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The Economic Impact of Karnal Bunt Phytosanitary Wheat Export Certificates

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Abstract

Karnal bunt (KB) is a wheat disease of limited distribution in the United States. Affected areas are quarantined to limit spread of the disease. Currently, the KB regulatory program allows the U.S. Department of Agriculture to issue phytosanitary export certificates stating that a wheat shipment is from an area where KB is not known to occur. Some in the wheat marketing chain, particularly elevator operators, find the regulatory program burdensome and advocate ending it. Ending the program would be expected to jeopardize U.S. exports to some countries. A model developed by the Economic Research Service was used to analyze the market effects of ending the certification. The average annual loss of 15.1 percent in export markets for U.S. wheat producers would be only partially offset by increased use of lower priced wheat for domestic livestock feed. Wheat prices would remain an average 7.5 percent below baseline levels. Reduced wheat production and lower prices would combine to reduce total cash receipts for wheat produced in the United States. National net farm income would fall $8 billion below the baseline because of the expected loss in export markets between 2011 and 2018.

Keywords: Wheat, Karnal bunt, KB, export certificates

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Introduction

Karnal bunt (KB) is known to occur in Asia (Afghanistan, Iran, Iraq, India, Pakistan, and Nepal), Africa (South Africa), and North America. In Mexico, it is present in the states of Chihuahua, Guanajuato, Jalisco, Michocan, Queretaro, and the Mexicali Valley in Sonora and Baja California. In the United States, KB is limited to Arizona (La Paz, Maricopa, and Pinal Counties) and Riverside County, California. KB is so named because it was discovered in 1931 on wheat grown near Karnal, India. (See box, "Significance and History of Karnal Bunt.")

KB, 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. Because the fungus poses no risk to human health, the U.S. Government does not have any food safety regulations concerning KB. However, KB affects flour quality if more than 3 percent of the grains are bunted because it produces trimethylamine, which gives off a fishy odor. However, this level of infection has never been observed in the United States. Pasta products made with flour contaminated with KB can also have an unacceptable color. (See box, "Biology of Karnal Bunt.")

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

Some of those involved in wheat marketing, mostly elevator operators, have proposed that the KB quarantine regulations and surveys be ended, suggesting that USDA should consider wheat contaminated by KB a quality issue and establish tolerances. For owners of grain elevators handling

Significance and History of Karnal Bunt

Karnal bunt (KB) is a significant U.S. export problem because many countries believe it to be a quarantine pest, although the United States considers it a quality pest. KB is known to affect only wheat (Triticum aestivum), triticale (Triticum aestivum X Secale cereale), and durum wheat (Triticum durum). KB was first detected in the United States in 1996.

KB is caused by the fungus *Tilletia indica* Mitra. It was first reported in 1931, infecting wheat growing near the city of Karnal in the Indian state of Haryana. Since that time, the disease has been found throughout all the major wheat-growing states of India. Karnal bunt has also been found in Afghanistan, Iraq, Iran, Pakistan, South Africa, Mexico, and the United States. In the United States, the Animal and Plant Health Inspection Service (APHIS) has designated parts of Arizona and California as areas regulated for KB, with restricted movement of wheat and farm equipment and yearly tests for bunted kernels.

wheat, the possibility that KB could be found in the wheat carries significant financial risk; to them, the testing is, at best, a nuisance. In many overseas markets, however, U.S. wheat faces continuing barriers because of the discovery of KB within the United States in 1996. This report presents the results of an analysis of the market effects of ending the issuance of certificates stating that U.S. wheat is from areas where KB is not known to occur.[1]

[1]See Vocke, Gary, Edward Allen, and J. Michael Price, "Economic Analysis of Ending the Issuance of Karnal Bunt Phytosanitary Wheat Export Certificates," *Wheat Yearbook*, WHS-2002, pp. 1-13, March 2002 for an earlier analysis of this issue.

