Economic Analysis of Ending the Issuance of Karnal Bunt Phytosanitary Wheat Export Certificates

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Abstract: Karnal bunt is a wheat disease that is subject to regulation in the United States through quarantining of affected counties to limit its spread. Currently, the Karnal bunt regulatory program allows the U.S. Department of Agriculture (USDA) to issue phytosanitary export certificates stating that wheat in a given shipment is from an area where Karnal bunt is not known to occur. Ending this certifiation program would jeopardize U.S. exports to some countries. A model developed by the Economic Research Service was used to analyze a scenario of ending the certification. The loss of export markets for U.S. wheat producers would be only partially offset by increased domestic feeding of lower-priced wheat. Wheat prices would remain below baseline levels. Reduced wheat production and lower prices for wheat combine to reduce the total value of the wheat produced in the country, as well as the net income in U.S. agriculture. The cumulative reduction of national net farm income from 2003 to 2007 relative to the baseline is $5.3 billion. However, this includes cumulative marketing loan payments associated with all crops of $2.0 billion above the baseline over the 2003-07 period.

Keywords: Wheat, Karnal bunt.

Introduction

Karnal bunt (sometimes called partial bunt), caused by the fungus *Tilletia indica* Mitra, seldom results in significant yield losses to wheat in the field. The fungus does not produce any toxic compounds in leaf, stem tissue, or seed that pose health risks when consumed (Bonde). Because the fungus poses no risk to human health, the U.S. Government does not have any food safety regulations concerning Karnal bunt. However, Karnal bunt affects flour quality if more than 3 percent of the grains are bunted because it produces trimethylamine, which gives off a fishy odor. Pasta products made with flour contaminated with Karnal bunt can have an unacceptable color.

Many U.S. trading partners will not accept U.S. wheat exports unless the wheat is certified to be from areas where Karnal bunt is not known to occur. USDA's Animal and Plant Health Inspection Service (APHIS) imposes quarantines in an attempt to contain the spread of Karnal bunt in the United States and conducts an annual voluntary survey of grain delivered to elevators to check for Karnal bunt across the country. The use of quarantines and the survey are the basis upon which APHIS is able to issue a certificate that is accepted by countries importing U.S. wheat.

Some have proposed that the Karnal bunt quarantine regulations and surveys be ended, suggesting that USDA should consider contaminated wheat a quality issue and establish tolerances for contamination (Combs). This paper analyzes the market effects of abruptly ending the issuance of certificates stating that U.S. wheat is from areas where Karnal bunt is not known to occur in the face of continuing barriers in many overseas markets.

The Incidence of Karnal Bunt

Karnal bunt is geographically isolated, limited to the Indian subcontinent, a small area of Mexico, and the southwestern United States (Murray and Brennan). Karnal bunt is so named because it was discovered in 1931 on wheat grown near Karnal, India. The disease was first confirmed outside of Asia in 1972 in the State

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of Sonora, in northwest Mexico (Dept. for Environment, Food & Rural Affairs).

The disease was first found in the United States in 1996, in Arizona, Texas, and California, and again in Texas in 1998. The latest outbreak was in north Texas in 2001. It is not known how the disease spread to the southwestern United States and then to north Texas. Because the early outbreaks were isolated from the major wheat-producing areas, the possibility of the disease's spreading to principal wheat-growing areas was thought to be minimal. However, the 2001 outbreak of Karnal bunt in north Texas was at the edge of the major wheat area of the Southern Plains (see fig. A-1). This raised the prospect that the disease could spread as far north as the spores can tolerate winter weather conditions. Karnal bunt spores may rapidly decay under extreme cold, suggesting that significant portions of the northern United States would not be conducive to long-term survival (and therefore permanent establishment) of Karnal bunt (Dobesberger, Jimenez, and Sequreira).

The occurrence of bunted kernels in areas infested with Karnal bunt spores is typically low. The ideal conditions for infection are temperatures in the range of 59-72 degrees F. and accompanied by rainfall, overhead irrigation, or high humidity. These conditions must occur during heading and for a few weeks afterward for bunted kernels to develop (Forster and Blair). These strict environmental conditions make it possible for problems with Karnal bunt to be only intermittent even if soil spore concentrations are high.

Spreading Karnal Bunt

Karnal bunt spores can be carried in soil and on a variety of surfaces, including seeds and other plant parts, farm equipment, tools, and vehicles. They can also be windborne. Karnal bunt spores are resistant to dry conditions, sunlight, a wide range of temperatures, and most fungicides. Wheat that is not infected can become contaminated with spores by passing through spore-contaminated equipment, transport vessels, or facilities. Other grains can also be contaminated with spores in the same way.

While Karnal bunt is not harmful to animals, it is suspected that spores in contaminated or infected feed (grain or bran from milled wheat) can survive ingestion by animals. Since the manure of livestock fed such feed is potentially a source of inoculum, bunted wheat in quarantined counties must be heat-treated if used for animal feed.

The American Phytopathological Society states that the experience from countries where Karnal bunt occurs suggests that Karnal bunt is a minor disease and the little risk that does exist for grain quality can be effectively managed with resistant varieties without the use of quarantines (American Phytopathological Society). The Society also suggests that although quarantines may delay the introduction of Karnal bunt into new areas, they are unlikely to prevent such introductions and subsequent establishment. This conclusion has been confirmed repeatedly, most recently by the occurrence of Karnal bunt in the United Sates despite quarantines imposed on wheat from countries where the disease has been known to occur.

Quarantines may be ineffective where wheat-growing areas are contiguous, as between Mexico and the United States. However, where longer distances apply, as between continents or where deserts or mountains intervene, quarantines may help to protect countries that do not have Karnal bunt (Murray and Brennan).

Yield Losses to Karnal Bunt

Karnal bunt spores usually replace only a portion of the developing kernel and only a few of the kernels in a head. Complete conversion of kernels to spores is rare. Thus, yield reductions are generally minimal. For example, surveys in India during years of heavy disease infestations revealed a general, area-wide yield loss of less than 0.5 percent (Davila). However, in a few fields with highly susceptible varieties, as much as 89 percent of the kernels were infected, with yield losses ranging from 20 to 40 percent.

