defining feature of a pest is that it causes an adverse effect upon some species of plant or animal that the farmer is trying to produce. While natural forms of pesticides have been employed since the very early stages of agriculture, pest management took on new significance following World War II as advances in chemistry and biology combined with the mechanization of agriculture and wide spread use of synthetic fertilizer to transform production technology. USDA estimates that 86% of the acreage planted to five major crops (wheat, corn, cotton, soybeans and fall potatoes) were treated at least once with a herbicide (USDA 2000, p. 19). Of these crops cotton

made the most use of all forms of pesticides and wheat the least . Other USDA analysis shows that fruits and vegetables have a far higher per acre use rates and employ a broader spectrum of pesticides (USDA 2001, p. 13). In production systems that are based upon intensive land management, there is an inevitable development of significant pest problems. This means there is a steady demand for new compounds to replace those that become less effective. Pest control products provide a means to sustain the production methods that have increased food production at a faster rate than world population growth, facilitate a reduction in the share of total employment required in farming, and lower the real cost of food for consumers. Although outlays on pest control products represent a relatively minor share of the total cost of food and fiber production, the timely application of pest control products can mean the difference between no production and a normal crop.

But pesticides have significant costs inherent in their use. Because they are toxic by design, they can harm non-target species, including applicators, bystanders and wildlife. Pesticide residues can become embedded in food products with possible harmful effects for consumers. In addition, intensive use of pesticides often leads to species evolution in the target pests so that they become resistant. As our understanding of the adverse consequences of many older pesticides has grown they have been removed from use and replaced by other compounds that have fewer negative effects. However the search for effective but safe pest control products has become more difficult over time due to, pest resistance, government imposing more stringent limits on acceptable risks to non-target species, and the simple fact that we have made all the easy discoveries.

While the use of pesticides carries an inherent risk, there would be severe costs if their use were prohibited. Table 1 demonstrates the importance of pesticides for the production of some major crops world wide. Without Crop Protection (CP in the table) lower yields, greater field and post harvest losses and declines in the quality of product lead to a reduced supply of food and fiber and consequently higher prices. As a result, there would have to be a significant expansion of land under cultivation, which would bring its own problems in the form of lost species habitat, and in-

Table 1: Impact of Pesticides on Production of Major Crops.

Crop	Theoretically Attainable Production	Actual Production Avg. 1990-98	Estimated		% Decline in Production w/out CP	% Increase in Land to Restore Actual Output
			Production w/out CP	Production w/out CP		
Rice (mt)	1047	509	184	184	64%	280
Wheat (mt)	831	548	400	400	27%	140
Barley (mt)	244	172	129	129	25%	130
Maize Grain (mt)	729	449	295	295	34%	150
Potato (mt)	464	273	123	123	55%	220
Soybeans (mt)	152	103	63	63	39%	160
Cotton (kt)	84.1	52.4	13.9	13.9	74%	380
Coffee (kt)	9.8	5.9	3.0	3.0	49%	200

Source: E-C Oerke, H-W. Dehne, F. Schonbeck, and A. Weber. *Crop Production and Crop Protection Estimated Losses in Major Food and Cash Crops*. Amsterdam: Elsevier Science B. V. [1994]

creased levels of erosion. Finally cultivation practices would have to return to more intensive use of plows, discs and harrows.

Stakeholder Interests

Because pesticides are both useful and dangerous, they have fallen into the class of products that is subject to significant government regulation. In many ways pesticides are like pharmaceuticals, and many of the pharmaceutical companies either still produce pesticides, or once did. Both types of compounds are used to reduce or prevent an undesirable effect. Both types of compounds result in the potential for adverse side effects. And our knowledge of the full effects of these products often comes only well after they have been in use for a significant length of time. While we can devote resources to predicting the effects of the introduction of a chemical compound, be it a drug or a pesticide, into the human population and the environment we can never be certain that we have identified all the consequences.

Government regulation of how pesticides are tested, which ones are deemed acceptable to use, how they are produced and marketed and how they are used provides a means to identify and manage risks. Regulation involves benefits and costs for the various parties involved in the process. These are the chemical companies who produce and sell pesticides, the general public who consume food treated with pesticides, farmers who buy the pesticides, bureaucrats who regulate their use, citizens with special concerns about the environment and food safety, and government itself.

While chemical companies often object to the costs incurred in getting a compound through the registration process, they also derive significant benefits from the existence of regulation. While a long registration process is a burden to firms that are trying to receive registration, it is a clear benefit to firms that will face competition from a competing compound once it too clears registration. The combination of a patent and a difficult registration review can provide a significant window of protection.

The general public faces significant information problems in dealing with pesticides in terms of food safety and adverse environmental impacts. Absent regulation they would have great difficulty in determining which food products had been treated with which compounds and in ensuring that non-target species are not being harmed. Regulation provides the assurance that only specific chemicals that have been rigorously tested are being used and that farmers have instructions on the safest way to use those products. Thus the regulatory process is an important part of persuading consumers that food production is being carried out in a manner that protects their interest and it reduces the amount of time that individuals have to spend individually trying to ascertain food quality. Because the costs of ensuring food safety have been reduced, the aggregate demand for food is higher than it would otherwise be. This outward shift of the demand curve results in increased consumer surplus and in benefits for farmers and, indirectly, for chemical companies.