Biology of Karnal Bunt

KB affects the heads of plants of wheat and triticale (a hybrid between wheat and rye). Once kernels become infected, the fungal mycelium may grow throughout the endosperm. As the infected kernel matures, part of the kernel will be converted to masses of dark fetid smut spores. The disease is often referred to as partial bunt, referring to the fact that, in most cases, only a portion of the kernel is converted to teliospores, and typically, only a few kernels on the spike will be affected. This partial infection is in marked contrast to common bunt and loose smut, where the entire kernel is converted to a mass of teliospores and the entire spike is affected. In most cases of KB infection, bunted kernels are not readily visible until the wheat is harvested.

This fungal disease spreads primarily by introduction of teliospores onto a field. Although infected seed planted in a field may or may not directly produce infected plants in the first year, infected seed is the primary way that spores get into the soil. Infection by secondary sporidia, produced by teliospores germinating on the soil surface, occurs during the heading stages of the host plant. The threat of disease is greater in the following years as soil is turned over, bringing these teliospores back to the surface. The ideal conditions for infection are cool weather and rainfall or high humidity during heading. Overhead irrigation during heading time can produce excellent conditions for infection. Although the spores may be carried on a variety of surfaces, the spores and the sporidia they produce also can be windborne. Because the sporidia are fragile and can move only short distances, contaminated seeds are considered to be the major source of spread. Recent data indicate that, even though high numbers of soilborne teliospores may be present in the field and the environment conducive for the disease to develop, a direct relationship between soilborne teliospores and disease incidence may not exist.[1]

Losses due to KB are attributed to the effect of the disease on grain quality. The fungus releases trimethylamine, a volatile compound with a characteristic fishy odor. The presence of 3 percent or more bunted kernels will give the flour an objectionable odor, color, and taste. Flour made from wheat containing large numbers of heavily bunted kernels is discolored and has an unpleasant odor. However, all of the discoveries of KB in the United States have resulted in infection rates of less than 1 percent.

[1]Allen, T.W., et al., "Application of the Humid Thermal Index for Relating Bunted Kernel Incidence to Soilborne *Tilletia indica* Teliospores in an Arizona Durum Wheat Field," *Plant Disease* 93(7):713-19, July 2009.

USDA's KB Regulatory Program

The presence of KB in the United States has significant economic ramifications for the U.S. wheat export market, given that approximately 40 percent of exports are to countries with restrictions against wheat imports from countries where KB is known to occur. The benefits of the regulatory program can thus be viewed as the avoidance of potential losses to the U.S. wheat export market.

The National KB Survey

The National KB Survey was initiated in 1996 in response to the detection of KB disease in the United States. Since then, the survey has provided information to support the export of U.S. wheat to foreign markets. The KB Survey establishes the basis for defining KB-free areas in the United States, which allows U.S. officials to issue phytosanitary certificates when required by the countries to which the United States exports wheat.

The KB Survey is conducted in all wheat-producing States outside of known quarantine areas. Fields in quarantine areas are surveyed separately as part of the USDA KB quarantine program. The KB Survey does not sample every local elevator; representative 4-pound samples are collected from counties where susceptible crops are grown and where 1 million bushels of wheat have been produced, based on National Agricultural Statistics Service (NASS) data for the previous 5-year period. Counties meeting the criteria are sampled on alternating years. If a county has more than one elevator, the elevator location that best represents the entire county is chosen. If a county is represented in the NASS data but has no elevator, samples are taken from elevators to which the grain is shipped, which may be in adjacent counties or even adjoining States. Each elevator normally takes a moisture and/or quality sample from each load arriving at the elevator. Elevator operators are pressured by exporters to save a portion of these samples by placing them in a barrel. Samples may be taken when a barrel approaches capacity.