Options for Karnal Bunt Control

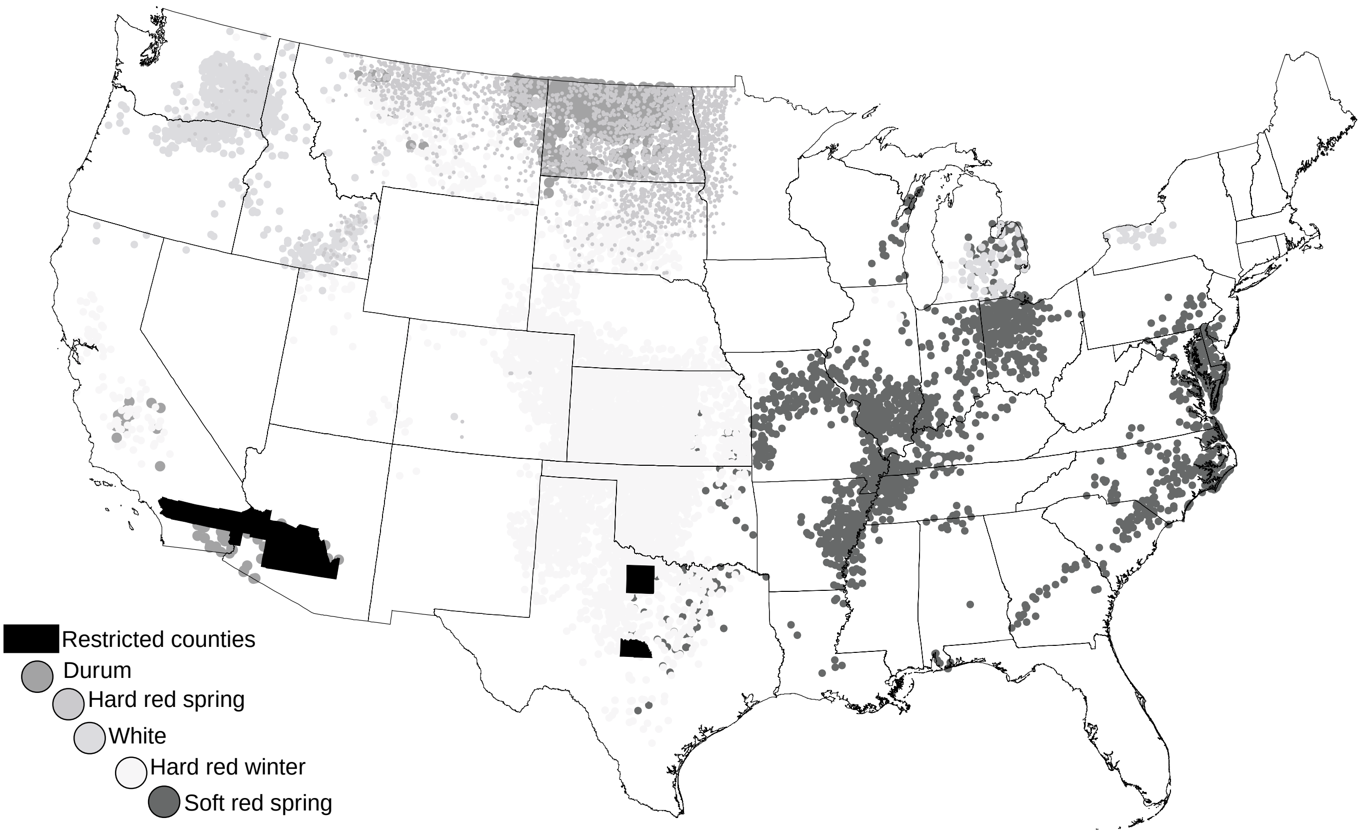
Wheat breeders in areas with Karnal bunt recognize the importance of avoiding the release of highly susceptible varieties.[2] This control measure has proven effective for reducing the level of Karnal bunt sufficiently that quality of the harvested grain is not severely affected. However, resistant varieties do not eradicate the disease, and Karnal bunt epidemics have recurred in India as soon as susceptible varieties were again grown (Murray and Brennan).

Apparently, cultural practices are of little practical value in reducing the probability of an outbreak (Murray and Brennan). Seed treatments can reduce the

[2] International Maize and Wheat Institute (CIMMYT) has identified 98 resistant lines of bread wheat, and Punjab Agricultural University, India, has 68 resistant lines (Davila).

Figure A-1

Karnal bunt now established at the southern edge of hard red winter plantings (area planted 1998)



1 Dot = 5,000 planted acres at the county level
(counties with less than 5,000 acres do not appear)

number of viable spores on seed, and, therefore, the probability that Karnal bunt will be introduced to new areas. Foliar application of fungicides can reduce the level of disease, but more than one application is usually required, making this an expensive control option. Fungicides are likely to be cost effective only if other important diseases, such as rusts or Septoria blotches, are also present. Fumigation of soil with chemicals, such as methyl bromide, metham-sodium, and formaldehyde, has been partially successful in killing the spores.

Exporting Under Deregulation Is Problematic

Not all countries that have restrictions against Karnal bunt would, in practice, strictly prohibit wheat imports from the United States if USDA stopped issuing certificates. Each country has regulations that are often idiosyncratic in how they are written and enforced. For example, Italy and Germany currently import wheat from countries where Karnal bunt is known to occur, after testing to ensure the wheat is free of Karnal bunt, despite European Union regulations against such a practice.

In addition, while some markets would be captured by wheat-exporting countries that are free of Karnal bunt, U.S. wheat exports to countries that have no restrictions against Karnal bunt would likely increase. The longrun effects would likely depend on the extent that world wheat markets treat Karnal bunt as a quality issue.

There is also an issue of what procedure would be used by other countries for Karnal bunt testing if the United States should stop issuing certificates. Currently, there is no accurate Karnal bunt test available that is rapid enough to use during ship loading. Even the microscopic examination for spores with the “wash test” can lead to false positives because of bunt on ryegrass *Tilletia walkeri*. Annual ryegrass is a significant weed problem in wheat fields in the southeastern United States. The wash test is currently used for seed wheat to ensure that there is no disease present. For non-seed wheat, USDA uses a "bunted kernel test" which involves visual inspection for bunt on the grain kernel. Spore-contaminated grain can pass the bunted kernel test. Currently, most importing countries, even with phytosanitary regulations against Karnal bunt, accept APHIS's certificate that the wheat comes from an area not known to have Karnal bunt, and do not routinely test for Karnal bunt spores or check for bunted kernels.

