Global Trends in Wheat and Challenges of Biotechnology

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Introduction

Several factors are currently impacting the international wheat market. These include changes in exports in non-traditional exporters, shifts in competitiveness of crops in traditional North American wheat producing regions and potential impacts due to introduction of GM wheats. Introduction of GM wheats bring numerous challenges due to aversion of buyers, multitude of traits, challenges of introduction on the marketing system, etc.

Trends in Non-Traditional Exporters

Significant changes have been occurring in wheat production/consumption in several non-traditional wheat exporting countries. These changes have allowed exportation of wheat, much of which has occurred from 2000-2003. For example, the Russian Federation which had been only exporting minimal amounts of wheat for much of the 1990s, spiked to 13 million MT in 2002. Similar increases were observed for the Ukraine, India and Pakistan. For other non-traditional exporters like China, Kazakstan, and Poland, wheat exports have been trending upward for much of the late 1990s and 2000s (Figure 1).

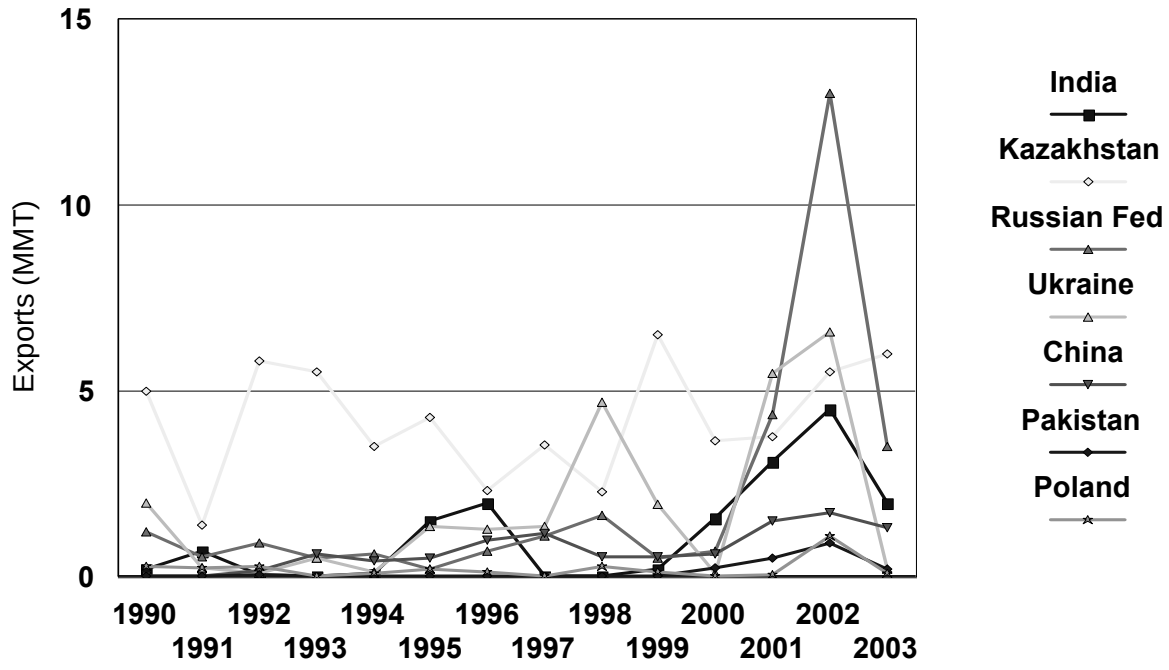


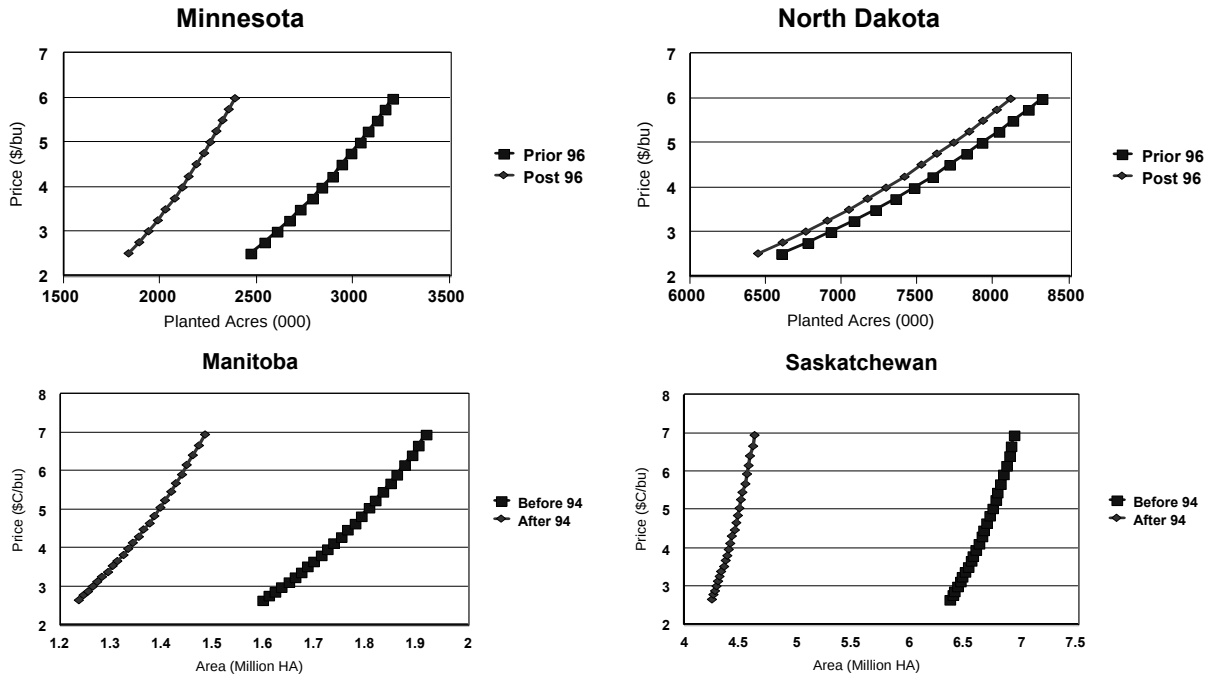
Figure 1. Exports of Wheat by Selected Non-Traditional Exporters, 1990-2003.

Shifts in North American Production Regions and Agronomic Competitiveness