As a group, farmers benefit from regulation because there is an enhanced demand for food, but also because regulation results in their having uniform access to information on how to appropriately use chemicals. The costs of registration are passed through to farmers and they in turn pass some portion of them on to consumers depending on farmers market power as a group and an upward sloping supply curve. But since pesticide use is so widespread in agriculture, it is likely that even with regulatory costs the net effect of pesticides is beneficial for most farmers. Farmers also benefit from the development of new pesticides for two significant reasons. The first is the common problem of pest resistance that makes many compounds less effective over time. The second is a trend to more pest specific compounds that have shorter half-lives, which when combined with lower levels of applicator exposure, reduces the health risk to farmers and field workers. Initially farmers relied upon regulation as a way to ensure efficacy, at a time when firms providing pesticides were less reliable providers of high quality compounds. Indeed the original function of regulation was to guarantee that pesticides worked as their promoters promised. Over time, as the production of pesticides was taken over by large firms and the registration process became more costly, the regulatory

concern with efficacy became less critical because firms would not bother to register ineffective compounds.

Government has a significant incentive to engage in regulation because of its responsibility for maintaining both public health and a high quality environment. While a scheme of self-regulation by the chemical industry might provide many of the benefits of regulation, there is a larger danger that a major adverse event could occur if a company acted outside the set of internal rules. Government would then be faced with having to reverse any damage to people or the larger environment and then restoring public confidence in pesticide use. Also by being directly engaged in the registration process, the government has better information on the potential risks and benefits associated with each compound that is on the market.

From an operational perspective, there are potential problems associated with government regulation. These are primarily traditional principal-agent issues involving the bureaucracy. There is the potential for regulators to be captured by special interests who either favor or oppose the use of pesticides, or regulators may shirk their responsibilities to act efficiently, resulting in higher costs. The creation of NAFTA may create a new set of principal-agent problems, where regulators may oppose harmonization because of its implications for their autonomy, staffing levels or perhaps only due to organizational inertia.²

THE REGULATORY PROCESS

In both Canada and the United States the original objective of pesticide regulation was the protection of farmers from inaccurate promises that pests would be effectively controlled by a given compound. Departments of Agriculture were the obvious location for this function since efficacy issues were best addressed by agencies with a technical knowledge

² The agent is hired by the principal and given certain responsibilities. Principal-agent issues arise when the principal cannot easily monitor the agent's actions or assure that they reflect his interests.

of farming. In the 1960s a growing body of information on the persistence of pesticides in the environment and their harmful effects upon non-target species of wildlife, especially birds and fish, prompted demands for more thorough assessments of pesticides to determine their environmental fate. Concerns over applicator safety and potential hazards from pesticide residues in food also became significant. This led to a major redirection of pesticide regulation away from efficacy and toward the unintended consequences of pesticide use. Through the 1960s and 1970s, as scientific knowledge improved and the ability to detect pesticide residues grew, there was increased evidence that many older chemicals had adverse effects that exceeded their benefits. This led to pressure to remove registration from agriculture agencies because of a recognized conflict of interest between safety issues and the core agency concern with optimizing the production of food and fiber. In the United States regulatory responsibility rests with the Environmental Protection Agency with a focus on the broad protection of human, wildlife and natural habitats, while the Pest Management Regulatory Agency of Health Canada is charged with protecting human well-being. Consequently, the impacts of pesticide regulation on farm profitability and the competitive position of agriculture are now secondary elements in the decision process.

In the last decade both Canada and the United States implemented major legislative changes in pesticide regulation. In the United States the Food Quality Protection Act (FQPA) of 1996 significantly changed the way pesticides were regulated although there was no major change in the nature of the agencies responsible for pesticide regulation. The major elements of FQPA were: repeal of the Delaney Clause to allow the presence of carcinogenic compounds in food if the level of presence is considered to pose no risk; creation of a new standard for assessing exposure, the "risk cup" that looks at all pathways of human exposure to classes of compounds, instead of focusing on exposure on a compound by compound basis; explicit attention to the possibility that infants and children may have more adverse consequences from a given level of exposure than adults; creation of a relatively short time-line for reassessing the registration status of all licensed pesticides using current standards; and elimination of economic benefit as a factor in the registration decision.

One consequence of FQPA has been a focus on two broad classes of compounds, organophosphates and carbamates, that are widely used ingredients in insecticides used on both major field crops and on fruits and vegetables. In many cases there are no obvious substitutes for insecticides based upon these materials and there is a concern that if these products are de-licensed there could be significant impacts on production. These impacts could include production practices in other countries if EPA set maximum residue levels (MRLs) or tolerances at a point where crops treated with the compounds could not enter the United States. However a more likely outcome is that de-licensing in the United States would result in similar action in Canada and probably in other countries.

In Canada, the Pest Control Products Act of 1995 transferred authority for the regulation of pesticides from a number of agencies including Agriculture Canada to Health Canada, and created the Pest Management Regulatory Agency (PMRA) within Health Canada to carry out all federal pesticide regulatory functions. PMRA is mandated to protect human health and the environment by minimizing risks associated with the use of pesticides. In general, PMRA and EPA follow similar procedures when evaluating pesticides for registration. PMRA continues to examine efficacy as part of the Canadian registration process and like EPA considers exposure levels for children separately from adults. Unlike EPA, PMRA has an explicit responsibility to investigate and promote non-pesticide based control strategies as part of its risk mitigation mandate.