If even a few important wheat-importing countries maintain prohibitions, shipping companies may have concerns about shipping wheat from a deregulated U.S. wheat sector. Ship owners wishing to protect their interests may insist on a certificate from an authoritative U.S. source that unequivocally confirms that the cargo is free from Karnal bunt spores.

Further, shipping vessels that carried contaminated wheat to countries without prohibitions would have to be sanitized to ensure that later cargoes from other sources going to countries that continue to have prohibitions will not be contaminated. Under U.S. deregulation, spores could spread through the storage and transport equipment to other products like corn and soybeans. The cost of testing and sanitizing to ensure freedom from the disease would likely be considerable.

There may also be issues with transshipment through the St. Lawrence Seaway if the United States deregulates Karnal bunt. Currently, Canada prohibits the entry of wheat from States with Karnal bunt. Any wheat that crosses the Canadian border needs a declaration that the grain originated in an area free of Karnal bunt on the basis of official surveys.

The future importance of these issues will likely depend on whether Karnal bunt becomes widespread across the U.S. wheat sector. However, there is no certainty about how far and how rapidly the disease might spread if the quarantine system is eliminated.

The USDA Regulated Areas

An area that is regulated by USDA for Karnal bunt is a definable commercial wheat-production area that includes at least one field that tested positive for Karnal bunted kernels. USDA restricts movement of wheat grain, straw, hay and farm equipment within and out of these regulated areas. USDA tests wheat grown in regulated areas each year for Karnal bunted kernels.

Currently, in a regulated area, a grain sample must be drawn by an APHIS inspector or State cooperator at the time of harvest, or if already harvested, from the storage bins, and examined for bunted kernels. If the sample is taken from the field as it is being harvested and no bunted kernels are found, a certificate will be issued and the grain allowed to be transported to any market. If the grain sample came from grain already in storage and no bunted kernels are found, then a permit will be issued for the grain to be transported to any market. If one or more bunted kernels are found in the sample, then a notice will be issued and the grain sealed in the storage facility prior to approved treatment or disposal.

In a regulated area, wheat grown to produce seed can be planted only within the regulated area and only if the seed tests spore negative through the wash test. Seed wheat cannot be moved outside the regulated area. Any seed grown in a regulated area that tests spore positive (based on the wash test), but is bunt negative (based on visual inspection) cannot leave the area for seeding purposes, but it can leave the area for export as grain to a country that does not require an APHIS Karnal bunt certificate or for domestic use for livestock feed or milling.

Wheat grain, straw, or wheat hay that tests bunt positive cannot be moved outside the regulated area without APHIS approval. If needed, a permit is issued to allow the transport of these products to an approved facility outside the regulated area for treatment or disposal.

Karnal bunt quarantines have been controversial since they were initiated in 1996. To increase cooperation, USDA compensates producers, grain handlers, and other affected parties for losses suffered due to the Federal quarantine action. Compensation payments have totaled about $35 million since 1996 (U.S. Department of Agriculture).

Estimating the Effects of Karnal Bunt Deregulation

Even though Karnal bunt poses no health risk, many U.S. wheat export markets have a precautionary stance against the acceptance of wheat without a certificate indicating the wheat is from an area where Karnal bunt is not known to occur. Thus, if the United States were to stop its certification, U.S. wheat would not meet those importing countries' phytosanitary requirements.

It is uncertain how the wheat-importing countries of the world would react if the United States were to end its Karnal bunt quarantine regulation. The reaction of many countries would likely depend upon how frequent and how widespread Karnal bunt outbreaks occurred in the United States and the availability of wheat from other sources. However, it is possible to anticipate the likely reactions of governments and industry to deregulation not accompanied by a severe outbreak. This study does not attempt to forecast future incidence of Karnal bunt in U.S. wheat fields.

The scenario analyzed assumes a unilateral end to U.S. karnal bunt certification, without significant success in getting importing countries to accept something other than a zero tolerance level for karnal bunt spores. If ongoing scientific research and diplomatic efforts cause a significant number of wheat importers to accept a more relaxed standard than a zero tolerance, then trade effects would likely be smaller. However, such efforts would undoubtedly take time.

With unilateral deregulation, we assumed that most of the adverse reactions of U.S. wheat customers would fall on hard red winter wheat (HRW) producers in the Central and Southern Plains and soft red winter wheat (SRW) producers (these two classes averaged 62 percent of U.S. wheat production between 1996 and 2000). The combination of weather conditions and stage of plant growth needed to result in Karnal bunt infection are most likely in areas where these two classes of wheat are grown (Dobeseberger, Jimenez, and Sequeira). Because U.S. wheat is blended, we also assumed that HRW and SRW from northern States that might not be susceptible to karnal bunt cannot be certified as free of spores. However, the harsh winters in the northern United States where the other classes of wheat are principally grown are expected to prevent the spread of the disease into those regions. U.S. domestic and international customers for the three classes of wheat: hard red spring (HRS), durum in the Northern Plains, and white wheat (from the traditional Pacific Northwest and Northeastern white wheat areas, not Kansas) are assumed to be unconcerned about Karnal bunt contamination, even with decertification. This lack of concern assumes that some alternative government or private certification is found acceptable for importers of spring and white wheat and is a major reason why this scenario does not have a larger U.S. trade loss. Moreover, Canada is also assumed to accept alternative certification, allowing transshipments through the Saint Lawrence. For many common uses, HRS and HRW are readily substituted, as are SRW and soft white wheat.

A world wheat trade model that appropriately estimates trade flows by class and country was not available to analyze the issue, so a scenario was developed based on expert judgment of USDA analysts. A set of assumptions about prices and trade impacts by country was developed using the February 2002 trade matrix of 2001/02 world wheat trade. The percent changes in U.S. wheat exports were then applied, beginning in 2003, relative to the *USDA Agricultural Baseline Projections to 2011*, in a U.S. agricultural sector model to calculate the impacts on the domestic farm sector.

As a first step, countries were classified by their antipathy to Karnal bunt and their presumed response to U.S. deregulation (table A-1). For this analysis, each significant market for U.S. wheat exports was put into one of three categories.

Group A, accounting for 25 percent of forecast U.S. exports, includes countries that: (1) have strict requirements on Karnal bunt as reported by APHIS, (2) have a history of strict observance of phytosanitary regulations, (3) normally import hard red winter (HRW) or soft red winter wheat (SRW), and (4) could be expected to remain intransigent about only importing wheat that is certified as coming from a Karnal bunt-free zone. Important markets in this group include EU-15, Eastern Europe, China, Egypt, Algeria, Morocco, Libya, Tunisia, and Brazil.