Shifts in area devoted to wheat in traditional producing regions in North America have occurred for a number of factors (changes in government programs, competition from competing crops (i.e., canola in Canada), etc.). These shifts can be seen by shifts in supply response of growers to prices that have occurred since 1996 in the U.S. and 1994 in Canada (Figure 2).

What is important, is that these shifts for most traditional wheat growing regions in North America have been leftward shifts in acreage for a given price level.

Figure 2. Shifts in Supply Relationships for Acres of Wheat in Minnesota, North Dakota, Manitoba, and Saskatchewan for Selected Periods.



The widespread producer acceptance of GM crops (corn and soybeans) in the upper Midwest would seem to indicate a willingness of producers to accept GM wheat when it becomes available. There has been a historical change in gross returns for corn, soybeans, and wheat over the past 40 years in North Dakota (Table 1). Not surprisingly, there has been a general decline in planted acreage of wheat and barley in the state over the past 30 years. This decline is largely replaced by planted acreage of corn, soybeans, and canola, particularly since the introduction of GM varieties in these crops (Figure 3). This shift in acres is in large part due to the increased returns realized with GM crop varieties, as well as the impact of vomitoxin which began to adversely affect wheat and barley in some regions in 1993.

Table 1. Historical Change in North Dakota Corn, Soybean, and Wheat Gross Returns.

	Gross Returns ($/acre)		
	Corn	Soybeans	Wheat
Average 1961-1965	34	38	38
Average 1997-2001	190	152	94
Change, %	449	304	148

Source: Derived from USDA/NASS (2001, 2002) data.