Process For Resolving Trade Irritants

For more than a decade pesticide regulatory agencies in Canada and the United States have been involved in efforts to coordinate their regulatory processes. Following the introduction of NAFTA, this process expanded to include Mexico and resulted in the formation of the NAFTA Technical Working Group (TWG) on pesticides. Members of the TWG come from the various agencies with regulatory responsibility in the three countries. The TWG provides a forum for developing ways to better integrate pesticide registration within the context of each nation's specific legislative framework. In particular, the TWG has developed procedures for identifying and resolving five categories of trade irritants:

- Category A- -an MRL/tolerance exists in the exporting country but it is lower in the importing country so the product is out of compliance;
- Category B- -an MRL/tolerance exists in the exporting country but one does not exist, or is lower, in the importing country;
- Category C- -a pesticide-commodity combination is registered in one country but not in another, and growers in the country where the use is not registered wish to have that option;
- Category D- -a discrepancy is detected resulting from a non-registered use in the exporting country; and
- Category E- -the exporting country has established a time-limited tolerance but full registration does not exist in the importing country. (Trade Irritant Process Team, Dec. 18, 1998 p. 1-2)

In each case the cause of an irritant is defined as a mismatch in terms of registration status that results in a commodity entering a country without there being an appropriate tolerance level in place for residues. This addresses the first type of trade impact -- barriers to trade that arise because of inconsistent regulations on exposure levels among the three countries.

Farmers have complained both about price differences between the two countries and the differential availability of pesticides across the border. A striking element in this classification scheme is that price differentials are not even mentioned as a potential source of irritation. The simple explanation for the focus on residue tolerances is that registration agencies are not involved in the analysis of prices once a compound is on the market. Their role is to monitor safety and to some extent how well the pesticide does its job. Reinforcing this focus on residue levels is the right of countries under NAFTA to block imports only where they can show that the residue level is not consistent with domestic standards.

Category C issues do address the important question of differentials in registration status. In this case the remedy involves two distinct elements. The country where the pesticide-commodity pair is not registered should establish a tolerance level to resolve the issue of imported product. Then the company that produces the pesticide must decide whether

to apply for registration in the country where the use is not allowed. Note that from the perspective of the Trade Irritant Process Team there is no suggestion that equal access is a specific item that should be promoted by the governments as a way to diffuse irritants.

Current Harmonization Efforts

Some of the other NAFTA Technical Working Groups function mainly as a forum to exchange information on upcoming regulation or perhaps provide an opportunity to discuss trade irritants. The NAFTA Technical Working Group on Pesticides has gone further in clearly articulating goals of harmonization and working toward creating a North American market for pesticides in which “growers in all three countries can access the same pest control tools.” The TWG on pesticides recognized, soon after it was formed in 1996, that the NAFTA free trade objective could not be met unless barriers posed by regulation were eliminated. They have approached harmonization through agreements on work sharing and the creation of a joint application process that includes a common data submission and format, and a coordinated review process. The working group has begun work on a NAFTA label that would be used in all three countries.

Joint submission is a significant step in reducing the cost of approval of new pesticides. Assembling the data required for registration is both time consuming and expensive especially in a country where the level of expected revenue after registration might be an issue. Work sharing offers potential of considerable cost saving on the part of the regulatory agencies. Each nation takes a piece of the data in a given registration package and performs an evaluation that will be accepted by the other parties. The additional time and expense savings and the chance that compounds will be registered in all three countries can have an impact on prices.

With a common label, issues of own-use importation would largely be resolved because every country would have agreed upon a common set of MRLs for the specific applications. Because the label would be legal in each country there would be no reason to block a farmer from crossing the

border to purchase a specific chemical. Note that a common label does not have to mean that all uses or application rates are standard. While a farmer in one country could purchase a product that had a common label, it could only be used for those purposes and at those rates that were legal within that country. In particular, differences in environmental fate and impacts on non-target species could still make some uses possible in one country but not in another. In addition allowable uses could vary from country to country because of differences in the patterns of exposure. In particular, the use of a “risk cup” (see p. 103) sets an upper bound on exposure to specific classes of compounds. Because patterns of exposure and use of the various classes of compounds could easily vary from nation to nation, even if all three countries adopted the same maximum exposure level, there could be differences in which pesticide-commodity combinations fill up the cup, and as a result differences in types of acceptable use for specific pesticides.

For agricultural producers, harmonization is mostly a positive thing. If the costs of producing a chemical are reduced, including the cost of registration, this should result in lower input costs. If companies can produce for a continental market, farmers may also reap the benefits from any scale economies available to the chemical companies. In addition aggregating demand over a continental market may allow chemicals to be developed or registered for uses that would not be economically viable otherwise. Similarly, while farmers may benefit from lower costs and a potentially larger range of products so too should farm chemical companies and food consumers. This suggests that efforts to harmonize pesticide registration procedures and establish uniform MRLs are beneficial to all parties. However this is possibly too simplistic a perspective on the subject. The most obvious issue is that there may in fact be fundamental differences in levels of acceptable risk among the three societies so that a common MRL is not possible. Without a common MRL it becomes almost impossible to treat North America as a single market for pesticides. Even if it is possible to resolve the registration package and MRL issue, regulators may still come to different conclusions based upon differences in environmental fate. If environmental differences are significant between nations then it is reasonable to expect different registration decisions.

Further, it is not clear that it is necessarily in the interest of chemical companies, and at least some producer groups, to move to a single market for pesticides. The current system, although imposing additional registration costs, results in the chemical companies being able to segment demand. The resulting ability to price differently in various markets could convey sufficiently higher revenues that more than offset the higher costs of multiple expenses for production and registration. In addition, given the usual assumption that the demand for food products is relatively price inelastic, it is possible that limiting access to chemicals makes sense for those farmers who already have access. Doing so results in a lower ability to compete in some countries and hence higher profits for farmers in the country where the compound is available. To the extent that harmonization facilitates higher levels of production in those places where it was previously difficult, and leads to lower prices for all producers of the crop, existing producers are worse off. Thus some commodity organizations in one country may oppose the development of a uniform pesticide registration procedure if they believe it will stimulate farmers in another country to increase their production.