Group B, accounting for 35 percent of forecast U.S. exports, includes countries that: (1) have strict requirements on Karnal bunt, as reported by APHIS, (2) may be somewhat more flexible in implementation of phytosanitary regulations, (3) normally import only a portion of U.S. wheat from regions potentially at risk, and (4) although decertification would disrupt HRW and SRW shipments in the first year, over the next 2 years these countries would be expected to relax Karnal bunt standards to tolerance levels that would permit trade and a resumption of imports from the United States. Important markets in this group include the former Soviet Union, Yemen, South Korea, Indonesia, Taiwan, Sri Lanka, Mexico, Venezuela, Colombia, and other Western Hemisphere countries.

Group C, about 40 percent of forecast U.S. exports, consists of countries: (1) without strict requirements on Karnal bunt, as reported by APHIS, (2) that import only U.S. spring or white wheat, and (3) without significant wheat production, and (4) could be expected to demand that less than 3 percent of bunted kernels be allowed according to milling standards, but would not test for spores. Important countries in this group

Table A-1--Likely trade effect of unilateral U.S. deregulation of Karnal bunt1/

Major importers	KB antipathy	Total U.S. wheat exports 2001/02 forecast	HRW share of U.S. exports	SRW share of U.S. exports	Other classes share of U.S. exports	1st year U.S. export loss 2/	2nd year U.S. export loss 2/	3rd year U.S. export loss 2/	Long term U.S. export loss 2/
					1,000 metric tons				
Total Western Europe		2,300	0	550	1,750	385	1,152	439	404
EU-15	high	2,200	0	550	1,650	385	1,122	424	404
Other West Europe	high	100	0	0	100	0	30	15	0
Eastern Europe	high	100	80	0	20	78	96	86	82
FSU	medium	125	100	13	13	111	120	56	28
Total Asia & Middle East		11,975	2,725	523	8,727	1,280	1,958	455	6
Total Middle East		2,425	1,565	131	729	928	1,019	233	73
Iran		0					0	0	0
Iraq		0					0	0	0
Yemen	medium	625	0	31	594	31	75	38	19
Israel	low	700	630	56	14	-70	-35	-53	-70
Other Mid East	medium	1,100	935	44	121	967	979	248	124
Total East & SE Asia		9,550	1,160	391	7,998	352	939	222	-66
Japan	low	3,040	152	30	2,858		0	0	0
South Korea	medium	1,300	260	26	1,014	185	406	92	0
Pakistan	low	395	8	0	387	-40	-20	-30	-40
Indonesia	medium	250	25	25	200	50	85	43	21
Philippines	low	1,700	17	255	1,428	-170	-85	-128	-170
China	high	275	14	55	206	69	165	76	69
Malaysia	low	200	20	0	180	-20	-10	-15	-20
Bangladesh	low	300	195	0	105	-30	-15	-23	-30
Taiwan	medium	930	279	0	651	214	172	86	43
Sri Lanka	medium	560	101	0	459	55	119	60	30
Other Asia	medium	600	90	0	510	39	122	61	30
Total Africa		6,700	3,862	1,834	1,005	3,535	4,239	3,638	3,371
Total North Africa		4,100	1,910	1,598	593	3,329	3,943	3,676	3,502
Egypt	high	3,500	1,680	1,470	350	2,975	3,500	3,273	3,124
Algeria	high	175	35	0	140	35	70	53	44
Morocco	high	225	113	90	23	200	225	220	210
Libya	high	125	75	38	13	111	125	122	117
Tunisia	high	75	8	0	68	8	23	8	8
Sub-Saharan Afr.		2,600	1,952	236	412	206	296	-38	-132
Nigeria	low	1,800	1,584	180	36	-180	-90	-135	-180
Other Sub-Sahar.	medium	800	368	56	376	386	386	97	48
Total Western Hemisphere		6,150	2,908	2,025	1,218	1,486	1,943	733	265
Brazil	high	175	105	70	0	175	175	193	184
Mexico	low	2,150	1,290	774	86	-215	-99	-157	-215
Peru	low	550	451	88	11	-55	28	-14	-55
Venezuela	medium	550	165	220	165	369	422	184	92
Colombia	medium	550	402	138	11	538	550	269	134
Cuba	low	75	75	0	0	-8	-4	-8	-8
Other West Hem.	medium	2,100	420	735	945	683	872	265	133
Unaccounted		150	75	75	0				
2001/02 Total		27,500	9,750	5,018	12,732	6,876	9,508	5,405	4,156
Percent of total exports						25	35	20	15

1/ Assumes increased U.S. shipments of HRS and White to markets not accepting HRW and SRW as well as increased shipments of HRW and SRW to markets with low antipathy to Karnal Bunt. After the first year, increased competitors' production also reduces U.S. market share.

2/ A positive number indicates a loss of exports, a negative number indicates an increase.

Examples By Country

Egypt is an important example of how a country might react to Karnal bunt decertification. Egypt has strict phytosanitary regulations regarding Karnal bunt. Moreover, it is a significant producer, with irrigated land that could be quite susceptible to the disease. These factors would likely cause Egypt to be inflexible about accepting wheat with Karnal bunt spores (a Group A country). However, while most U.S. exports to Egypt have been HRW or SRW, some are other classes. U.S. shipments of white wheat could be expected to increase, limiting U.S. losses in the first year of the scenario (2003) to less than 3 million tons (see table A-1). However, in 2004, increased competition, in this case especially from Australian white wheat, is expected to push U.S. wheat out of the Egyptian market. In the third year and later, after prices and production in Australia decline from the peak in the second year, U.S. white wheat shipments to Egypt recoup losses, ending up higher than without Karnal bunt. However, without SRW and HRW, the United States has still lost most of its wheat export market to Egypt.

Venezuela is an example of a Group B country (with medium Karnal bunt antipathy). While Venezuela has regulations prohibiting Karnal bunt in wheat imports, and Karnal bunt might propagate in that climate, Venezuela's wheat production is insignificant. Eventually, Venezuela could be expected to accept a Karnal bunt spore tolerance greater than zero. However, it would likely take extensive negotiations. About 70 percent of U.S. exports to Venezuela are HRW or SRW. In the first year of the scenario, U.S. HRS shipments would be expected to increase some, but Canada and Argentina would be expected to provide intense competition, replacing most of U.S. HRW and SRW shipments. In the second year, with negotiations ongoing and intense competition from Canada, even the U.S. HRS share is reduced. In the third year, Venezuela is assumed to accept a reasonable tolerance for Karnal bunt spores, and U.S. exports increase dramatically, but in the long run Canada has gained a competitive edge, and the U.S. share remains about 17 percent below what it would have been without Karnal bunt.