Classifying an Area for Regulation

APHIS will classify a field or area as a regulated KB area when the field has been planted with seed from a lot found to contain a bunted wheat kernel, or when a field is found during a survey to contain a bunted kernel. The defined area may include an area where KB is not known to exist, but where intensive surveys are required because of the area's proximity to a field found to contain a bunted kernel. In effect, the noninfected acreage serves as a buffer zone between fields or areas affected with KB and areas outside of the regulated area.

Operation of a Regulated Area

In a regulated area, APHIS restricts movement of wheat grain, straw, hay, and farm equipment within and out of the area. APHIS tests wheat grown in regulated areas each year for bunted kernels.

Other parties to wheat production also bear costs associated with regulated areas. The quarantine regulations require that all conveyances, mechanized harvesting equipment, seed conditioning equipment, grain elevators, and structures used for storing and handling wheat, durum wheat, or triticale (a hybrid between wheat and rye) be cleaned by removing all soil and plant debris. Disinfection may be required by an inspector in addition to cleaning.

Currently, in a regulated area, a grain sample must be drawn by an APHIS inspector or designated State official during harvest—or, if the crop is already harvested, from the storage bins—and examined for bunted kernels. If the sample is taken from the wheat 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. A permit will also be issued if the grain sample came from grain already in storage and no bunted kernels are found. 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 that area and only if the seed tests "spore negative" through microscopic examination. 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 bunt-negative (based on visual inspection) cannot leave the area for seeding purposes. However, it can be exported to countries not requiring an APHIS KB certificate or using it for domestic milling or livestock feed.

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

The U.S. KB quarantine program has been controversial since it was initiated in 1996. To increase cooperation, USDA compensates producers, grain handlers, and other affected parties for losses due to Federal quarantine action.

Release from Regulation

A field will be released from regulation if (1) the field has been permanently removed from crop production, or (2) the field is tilled at least once per year for a total of 5 years (the years need not be consecutive). After tilling, the field may be planted with a crop or left fallow. If the field is planted with a host crop, the harvested grain must test negative for KB through the absence of bunted kernels.

As of May 2010, the remaining regulated areas in the United States included 232,807 acres in Arizona and 17,827 acres in California. In 2009, U.S. wheat producers harvested nearly 50 million acres of wheat, so the KB area is proportionally small. However, in Arizona, only 129,000 acres of wheat were harvested in 2009, so for that State, KB problems are pervasive.

Options for KB Control

Wheat breeders in areas with KB recognize the importance of avoiding highly susceptible varieties. This control measure has proven effective for reducing the level of KB to the extent that, even when KB is present, the quality of the harvested grain is not severely affected. However, replacing susceptible varieties with resistant ones does not eradicate the disease, and KB epidemics have recurred in India as soon as susceptible varieties were again grown.

With the exception of repeated tilling, standard preventive practices are of little value in reducing the probability of a KB outbreak. Seed treatments can reduce the number of viable spores on seed, and, therefore, the probability that KB will be introduced to new areas, but will not protect wheat plants from infection if the seed is planted in infested soil. Seed treatments are not effective on the current crop, since KB does not infect seedlings and there is insufficient chemical in the plant at heading to prevent infection, the point at which it occurs. Foliar application of fungicides can reduce the level of disease, but more than one application is usually required, making this an expensive control option. The registration status of foliar fungicides applied after heading may be an issue. Fungicides are likely to be cost effective only if other important diseases, such as rusts or Septoria blotches, are also present and need to be controlled. Fumigation of soil with chemicals, such as methyl bromide, metham-sodium, and formaldehyde, has been partially successful in killing the spores, but some States prohibit the use of selected soil fumigants from that list.

Estimating Decertification Effects on Exports

Responses by Wheat Importers

Not all countries with restrictions against KB would, in practice, strictly prohibit wheat imports from the United States if USDA stopped issuing certificates. Each country has its own regulations, which are often idiosyncratic in how they are worded and enforced.

Under decertification, some markets would be captured by wheat-exporting countries that are free of KB, but U.S. wheat exports to countries that have no restrictions against KB would likely increase. The longrun effects would likely depend on the extent to which world wheat markets treat KB as a quality—rather than a phytosanitary—issue.