While there has been considerable progress in finding ways to harmonize the registration process, it is really just beginning and barriers to free trade in pesticides will remain for many years. There is at present several outstanding differences in the regulatory approach between Canada and the United States such as the extent of cost recovery and the Canadian requirement for efficacy testing. Joint submission is currently only an option although there is attempt to encourage its use by expedited processing. Only a small number of completely new pesticides are evaluated each year and there are no plans to harmonize the relatively large number of pesticides that have already been approved. It is too early, therefore, to see whether this model of regulatory harmonization will be able create a single harmonized North American market within a reasonable time period.

SOURCES OF CONFLICT

Possible Causes Of Price Divergences

Implicitly patent and brand name rights allow a company to exercise market power as a means of recovering the research and development

investment needed to bring a new pesticide to market. Companies can therefore price their product at the point where marginal revenue equals marginal cost and there is no reason to think they would charge a lower price. In addition, geographic borders, when combined with the separate regulatory systems, provide a basis for price discrimination. In addition within a country common practices such as volume or other discounts can be seen as evidence of additional price discrimination. Under price discrimination, the monopolist prices in each country according to the following:

$$MC = MR_1 = p_1 \left(1 - \frac{1}{\eta_1} \right) = MR_2 = p_2 \left(1 - \frac{1}{\eta_2} \right)$$

where MC is marginal cost, MR_i , p_i and η_i are marginal revenue, price, and demand elasticity respectively in country i . This implies that a higher price will be charged in the country with the less elastic demand and the price would only be the same if by chance the demand elasticity is the same.

Farmers demand for pesticides is a derived demand. We might expect that demand would be more inelastic if substitutes for the pesticide are not nearly as effective, if the pesticide is a small portion of cost and if the demand for the product produced by farmers is more inelastic. This will vary from one side of the border to the other both for economic reasons and because there are two regulatory systems. Differences in agricultural policy support programs affect the effective farm commodity supply functions thereby altering farm level demand for pesticides. In particular even though market prices for commodities may be about the same in both countries the aggregate return to farm production is made up from market revenue and government transfers. It seems reasonable that chemical companies would consider this in their pricing decisions. Differences in demand will also occur if the same pesticide is registered for different commodities on either side of the border. Availability of different substitute pesticides on both sides of the border can also have an effect.

Surveys of price differentials have been conducted for a number of years [McEwan and Deen, 1997 and Carlson, McEwan and Deen, 1999].

These surveys are all based upon asking pesticide dealers in both countries that are relatively close to the border to provide their retail sales price for specific compounds. The prices are standardized for units and concentration of the effective ingredient and then adjusted using the prevailing exchange rate. Carlson, McEwan and Deen [1999] report average prices for the period 1993-97 for 32 pesticides. Average prices are higher in Canada for 19 of these with the price differential being greater than 10% of the average price in both countries for 11 of the 19; U.S. prices are more than 10% greater than the mean price for four pesticides. Several factors may result in differences in mean price differences between the two countries, which has nothing to do with price discrimination:

- mean price differences may be within the price variability in both countries so that differences in the means are just chance outcomes rather than systematic results;
- price variability may be caused by variability in the cost structure of retailers;
- some retailers may be using particular chemicals as loss-leaders.

McEwan provided his 1997-2001 data on five pesticides to allow us to evaluate these possibilities. He collected price information from up to five retail outlets in eleven Canadian locations, eleven times a year. Similar information was collected from seven U.S. locations. He performed the adjustments to the U.S. data before forwarding the data. We regressed deflated prices against a system of trend and dummy variables by location to determine mean and variance by location. The estimated equations are summarized in Table 2; while Figure 1 shows results for the product Treflan.

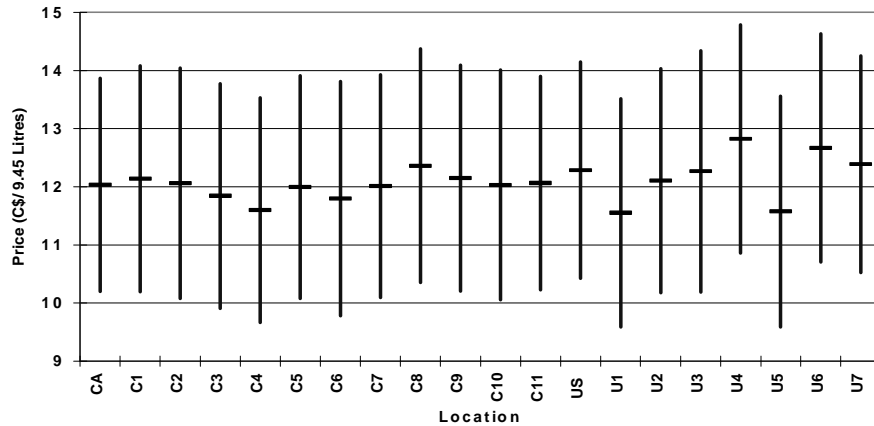
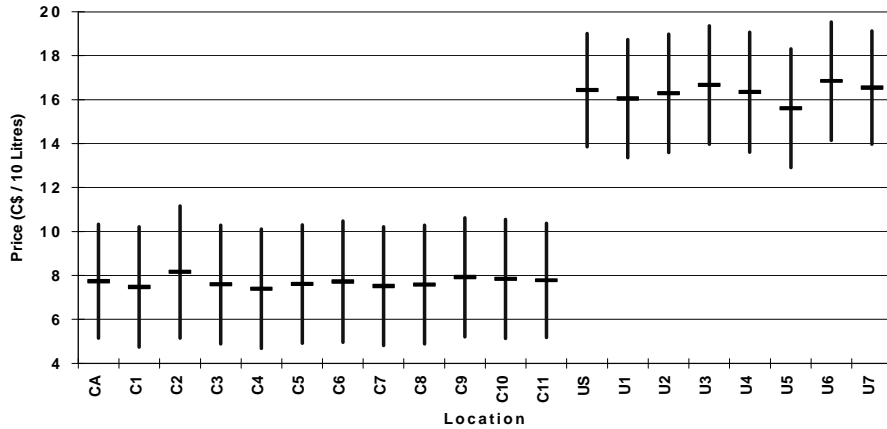
Figure 1 shows a pattern of mean and variance that is highly homogeneous within each country and across the border. There is very little evidence of differences in cost structure, or that retailers in any of the locations use Treflan as a loss leader.