A Group C country, with low Karnal Bunt antipathy, like Israel, has no regulation concerning Karnal bunt. Imports of U.S. wheat are above baseline levels throughout the scenario, but the increase in 2004 is less because increased competitor supplies and reduced prices limit U.S. gains. In 2005 and later, the U.S. share increases again because the price of U.S. HRW and SRW is comparatively attractive.

include Israel, Japan, Pakistan, Philippines, Malaysia, Bangladesh, and Nigeria.

U.S. wheat exports were examined to evaluate the effect of reducing U.S. HRW and SRW exports to zero for Groups 1 and 2 during the first year (see table A-1). This means that about 60 percent of U.S. customers would find about 55 percent of U.S. exports unacceptable. Some switching to other U.S. wheat classes is assumed, but switching would be limited by supplies and by limited substitutability for some uses. The world wheat market is segmented: some countries have inelastic demand, are willing to pay high premiums, and are expected to be concerned about Karnal bunt; other countries like discounted, cheap wheat and are not concerned about Karnal bunt. Assumptions about responsiveness in each country drives the analysis of changes in world wheat trade and U.S. exports.

In the first year, U.S. exports of HRW and SRW are calculated to increase to those markets still accepting them, while overall U.S. wheat exports are calculated to drop nearly 7 million tons, or 25 percent below baseline levels. Most of the drop in U.S. exports is expected to be gained by competitors' exports and reduced ending stocks (boosting prices in those countries). Importers also draw down stocks some, but the decline in world wheat trade is small because some importers actually increase imports of cheaper U.S. HRW and SRW.

While the U.S. average farm price for wheat drops significantly (45 cents per bushel in 2003) under this scenario, the premium for spring wheat (relative to the all-wheat average farm price) is assumed to be about 50 cents per bushel greater than normal, while the discount for HRW and SRW would be at least 50 cents greater than normal. The market impacts of by-class premiums and discounts are larger than the change in the average

U.S. price received by farmers for wheat. The assumed relative international price changes (about $1.00 per bushel) are thus similar enough in magnitude to price changes in 1995/96 (when the average farm price increased $1.10) so that the 1994 to 1998 reaction of U.S. competitors to high prices can provide insight into their likely reaction in this scenario.

In 1994/95, the major competitors (Canada, Australia, EU, and Argentina) reduced wheat stocks more than 11 million tons, while in the Karnal bunt scenario, a 6-million-ton reduction is anticipated. These countries increased wheat production by over 30 million tons in 1996/97, but a smaller increase, about 15 million tons, is assumed in the Karnal bunt scenario because their price increases would be less than occurred in 1995/96. Moreover, competitors are currently planting more wheat than in 1994/95, so it will be more difficult for them to expand from this higher base.

In the second year of the scenario (2004), some of the importing countries in Group B (see table A-1) are assumed to adopt less restrictive Karnal bunt standards, opening imports to U.S. HRW and SRW, thereby reducing the direct effect of Karnal bunt trade barriers. However, in that second year, foreign competitors' production (and U.S. HRS and White wheat) is expected to increase strongly in response to the first year's higher prices. Although a portion of competitors' increased production is used to replenish stocks, much is expected to move into export channels, further reducing U.S. market share. In the second year of the scenario, U.S. wheat exports are estimated down 9.5 million tons, 35 percent below the baseline level (without Karnal bunt).

In the third year after deregulation, the rest of Group B countries further relax Karnal bunt import standards, and competitors' response is muted, as wheat prices and premiums in those countries decline. However, in the third year, U.S. wheat exports are 20 percent below baseline levels. In subsequent years, the U.S. recaptures some lost market share as price premiums in competing countries become small. However, the exclusion of U.S. HRW and SRW from group A markets results in a small premium for U.S. competitors that are free of Karnal bunt and reduces long-term U.S. wheat exports by 15 percent below baseline levels. This long-term decline represents a loss in market share despite the development of alternative regulatory mechanisms in markets accounting for 80 percent of U.S. wheat exports.

No model is available that includes the effects of wheat classes on world trade or U.S. regional and class differences with appropriate substitution elasticities. Therefore, a more general model was used to quantify price changes and address the effects on U.S. agriculture.

Model Simulation Results

The U.S. domestic impacts of terminating certificates for Karnal bunt were estimated with the Food and Agricultural Policy Simulator (FAPSIM). FAPSIM is a large-scale econometric model of the U.S. agricultural sector maintained by the Economic Research Service (ERS). The model contains submodels for 24 agricultural commodities, including wheat.[3] The model also includes submodels to estimate the value of exports, net farm income, and Government outlays on farm programs for the United States.

These submodels are linked together through the variables that they share in common. The model computes the set of market prices that equilibrate supply and demand in all of the commodity markets simultaneously, given any set of exogenous conditions.

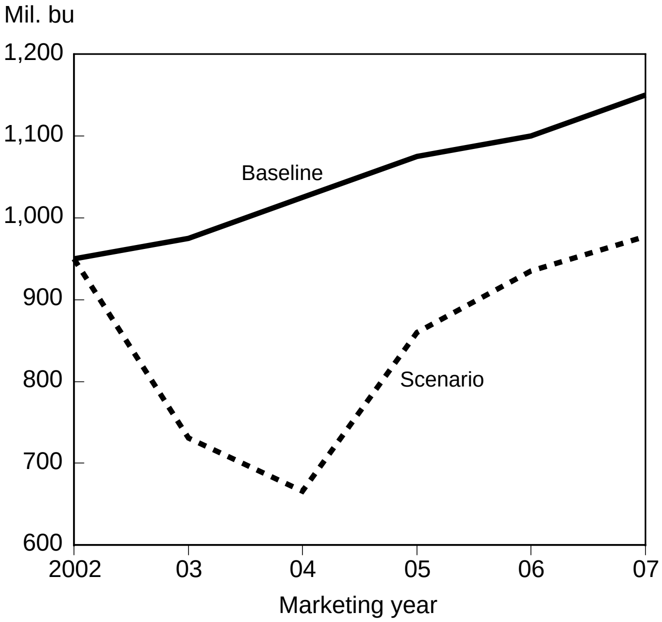
The estimated trade impacts were introduced into the model by exogenously reducing wheat exports from their baseline levels over the 2003-07 period by the percentages already mentioned. The initial export levels used in the analysis were obtained from the February 2002 USDA baseline (USDA, Office of the Chief Economist). All of the model simulation results from the scenario are compared against the USDA baseline projections in the discussion that follows.