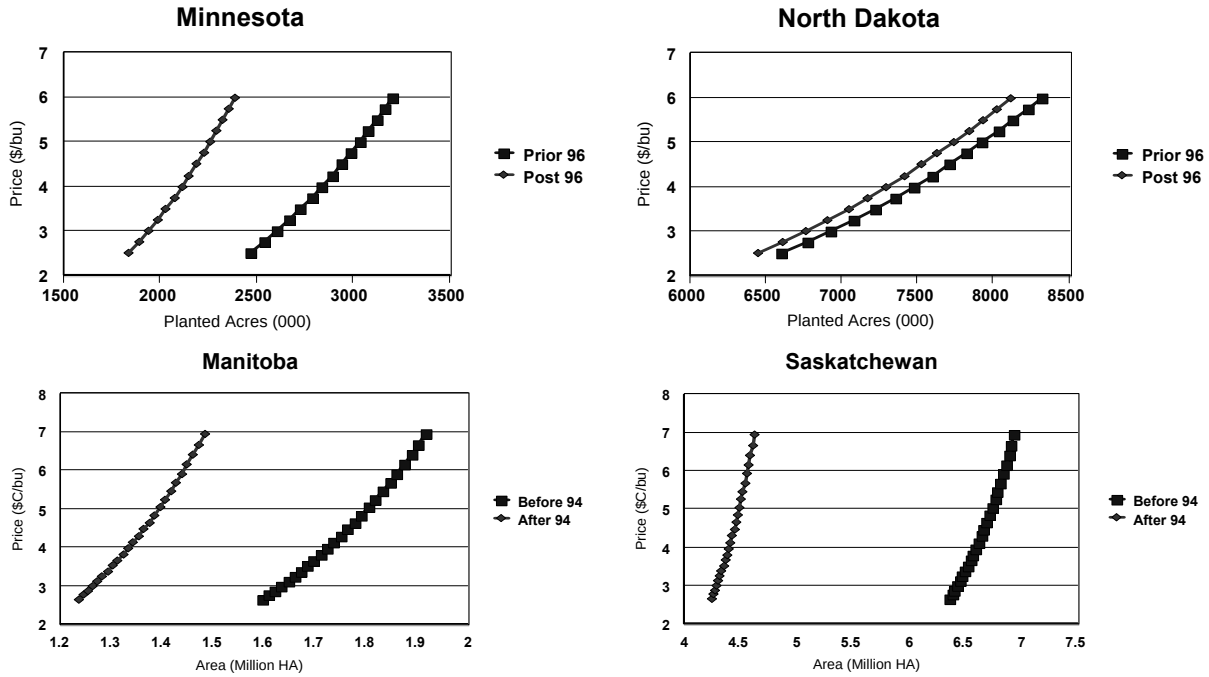


Figure 3. North Dakota Planted Acres for Wheat, Soybeans, Corn, Canola and Barley, 1970-2001.

Research on GM wheats

Research on development of GM traits in wheat has grown since the early 1990s. Wilson, et al., compiled non-comprehensive data on GM wheat development. This data is useful and suggestive of some important facts regarding GM trait development in wheat. Most important are that research in this area has grown dramatically since the early 1990s and appears to have peaked in the later 1990s. Second, the United States is dominant, albeit not the only player in trait research. Herbicide tolerance is only one trait under development. his is followed by product quality, fusarium resistance, and others (Figure 4). Finally, there are numerous diverse organizations involved in trait development. These range from private companies, state universities, federal governments, and others.

The implications of these are important for the wheat marketing industry. Of particular importance is that any debate and/or discussion regarding GM traits is more comprehensive than that of RRW which has already applied for review in the Untied States. Second, Syngenta (Syngenta, 2002) has indicated a proposed launch date of 2007 for "fusarium resistance for improved grain quality," which is likely the number one problem in small grains [Wilson and Dahl (2001) found the average discount for fusarium applied by elevators was 20 cents/bu]. Finally, there is extensive research on product quality of varying forms (e.g., protein quality, storability). All of these suggest that at some time in the future, the market, regulatory and institutional/organizational regimes will have to deal with a multitude of GM traits simultaneously.