Figure 2 and 3 shows the very different results obtained for Roundup and Malathion (See Appendix for Furadan and 2,4 D 95% price confidence intervals). Roundup is much more expensive in the United States while Malathion is significantly more expensive in Canada. The

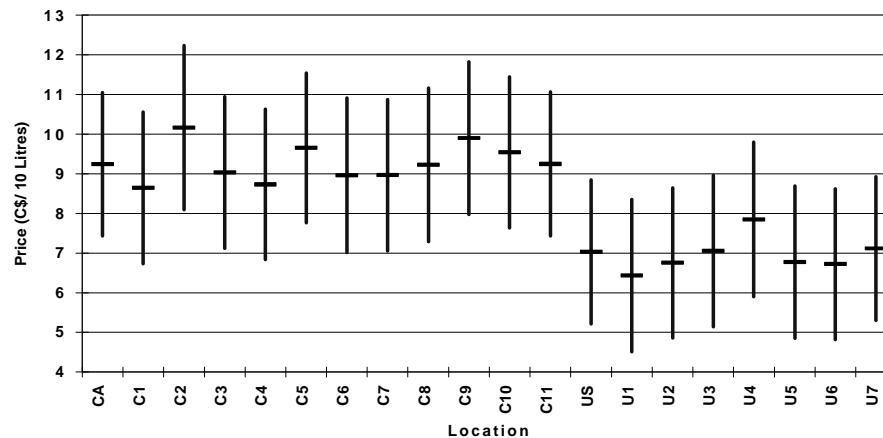
Table 2: Summary of Regression Results.

Variable / Statistic	Roundup	Treflan	Malathion	Furadan	2,4 D
Range of Location Coefficients					
Canada	-0.35 - 0.44 (5 of 11)	-0.43 - 0.33 (5 of 11)	-0.69 - 0.92 (9 of 11)	-2.26 - 1.48 (9 of 11)	-0.37 - 0.46 (3 of 11)
United States	-0.82 - 0.80 (5 of 7)	-0.73 - 0.72 (6 of 7)	-0.60 - 0.82 (6 of 7)	-1.07 - 1.26 (3 of 7)	-0.17 - 0.22 (5 of 7)
Trend in Canada	-0.017 (-9.3)	-0.016 (-10.5)	0.044 (29.7)	0.000 (0.1)	-0.002 (-2.6)
US Trend Differential	-0.007 (-2.5)	-0.021 (-7.7)	-0.024 (-10.6)	0.055 (8.7)	0.010 (9.3)
US Canada Differential	4.45 (96.0)	0.41 (9.9)	-0.76 (-20.7)	-2.08 (-18.3)	-0.18 (-10.9)
CONSTANT	12.66 (273.6)	12.88 (311.2)	7.25 (196.6)	26.11 (230.1)	4.55 (282.0)
R-squared adjusted	0.92	0.31	0.68	0.38	0.17
Mean Dependant Variable	11.27	12.13	8.23	27.51	4.64
Regression Standard Error	1.28	0.91	0.90	1.94	0.42

T-Statistics are reported in parentheses. For the location coefficients, the number significantly different from zero at the 95% confidence level is given.

Figure 1: Treflan 95% Price Confidence Intervals.**Figure 2: Roundup 95% Price Confidence Intervals.**

homogenous price pattern within each country and the significant difference between countries imply that we are not seeing the effects of retail level phenomena but rather the effects of the pricing policy followed by the manufacturer such as simple price discrimination.

Figure 3: Malathion 95% Price Confidence Intervals.

Other more complicated marketing strategies could also result in the price patterns observed. Companies might be expected to recover the cost of registration in their wholesale prices and avoid cross-subsidizing registration costs in one country with revenues from another. In addition, each country provides patent protection for a defined length of time which creates an incentive for chemical companies to attempt to recover their investment costs within the patent life so they have adequate revenue to remain in business on an ongoing basis. The registration process takes place within this patent window, and as the regulators in Canada have already recognized that the process is longer in Canada, then there is a shorter period of time available to the company to recoup its costs, and hence a higher price is required. While these may be important factors in pricing policy, the contrasting results for Roundup and Malathion suggest that demand factors are more important at least for some pesticides.

However, it should be born in mind that there is nothing illegal or even immoral in price discrimination in this situation. Patents and other marketing rights are extended to the companies so that then can recover the cost of product development and approval. Indeed, it would be surprising if they did not practice price discrimination. To the extent that price

discrimination is a significant factor in providing a high enough rate of return to justify investing in research and development of new pesticides it may provide long run benefits even though it has short term costs.