Figure A-2 shows the assumed reduction in wheat exports under the scenario compared with the baseline. In 2003/04 and 2004/05, exports under the scenario decline relative to the baseline by 25 and 35 percent, or by 244 million and 359 million bushels, respectively. Exports partly recover in the succeeding years of the analysis, averaging 15 percent less than the baseline.

The decline in exports under the scenario reduces the farmgate price of wheat (fig. A-3). Prices decline from the baseline by 17 and 19 percent, or by 45 and 53 cents per bushel, in 2003/04 and 2004/05, respectively. The loss is larger in the second year because the sharply higher prices expected to be received by U.S. competitors in 2003/04 result in significantly expanded

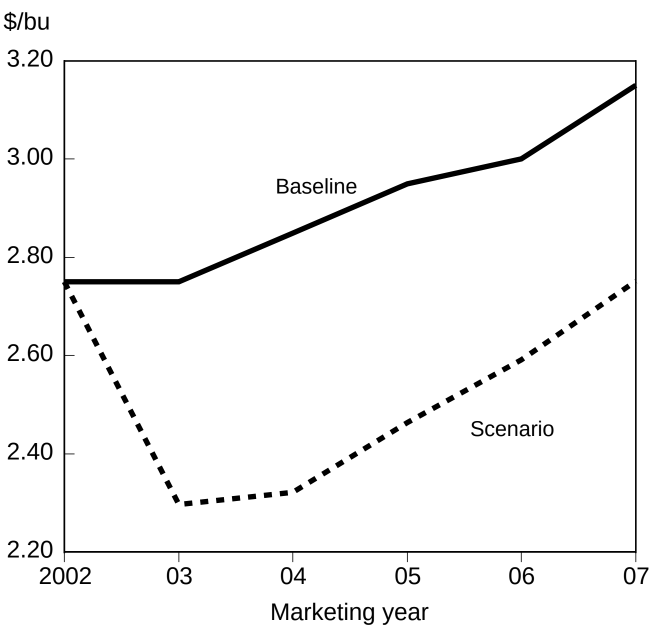
[3] The wheat submodel in FAPSIM is an aggregate model. It does not distinguish between the different classes of wheat.

Figure A-2
U.S. wheat exports



Source: FAPSIM.

Figure A-3
U.S. wheat price



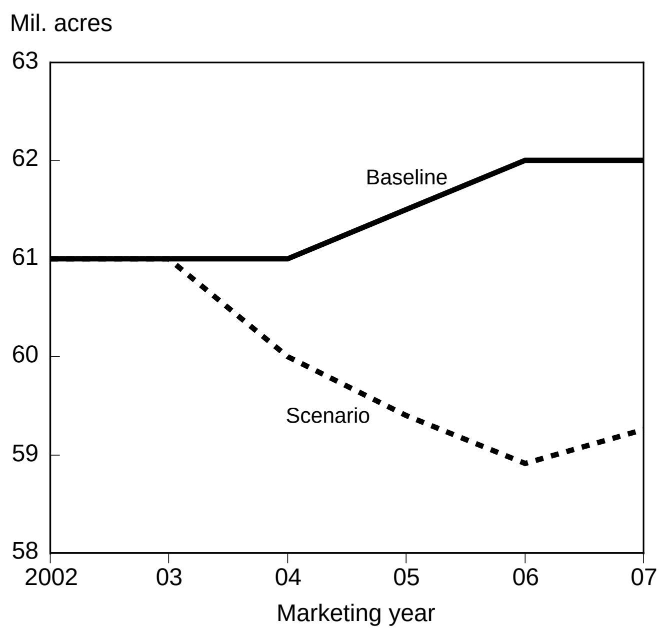
Source: FAPSIM.

production in 2004/05. We assumed that the European Union would not put a tax on wheat exports to hold down its domestic prices. U.S. domestic prices partially recover relative to the baseline in succeeding years with recovery of some of the lost export markets. The prices under the scenario are still below baseline prices by 13 percent in 2007/08.

With domestic prices lower under the scenario, the U.S. area planted to wheat declines relative to the baseline (fig. A-4). However, the response by producers to the lower wheat prices is muted somewhat over the initial years because of U.S. Government farm programs. Part of the market revenue loss that producers experience due to lower farm prices over this period is offset by an increase in marketing loan benefits that they receive from the government. As a result, the area planted to wheat declines relative to the baseline by 2 and 3 percent, or by 1.0 and 2.1 million acres, respectively, in 2004/05 and 2005/06. In contrast, area planted to wheat declines by 2.7 million acres below the baseline level in 2007/08 when producers are not expected to receive any offsetting compensation through marketing loans. Because the production response is muted in the early years, excess production occurs, causing the price impacts to be larger than they would be in the absence of government programs.

With lower prices under the scenario, domestic feeding of wheat increases sharply, by 32 and 107 percent, or by 88 and 295 million bushels, in 2003/04 and 2004/05, respectively. With smaller price impacts in the succeeding years, the changes in feed demand also

Figure A-4
U.S. wheat planted area



Source: FAPSIM.

become smaller. Nonetheless, wheat feeding under the scenario remains above the baseline level by about 32 percent in 2007/08. Part of the reason these impacts are large is that the model solution was constrained to ensure that the price of wheat never falls below its feed value in relation to the price of corn. Wheat displaced corn as an animal feed to the extent necessary to ensure this constraint was satisfied.