There is also a question of what procedures would be used by other countries for KB testing if the United States should stop issuing certificates. Currently, no accurate KB test is rapid enough to use at the U.S. source during ship loading. Even microscopic examination for spores can lead to false positives because of morphological similarities between Karnal bunt (*Tilletia indica)* and other bunts, such as bunt on ryegrass (*Tilletia walker);* ryegrass is a significant weed problem in wheat fields in the Southeastern United States. Currently, most importing countries, even with phytosanitary regulations against KB, accept APHIS's certification that the wheat comes from an area not known to have KB and do not routinely test for KB spores or check for bunted kernels.

Decertification Impacts on U.S. Exports

In this analysis, the list of countries requiring KB certificates for U.S. wheat exports was used to determine the effects of a decertification scenario. We assumed that the countries now importing U.S. wheat without certificates would continue to do so, as the issue appears to be unimportant to them.

U.S. exports by destination are not detailed in the baseline projections, but total exports are. Broadly, the export destinations for U.S. wheat over the next decade are not expected to differ greatly from those in recent years, although in any given year, export destinations will vary. Therefore, we use the 2004/05-2008/09 5-year average of U.S. wheat exports by destination as a benchmark for the next decade.

Based on the 5-year average, 38.6 percent of U.S. wheat exports went to countries demanding a KB certificate. Thus, over 60 percent of U.S. exports are to destinations that do not ask for certification. However, the nearly 40 percent of export destinations that do demand certification are crucial to the marketing of U.S. wheat, absorbing 25 percent of the U.S. wheat crop. Reallocating such a large portion of production to domestic livestock feeding, increased stockholding, or alternative export destinations is bound to entail a significant loss in revenue to producers.

The revenue losses associated with the redirection of U.S. exports is compounded by the abundant global supplies of wheat projected through the next decade in the USDA baseline. The declining U.S. share of the world wheat trade over the last two decades, from over 30 percent in 1989/90 to the 18 percent projected for 2009/10, means that importing countries have ample alternative sources for wheat purchases. Few importers are constrained to buy U.S. wheat. This situation is very different from that faced by a world market such as corn, where the U.S. share is about 60 percent.

In the first year of the decertification scenario, all countries requiring a KB Certificate are expected to experience a disruption of wheat trade with the United States, requiring the reallocation of 38.6 percent of U.S. wheat exports. However, in subsequent years, some of the countries that currently demand certificates are expected to reach alternative arrangements that permit the resumption of wheat imports from the United States. Economic Research Service researchers expect that countries accounting for 12 percent of U.S. exports might make such accommodations. The accommodations might include: (1) buying a class of U.S. wheat, such as hard red spring, not grown in regions known to have KB; (2) accepting a private-company certification from outside of a KB region; or (3) simple nonenforcement of import requirements. However, these accommodations would leave 26.6 percent of historical U.S. wheat export destinations that would not buy U.S. wheat (table 1).

Predicting which countries would accept wheat without certification and which would not is not possible. However, given the estimate of 38.6 percent of the export volume to countries now asking for certificates, finding another way to gain acceptance of U.S. wheat, such as offering private certification or testing, seems reasonable. Positing that some countries that currently require certificates will become open to noncertified U.S. wheat assumes that efforts to change foreign countries' KB policies, by U.S. wheat-exporting trade associations and the U.S. Government, could be more successful after decertification than they have been in recent years.