The level of awareness of cross border price differentials and availability is generally a declining function of proximity to the border. Consequently those farmers arguing that they are being unfairly treated generally are correct in claiming that pest problems, broad environmental conditions, and production practices are similar on both sides of the boundary. In these cases, farmers justifiably wonder why it is possible for their neighbors to either have access to products they cannot use, or why in an era of free trade they are forced to pay a higher price for the same pesticide. So differential access can be important. Because a far larger share of agricultural production in Canada takes place in close proximity to the border and the size of the Canadian market for most compounds and uses is significantly smaller, both price and access issues have been more common in Canada.

Recently the most visible event took place in the United States and concerned price differentials on pesticides licensed for use on canola (see Taylor and Koo). Farmers in North Dakota argue they can buy pesticides for use on canola at lower prices in Canada, and that their growing environment is similar to that in Manitoba and Saskatchewan so that they should be allowed to use Canadian pesticides. Allowing these and other farmers to import pesticides for their own use would resolve price and availability differentials and be consistent with the principles of NAFTA.

The most persuasive bureaucratic case for own-use importation is in those instances where the irritant is strongest, right along the border. There is probably no compelling reason why a compound that is licensed in one country could not be used in another. Further, if the compound is licensed in both countries for the same use, and there are significant cross-border price differences then allowing own-use imports is the obvious way to equilibrate prices.

But own-use importation opens up other issues. For example, there is the question of cost recovery. Licensing a product is an expensive undertaking in both countries that companies have to recover through their retail prices. Significant levels of own-use imports could reduce the incentive to apply for a license, and without the data that is part of the approval process, we would be less sure that there are no adverse local consequences from pesticide use. Consider canola further. Canola is also grown further south in the United States in a double crop rotation. Here it is less clear that there would be no adverse consequences associated with importing product from Canada and using it according to Canadian label requirements. NAFTA harmonization with a NAFTA label would resolve this issue. Allowing own use importation would force the pace of regulatory reform needed to protect users and the environment while creating a single North American market.

Availability Issues

In the context of the existing regulatory structure the main issue with availability is that consumers are protected from exposure to residue levels from pesticide and farm product combinations that have not been explicitly registered. Implicit in this approach is a reliance on imports of food products to meet consumer needs in cases where specific compounds are not available and their absence limits the ability for domestic production. This approach is understandable from a public health perspective because it avoids all the costs associated with testing a large number of possible uses, as well as potential problems with worker exposure, environmental fate and non-target species effects in the importing country. However it does place potentially significant impediments on farmers as well as raising the interesting issue of government protecting imports at the expense of domestic production.

As noted earlier in the discussion of the procedures established by the Trade Irritant Process Team, the decision on availability is seen as being largely outside the domain of the regulatory structure. However other aspects of pesticide regulations make this an important topic. As regulations become more sophisticated, old products are re-tested to ensure they meet current standards and pesticides are grouped into classes with maxi-

mum exposure levels for the entire class (risk cup), with the result that the number of compounds farmers have for managing specific pests in a large number of crops is falling. Pesticides that have been in use for a long time are being withdrawn from the market either because they do not meet current standards or because they do not have a large enough sales volume to justify the expense of submitting a new registration package. This can leave producers with limited options in terms of pest control strategies and in extreme cases make the production of specific crops unprofitable

Pesticide manufacturers continue to submit both new compounds and new uses for registration but as the costs of registration increase, manufacturers are concentrating on providing compounds for large volume markets. As a result there is little effort to develop replacement compounds in minor use markets even though from a farmers perspective there may be no real alternative to a compound that is being withdrawn from use. To some extent minor use status is a relative concept. For example much of the fruit and vegetable production in the United States involves a minor use of pesticides relative to row and field crops like corn and wheat. But fruit and vegetable production in the United States still represents a large enough market that it is worth the support of chemical manufacturers. By contrast, fruit and vegetable production in Canada is both a minor market, relative to row and field crops, and small enough that the volume of sales may not be enough to warrant registering a compound for use in Canada even if it is available in the United States for the same crop. Thus, a government may be trying to establish high value agricultural production as a way to enhance farm incomes and increase the viability of farming in regions with large urban populations. But without effective pest control options, the long-term viability of these farms is doubtful. Although pesticide outlays are a fairly small share of total costs of production, if the substitute methods have considerably higher costs there may be a difficulty maintaining production. This suggests that the registration process should look beyond ensuring that exposure levels are harmonized and recognize that precluding domestic production may have adverse consequences in terms of farm structure, rural environment and seasonal access to fresh produce, as well as the already recognized indirect positive effects of lower levels of exposure.

In particular, producers of fruits and vegetables in Canada are concerned that they will soon be forced out of business if many more of the currently available chemicals are withdrawn from use and are not replaced with equally effective products. Even though it may be possible over time to adjust production practices to use alternative pest control approaches, it is unlikely that most of the existing producers will be able to do so. Their investments are tied up in a production structure that is predicated upon the use of pesticides, and changing that production structure can require major new investments that they cannot afford. If existing compounds were withdrawn in both Canada and the United States but new ones were registered only in the United States, a situation would be created for a significant trade dispute to develop. This means that enhancing harmonization is particularly important for minor use products.

CONCLUSION: LESSONS FOR DISPUTE RESOLUTION

Pesticides are controlled substances in all NAFTA countries, so how they are regulated greatly influences pest control strategies available to farmers. Because pesticides are an increasingly important part of the most common farm production technologies and, because NAFTA has essentially opened the borders to the free flow of agricultural products, differences in how pesticides are regulated can affect the competitive position of farmers in the three countries. A focus on agricultural trade suggests that harmonization of regulations is a desirable outcome because it would allow a level playing field in terms of farmer access.