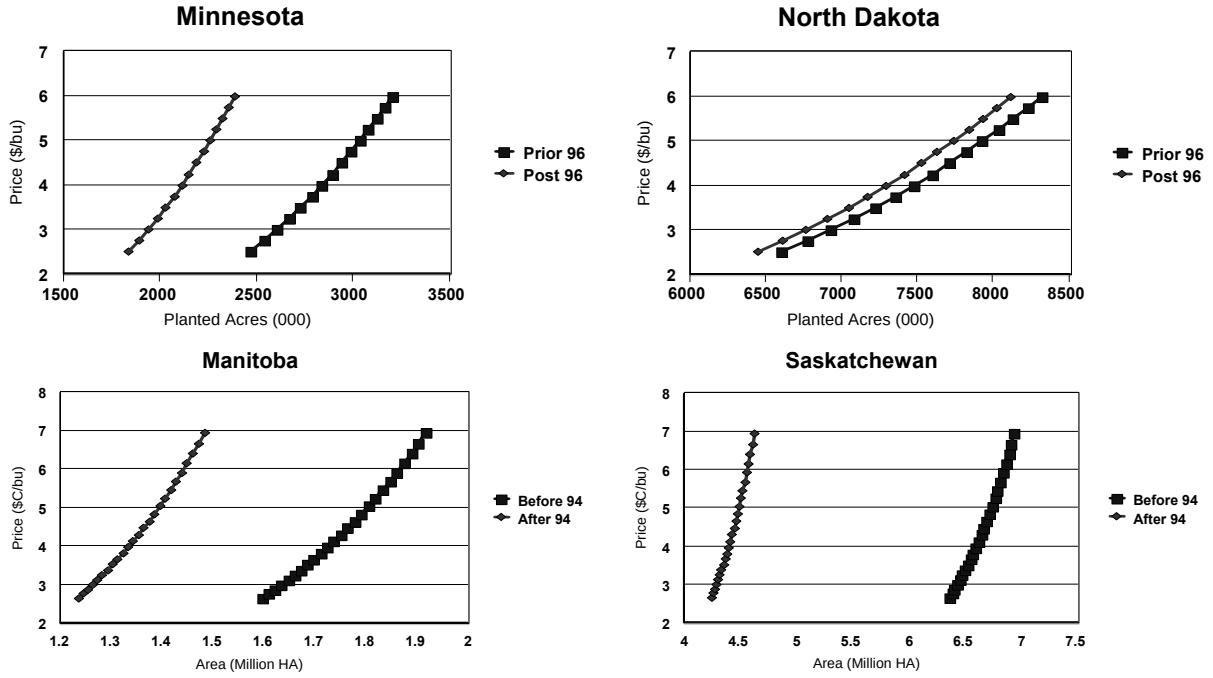


Figure 4. Number of World GM Wheat Field Trials, by Trait, 1993-2002.

Impacts on Marketing System

With the introduction of GM crops, there is a spectrum of alternative procurement strategies that can be adopted. Ultimately, it is buyers that determine the elements of their procurement strategy. These can range from spot transactions simply on grade and non-grade factors, to full integration into grain production and/or handling. Intermediate solutions contain varying forms of testing, contracting, Identity Preservation and traceability systems.

Costs of segregating IP grains have been estimated from several studies that range from 1 to 72 cents/bu (Wilson and Dahl, 2002). Among these, some are estimates in anticipation of what the process would be, some are a result of budget types of analysis of costs, some entail process verification and pure segregations throughout the system, but none quantify risks or the exposure to risk of the agents.

Wilson and Dahl (2002) developed a model to analyze the potential costs and risks associated with a marketing system based on testing and segregation. The model derives additional system costs at each stage of the marketing chain, tracks segregation flows throughout the system, and derives statistical properties on the proportion of lots with GM exceeding specifications within end-use flows.

The model incorporates risk in a number of variables and is solved using stochastic optimization. The primary sources of risk included farmer "truth-telling;" adventitious commingling occurring at several locations (farm, country elevator, export elevator, and transportation equipment) due to various factors (inadequate cleaning, etc.); sampling and inspection plans; and test accuracy.

The results identify the optimal testing strategies of a GM/Non-GM system versus the existing Non-GM system (Table 5). The optimal strategy would be to test every 5th railcar at the country elevator when loading and to test every ship sublot when loading at the export elevator. This testing strategy results in average rejection rates at the importer of 1.75 percent. An average of .02 percent of importer flows had GM content greater than tolerances which represents the buyers' risk of accepting quality that does not meet tolerances. The proportion of flows in the Non-GM channel declined from 80 percent at the farm level to an average of 70 percent at the importer. Thus, on average, 10 percent of Non-GM shipments are diverted to the GM segregation throughout the handling system. This illustrates to a large extent the sellers' risk of having shipments rejected throughout the system. Most of the diversions are due to adventitious commingling which occurs in the system, though some are effects due to test accuracy and large samples containing units with both adventitious commingling and Non-GM which are represented by a single test.

GM Aversion of Buyers

Although GM wheat is not yet available, there is concern about the potential impact it may have on exports. Early in the evolution of discussions about RRW, U.S. Wheat Associates published a list of countries that would potentially be averse to the purchase of GM wheats. Since then, U.S. Wheat Associates conducted a survey of buyers to assess their aversion to GM wheats (Forsythe, 2002). Representatives for Chinese, Korean, and Japanese wheat buyers surveyed said they would not buy or use RRW. Eighty-two percent of buyers from Taiwan and 78 percent of buyers from South Asia said they would reject the wheat. If the country had regulatory approval of the trait, each country, with the exception of Japan, indicated they would accept some GM wheat with a tolerance. One country expressed that regardless of government approval, "contracts will stipulate no adventitious presence of GM wheat." The majority of the responses indicated there was a future for biotechnology in wheat if there is some consumer benefit that can be marketed (Gillam, 2002).