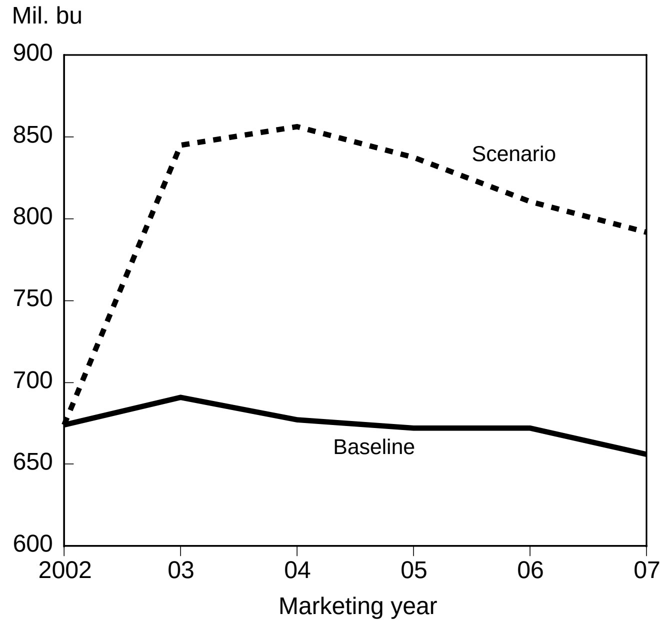
Total domestic use of wheat is estimated to rise by 7 and 22 percent, or by 90 and 296 million bushels, for 2003/04 and 2004/05, respectively (fig. A-5). This rise is almost entirely due to the increased feeding of wheat, with only a slight increase in food use. Seed use declines under the scenario relative to the baseline because of the reduction in area planted to wheat.

Even though wheat feeding increases sharply under the scenario, this rise is not enough to offset export losses. Thus, ending stocks are estimated to rise above the baseline by 22 and 27 percent, or by 154 and 179 million bushels, for 2003/04 and 2004/05, respectively (fig. A-6). Although the impacts on ending stocks become smaller in the succeeding years of the scenario, stocks remain above baseline levels by 21 percent in 2007/08.

The reduction in wheat production and the lower farm-gate prices under the scenario combine to reduce U.S. cash receipts received by wheat producers from farm marketings (fig. A-7). Cash receipts for wheat are estimated to drop below the baseline by $915 million and $1,293 million in 2003 and 2004, respectively. By the

Figure A-6

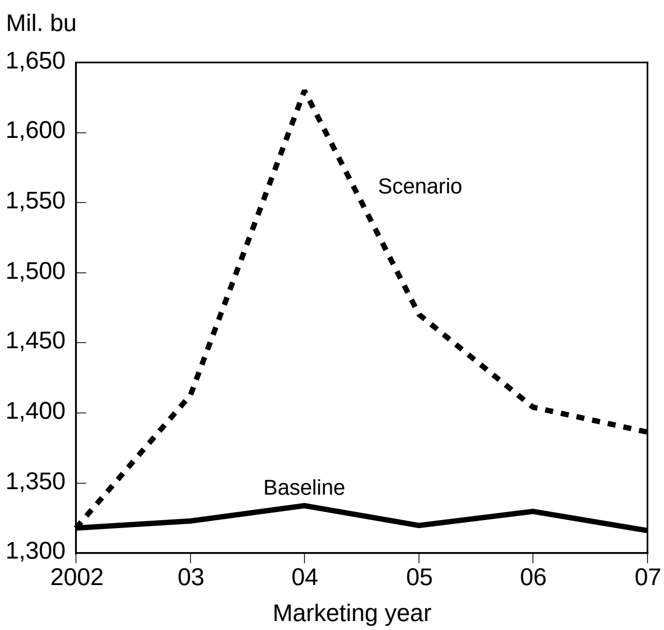
U.S. wheat ending stocks



Source: FAPSIM.

Figure A-5

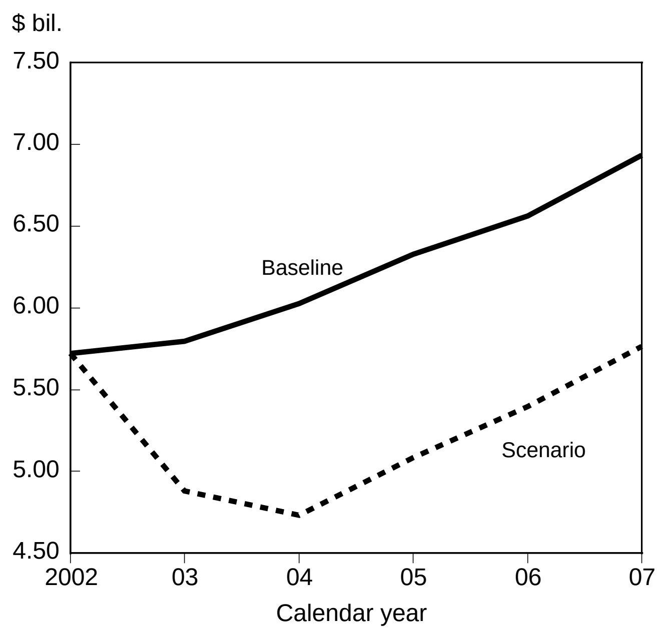
U.S. domestic use of wheat



Source: FAPSIM.

Figure A-7

U.S. wheat cash receipts



Source: FAPSIM.

final year of the analysis, cash receipts remain below baseline levels by $1,167 million. Cumulative wheat cash receipts decline by $5.8 billion below the baseline over the 2003-07 period.

No marketing loan payments are assumed for wheat over the 2003-07 period under the baseline. However, the price declines for wheat over the 2003-05 period under the scenario are sufficient to trigger marketing loan benefits. The payments to wheat producers are $0.7, $0.6, and $0.2 billion for 2003/04, 2004/05, and 2005/06, respectively. The cumulative marketing loan benefits associated with all crops increase by $2.0 billion above the baseline over the 2003-07 period.

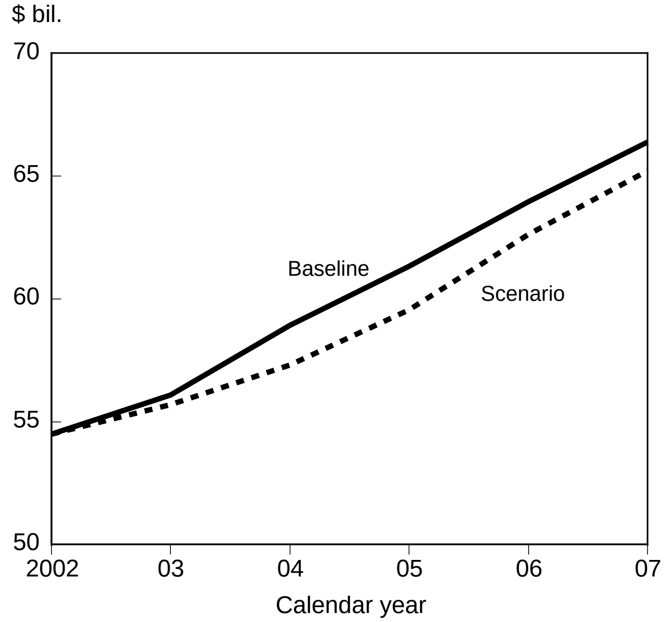
As suggested above, other commodities are also affected by the price adjustments that occur in the wheat sector under the scenario. As the profitability of wheat production declines, producers shift production from wheat to alternative crops. The increase in production causes the prices for other crops to decline. However, the price changes associated with other crops are small in relation to the price changes for wheat. Farm prices of other crops change by less than 5 percent from their baseline levels over the 2003-07 period. The price impacts for the livestock sector, stemming from lower feed costs, are even smaller.