However the other side of the pesticide issue is that pesticides can have undesirable consequences in terms of human health impacts and adverse environmental impacts. While the level of human health impact does not vary significantly from citizen to citizen, this is not as true for environmental fate. Different ecosystems may be more or less susceptible to the same quantity of pesticide. Moreover individual countries may choose to set different levels of acceptable risk for both their population and their environment. Thus even if everyone agrees on a common science protocol, the policy decisions may differ.

Despite the potential for different decisions to be drawn on appropriate levels of exposure, there are still strong arguments for harmonization. Indeed, NAFTA only extended prior efforts to reduce the costs of registration for companies and to adopt uniform protocols for assessing registration packages. Because registration involves large up-front outlays that can only be recovered over an extended period of time, cost reductions in the registration process can make a difference in the availability, especially for minor use compounds. Similarly, harmonization of registration procedures can also lead to simultaneous registration that is advantageous to farmers in countries that would otherwise have to wait longer for a product.

The potential for differences in pesticide regulations to affect trade flows among NAFTA countries has already been recognized and is being addressed. The current focus of the Technical Working Group on Pesticides is on ensuring that countries establish maximum residue levels on the basis of legitimate public health concerns not as a form of non-tariff barrier. National pesticide regulatory agencies are developing ways to share work loads in registration, ensure that common protocols are adopted and work toward common maximum residue levels of pesticides in food products. However this approach does not address the second trade issue of differences in access or prices affecting the competitive position of farmers.

Significant cross-border price differentials exist for some pesticides including large volume products and market size differences do not provide an obvious explanation. But for other compounds there is no significant cross-border price difference. These results can be interpreted in three different ways. The first is that the existing system in essence creates a segmented market that manufacturers can readily exploit to their advantage. Because a pesticide can only be used in a country if it has a national label, there is an effective barrier to arbitrage. Price differentials reflect the presence of this monopoly power. A second interpretation is that differences in price reflect differences in markets. These could include differences in registration costs or marketing and distribution costs. The fact that only some prices seem to be higher and that there is variability across

countries in terms of which has the highest price is not necessarily inconsistent with this perspective. The last interpretation is that both the previous models can apply. For some compounds, monopoly power may exist and be exploited and for others real cost differences may cause differences in price.

One way to resolve the price/availability issue would be to allow farmers to import pesticides for their own use from other NAFTA countries, providing that they followed the label directions on use. This policy is effectively a variation of recognizing the equivalence of the other country regulatory system and could be followed by each country individually or in partnership with other NAFTA countries.³ A grace period could be specified, allowing the regulatory agencies to identify specific pesticides/use combinations that might need to be restricted because of special exposure issues. Currently all pesticide imports are “positive list” items which are prohibited because their import is presumed to lead to misuse. This solution would effectively transform control of pesticide trade to a negative list system. If adopted by all NAFTA countries it would pressure the regulatory agencies to implement a fully harmonized regulatory procedures in terms of chemical availability, accepted uses, permitted application rates, environmental restrictions and public health standards. That is there would be considerable pressure to develop a common label.

Such a policy would weaken the regulatory agencies’ abilities to enforce their individual policies but might not make much difference if all three countries followed similar practices and if labels contained detailed geographic specifications. It would raise new issues for imported pesticides since tariffs would come into play. And it would be more of a problem in Canada where the border is generally nearby for most farmers. Transactions costs (information, distance, the red tape of dealing with customs) would limit this type of activity in the United States, except where demand is sufficient to justify the additional expenses. At the extreme, it

³ One of the problems of free trade, well known to anyone living near the border, is that cross border shopping has become much more complex because tariffs are far more complicated and regulations more pervasive. Most of the free trade happens at the wholesale level, while retail level trade has become much more restrictive.

might make it more difficult to establish a higher standard of risk avoidance and raises the (often imaginary) specter of the “race to the bottom.”

But to the extent that price differentials reflect the real cost of serving a given market, the long-term consequences of free trade could be problematic. Pesticide manufacturers would no longer be in a position to allocate costs to the appropriate parties. If they price compounds so that all registration costs are embedded in a common price then producers in the low cost country are implicitly subsidizing those in the higher cost country. If they choose not to pursue registration in the high cost country because they cannot recover their costs, then they are not likely to be able to use a NAFTA label, and imports will not be allowed. If they choose to price in each country so they cover actual costs, then farmers will make their purchases in the lower cost country.

While farmers facing either higher prices or limited access, as well as policy makers may see short term benefits from harmonizing prices in a free trade zone it is important to separate short term and long term consequences. For the most part the short term benefits have been the focus of our discussion. However, in the long run one possible consequence of allowing prices to equilibrate is that lower profit margins for pesticide manufacturers could lead to lower investments in bringing new products to market. Because of pest adaptation, farmers and society may be worse off in the long run if new compounds are not available to replace existing ones when they are no longer effective. This suggests that it is important to assess the relative benefits of working toward a harmonized registration process that creates a single continental market versus the possible disincentive of lower profits on new product development.

In an environment where trade in the final agricultural product exists, without harmonization of prices and access for inputs, the logical result is differences in returns to fixed factors. Since farmers in all countries will receive the same market price for their product but farmers in one country will have higher costs, their enterprises will be less profitable. Over the long run this should lead to reduced levels of production and to

the extent that farmland captures rents, lower land prices in the country with less access or higher pesticide prices.

More stringent pesticide regulations have important implications for efforts to expand the production of high value crops. If national agriculture policy is to diversify agriculture and move to higher value plant products, especially in Canada, then attention must be paid to the availability of minor use chemicals. Not only do high value crops tend to use a broader range of compounds, but many of these compounds are relatively old and are facing a difficult time meeting current safety standards as their registration status is being re-evaluated. Because they are minor use products there is less incentive for companies to invest in developing substitute pesticides, which may threaten the viability of some parts of agricultural policy. However the ultimate pressure for harmonization is driven by economics and it will have to be balanced against other issues such as public health and environmental concerns.