Several studies have addressed issues of RRW in Canada. One of these identified "at risk" countries (Kuntz, 2001) Citing a CWB source, the 10 countries identified as "at risk" have publicly stated their concerns regarding genetically modified wheat and have indicated the possible termination of Canadian Western Red Spring (CWRS) wheat imports. Based on this analysis, one third of Canadian exports are at risk of loss with the major concerns being Japan, Iran, and Brazil.

Trade volumes were compared to illustrate the importance of alleged buyer aversion to GM wheats to the United States. These data were assembled as follows: U.S. Wheats Associates' initial estimates of buyer aversion to GM content were defined; imports of U.S. HRS by these countries were assembled for 1999/00; and the U.S. domestic market was included in these data (assuming non-averse). Results illustrate the U.S. domestic market is by far the domineering market and as suggested is non-averse. Aside from the U.S. market, the largest GM averse markets are Japan, the Philippines, Korea, and the EU countries (notably, Italy, Spain, and the United Kingdom). Taken together, these results suggest that about 72 percent of the market would be GM tolerant, the remaining being potentially averse.

The non-aversion assumption of the U.S. domestic market is debatable. Some important considerations in this assumption are that: 1) 70 percent of grocery products sold in the United States

contain GM ingredients; 2) results of most surveys (summarized previously) suggest that U.S. consumers are more tolerant of products produced with GM ingredients; and 3) in the case of bread, numerous ingredients are already from GM grains and/or oilseeds. Further, a large component of the U.S. market is non-branded wheat products (i.e., food service, private label, industrial foods) for which wheat aversion would be non-apparent.

There are several important points in understanding the data and their interpretation and assessment of foreign buyer acceptance. First, prior studies (Blaine, *et al.*, 2002) which surveyed consumers noted the tendency for consumers to indicate one thing in surveys, but their actual purchase behavior differed. In the case of GM wheats, it is fully expected that buyers will be naturally averse to a trait prior to it gaining regulatory approval, and they may not be fully informed about the functional differences/similarities and food safety. Second, the regulatory process in many countries is evolving and/or may not have the scientific sophistication of that in the United States. As a result, some countries (e.g., the Philippines, China; Mexico) may very well adopt the position that if a trait is approved in the exporting country, it would allow its importation (concurrent with certification as such). Finally, it is significant that some of the countries that are claimed to be averse to GM content in wheat, are in fact large importers of GM soybeans and corn, at least from the United States. However, it is illustrative that apparently these countries have established protocols to facilitate grains and oilseeds from regions in which there are known production of GM grains and oilseeds.

References

Blaine, K., S. Kamaldeen, and D. Powell. 2002. "Public Perceptions in Biotechnology." *Journal of Food Science* 67(9), 2002:3200-3208.

Forsythe, D. 2002. *GM Wheat: Customer Acceptability Survey Results from Asia*. U.S. Wheat Associates, Washington, DC, September 30.

Gillam, C. 2002. "Asian opposition to biotech spring wheat steadfast." Reuters, October 9.

Kuntz, Grant M. 2001. *Transgenic Wheat Potential Price Impacts for Canada's Wheat Export Market*. Unpublished Master's Thesis, Department of Agricultural Economics, University of Saskatchewan, Saskatoon, Canada.

Syngenta. 2002 *Tomorrow's Products*. Syngenta, Internet Document, Accessed December 2002, http://www.syngenta.com/en/products-services/tomprod.asp.

Wilson, William W., and Bruce L. Dahl. 2001. *Evaluation of Changes in Grade Specifications for Dockage in Wheat*. Agribusiness and Applied Economics Report No. 458, Department of Agribusiness and Applied Economics, North Dakota State University, Fargo, July

Wilson, William W., and Bruce L. Dahl. 2002. *Costs and Risks of Testing and Segregating GM Wheat*. Agribusiness & Applied Economics Report No. 501, Department of Agribusiness and Applied Economics, North Dakota State University, Fargo, October.

Wilson, W.W., E.L. Janzen, B. Dahl and C. Wachenheim. 2003. *Issues in the Development and Adoption of Genetically Modified (GM) Wheats*. Agribusiness & Applied Economics Report No. 509, Department of Agribusiness and Applied Economics, North Dakota State University, Fargo, January.