The farm price of corn is estimated to decline below the baseline level by 4.5 percent in 2003/2004 as livestock producers shift from corn to the lower priced wheat in their feed rations. On average, corn prices are 1.3 percent below baseline levels over the 2003-07 period, with comparable changes for other feed grain prices. As a result, cumulative cash receipts for feed grains decline by $1.2 billion below the baseline over the 2003-07 period.

With lower wheat exports and prices under the scenario, the value of U.S. exports of wheat declines below baseline levels. The cumulative value of total U.S. agricultural exports is estimated to fall by over $6.3 billion over the 2003-07 period under the scenario (fig. A-8). Although most of the decrease is associated with wheat, there are also downward adjustments in the value of exports for other commodities due to lower prices.

Because prices of all agricultural commodities decline under the scenario, total U.S. cash receipts from the farm marketings decline below baseline levels. Cumulative cash receipts over the 2003-07 period are estimated to be $10.4 billion below the baseline level.

Figure A-8
U.S. value of agricultural exports



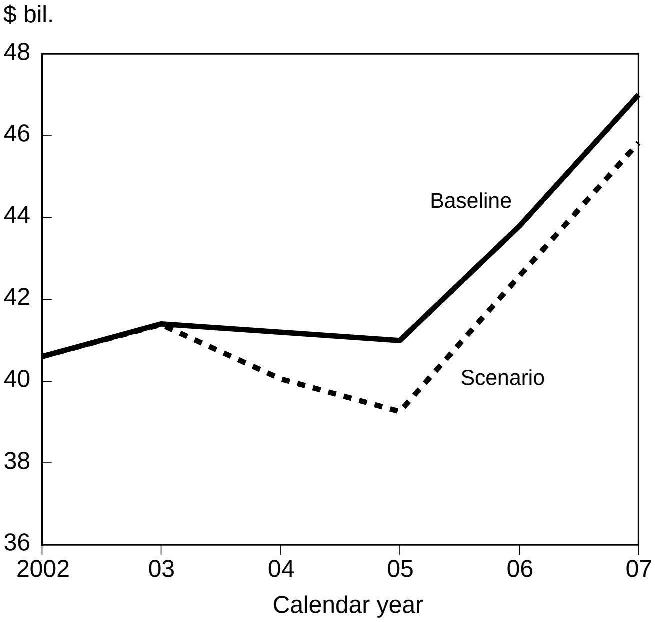
Source: FAPSIM.

More than half of this decline is associated directly with wheat. There are also some offsetting adjustments. Because there is less total crop area planted under the scenario, producers incur fewer production expenses. In aggregate, cumulative farm expenses are seen as $2.9 billion below the baseline level over the 2003-07 period. In addition, with producers receiving increased government support payments through marketing loan benefits, cumulative net farm income over the 2003-07 period is estimated to be $5.3 billion lower than the baseline level (fig. A-9).

The average impacts discussed here would not be spread evenly across the Nation's wheat sector. Because Karnal bunt deregulation would be focused on hard red winter and soft red winter exports, impacts would center on wheat producers in the Central and Southern Plains and the Southeastern region of the country. It is possible that a longer run effect of deregulation would be to reduce wheat acreage in the Central and Southern Plains and to increase wheat acreage in the Northern Plains, if foreign customers continue to be reluctant to purchase wheat grown in areas potentially affected by Karnal bunt.

The analysis assumes that domestic millers of wheat are not affected by deregulation. However, if domestic millers do respond negatively to wheat from potential-

Figure A-9
U.S. net farm income



Source: FAPSIM.

ly affected areas, the economic incentives to shift wheat acreage to the North would be enhanced.

Conclusions

Karnal bunt seldom results in significant yield losses to wheat in the field. However, Karnal bunt affects flour quality if more than 3 percent of the grains are bunted because it gives off a fishy odor. In addition, pasta products made with flour contaminated with Karnal bunt can have an unacceptable color. The fungus that causes Karnal bunt does not produce any toxic compounds in leaf, stem tissue, or seed that pose health risks when consumed. Thus, Karnal bunt is a food quality issue rather than a food safety issue. Because the fungus poses no risk to human health, the U.S. Government does not have any food safety regulations concerning wheat infected with Karnal bunt. However, the compensation payments for the Karnal bunt quarantine regulatory program have totaled about $35 million from 1996 through 2001.

Even though scientific evidence is that Karnal bunt posses no health risk, many U.S. wheat export markets require that wheat from the United States be from areas where Karnal bunt is not known to occur. Such countries would likely resist importing U.S. wheat if the certification procedures were terminated.

The assumed impact of terminating Karnal bunt certification is entirely through reduced exports. Using an ERS model of U.S. agriculture, an export scenario was evaluated. Domestic prices dropped sharply, which, in turn, reduced the area planted to wheat. Although wheat feeding rose with the lower prices, the increase was not nearly enough to offset the loss of export markets. Wheat prices remained below baseline levels. The reduction in wheat production and the lower prices combined to reduce the total value of the wheat produced in the country, as well as the net income of U.S. agriculture. The effects primarily affected producers in the Central and Southern Plains and in the Southeast.

The cumulative total reduction of national net farm income from 2003 to 2007 is $5.3 billion. The cumulative marketing loan payments associated with all crops increase by $2.0 billion above the baseline over the 2003-07 period.

This article does not consider the cost of testing of wheat for Karnal bunt contamination, or the wheat quality discounts that could emerge in the world marketplace. Other important issues include possible contamination of vessels and handling facilities, regulations for the transhipment of grain through the St. Lawrence Seaway, and possible trade impacts for other grains such as corn and soybeans if the Karnal bunt quarantine system is deregulated.

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