Existing cooperation among regulatory bodies through the Technical Working Group provides the beginning of a model for trade harmonization- -it provides a set of ways to cooperate, from joint registration, to data exchange to informal consultation. This is a useful way to proceed, instead of establishing a formal agreement, because it allows flexibility and incremental extension once capabilities increase and demand is established. But the process needs nurturing and ongoing commitments.

Finally, there are some obvious impediments to cooperation among the pesticide regulatory agencies. These include bureaucratic inertia, regulatory capture, and ease of communication when three languages are involved. Although progress can be seen, there are also examples of inertia. However even with greater efforts to reduce trade frictions, there will still be problems because the degree of change may not be fast enough for some people and yet will be too fast for others.

REFERENCES

- Canadian Horticultural Council. 2001. "Crop Protection- - A Better Future for Canada." Mimeo. Ottawa. November.
- Carlson, Gerald, John Deal, Ken McEwan and Bill Deen. 2002. "Pesticide Price Differentials Between Canada and the U.S. 1999." <http://www.ridgetownc.on.ca/KMcEwan/Reports/kmpest.pdf>. February 15.
- Health Canada. 2001. "Pest Management Regulatory Agency Overview Document." May. (http://www.hc-sc.gc.ca/pmra-arla/english/pdf/pmra/pmra_overview-e.pdf). February 15.
- McEwan, Ken and Bill Deen. 2002. "A Review of Agricultural Pesticide Pricing in Canada. 1997." <http://www.ridgetownc.on.ca/KMcEwan/Reports/kmpricreview.pdf>. February 15.
- North American Free Trade Agreement Technical Working Group on Pesticides. 2001. *The North American Initiative: Milestone Report*. U.S. EPA 735-R- -01-002. Washington D.C. September.
- Oerke, E-C, H-W.?, Dehne, F. Schonbeck, and A. Weber. 1994. *Crop Production and Crop Protection Estimated Losses in Major Food and Cash Crops*. Amsterdam: Elsevier Science B. V.
- Pest Management Regulatory Agency. 2002. "A Decision Framework for Risk Assessment and Risk Management in the Pest Management Regulatory Agency SPN2000-01." December, 2000. <http://www.hc-sc.gc.ca/pmra-arla/english/pubs/spn-e.html>. February 15.
- Pest Management Regulatory Agency. 2002. "Guidance for Identifying Pesticides that have a Common Mechanism of Toxicity for Human Health Risk Assessment SPN2001-01." January 2001. <http://www.hc-sc.gc.ca/pmra-arla/english/pubs/spn-e.html> on February 15.
- Taylor, Richard D. and Won W. Koo. 2001. "United States and Canadian Agricultural Herbicide Costs: Impacts on North Dakota Farmers," Northern Plains Trade Research Center, Department of Agribusiness and Applied Economics, North Dakota State University

-
- Trade Irritant Process Team, NAFTA Technical Working Group on Pesticides. 2002. Procedures for the Identification and Resolution of NAFTA Pesticide Trade Disputes version 2. December 1998. <http://www.hc-sc.gc.ca/pmra-arla/english/pdf/intern/tridrs-e.pdf>. February 18.
- United States Environmental Protection Agency. 2002. The North American Initiative A Report on the North American Free Trade Agreement Technical Working Group on Pesticides 735- R-01-002. September 2001. <http://www.epa.gov/oppfead1/international/naftatwg/naftarpt.pdf>. February 15.
- United States Department of Agriculture. 2002. Agricultural Resources and Environmental Indicators, 2000. Economic Research Service, Resource Economics Division. 2001. <http://www.ers.usda.gov/Emphases/Harmony/issues/arei2000/>. February 15.
- United States Department of Agriculture. 2000. *Production Practices For Major Crops in the United States 1990-1997*. Statistical Bulletin No. 969. USDA - ERS. Washington D.C. September.
- United States Environmental Protection Agency. 2002. Summary of FQPA Amendments to FIFRA and FFDCA. <http://www.epa.gov/opppsbs1/fqpa/fqpa-iss.htm>. February 10.

APPENDIX

Figure A1: Furadan 95% Price Confidence Intervals.

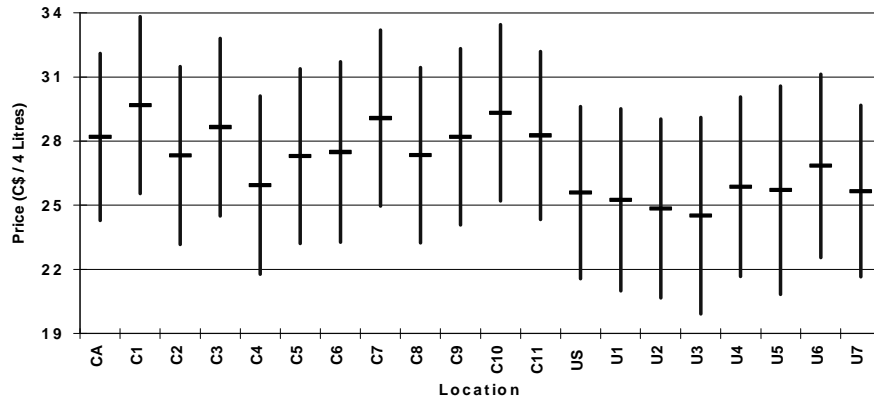


Figure A2: 2,4 D 95% Price Confidence Intervals.