Domestic Economic Impacts of Decertification

The economic impacts of the U.S. loss in wheat export markets due to decertification were analyzed by using the Food and Agricultural Policy Simulator (FAPSIM). FAPSIM is an econometric model of the U.S. agricultural sector that includes submodels for the major livestock and crop commodities, including wheat. The model also has submodels to compute aggregate indicators for the sector, such as farm income and the value of exports.[2]

Wheat export losses associated with ending KB certificates, described above, were introduced into FAPSIM as exogenous shifts in the wheat export demand function (fig. 1). All of the domestic impacts associated with these export changes are compared with the USDA baseline projections.[3] The model estimates indicate that:

- The loss in foreign demand for U.S. wheat leads to a decline in the farm price of wheat. Wheat prices decrease from $5.50 to $5.04 per bushel in the 2011 marketing year, the initial year that exports decline (table 3). This is equivalent to an 8.3-percent decline in farm price from

[2]Salathe, Larry E., Michael J. Price, and Kenneth E. Gadson, "The Food and Agricultural Policy Simulator," *Agricultural Economics Research* 34(2):1-15, April 1982.

[3]U.S. Department of Agriculture, Office of the Chief Economist, World Agricultural Outlook Board, "USDA Agricultural Projections to 2018," *Long-term Projections Report OCE-2009-1*, February 2009.

Table 1

U.S wheat exports by country of destination based on 2004/05-2008/09 average[1]

Countries requiring Karnal bunt certificates	Share of total exports	Countries potentially discontinuing Karnal bunt certificate requirements	Share of total exports
	Percent		*Percent*
Mexico	9.12883		
Egypt	6.84947		
South Korea	4.47423	South Korea	4.47423
Colombia	2.68212	Colombia	2.68212
China (Mainland)	1.77109	China (Mainland)	1.77109
Italy	1.70304		
Peru	1.54378		
Algeria	1.18889		
Ethiopia	1.06380		
Morocco	1.01334		
Republic of South Africa	0.99705		
Brazil	0.99038	Brazil	0.99038
Spain	0.98874		
Chile	0.96621	Chile	0.96621
Pakistan	0.61941		
El Salvador	0.57990	El Salvador	0.57990
Ecuador	0.42065	Ecuador	0.42065
Belgium	0.36243		
Portugal	0.24225		
United Kingdom	0.22170		
Tunisia	0.16916		
Kenya	0.15299		
Turkey	0.07449		
Canada	0.06603		
Netherlands	0.05930		
Georgia	0.05633		
Madagascar (Malagasy)	0.04903		
Tanzania	0.04225	Tanzania	0.04225
Bolivia	0.03361	Bolivia	0.03361
Ireland	0.01613		
Cyprus	0.01133		
France	0.00954		
Sweden	0.00772		
Zimbabwe	0.00504		
Finland	0.00262		
Somalia	0.00144		
Greece	0.00123		
Germany	0.00075		
Ukraine	0.00023		
Austria	0.00002		
Total	38.566533	Total	11.96043

[1]Average total U.S. wheat exports over the 2004/05-2008/09 period were 27,800,651.
Source: U.S. Department of Commerce and USDA, Economic Research Service.

Table2

Wheat: Area and Supply

Item	Marketing year 2011	2012	2013	2014	2015	2016	2017	2018	2011-18 average
	Million acres								
Area planted:									
Scenario	61.1	57.2	57.2	57.1	56.6	56.6	56.6	56.6	
Baseline	61.0	60.5	60.0	60.0	59.5	59.5	59.5	59.5	
Difference	0.1	-3.3	-2.8	-2.9	-2.9	-2.9	-2.9	-2.9	-2.6
Percentage difference	0.1	-5.4	-4.7	-4.8	-4.9	-4.9	-4.9	-4.9	-4.3
Area harvested:									
Scenario	51.9	48.6	48.6	48.5	48.1	48.1	48.1	48.1	
Baseline	51.9	51.4	51.0	51.0	50.6	50.6	50.6	50.6	
Difference	0.0	-2.8	-2.4	-2.5	-2.5	-2.5	-2.5	-2.5	-2.2
Percentage difference	0.1	-5.5	-4.8	-4.8	-5.0	-5.0	-5.0	-5.0	-4.4
	Bushels per acre								
Yield per harvested acre:									
Scenario	43.6	43.9	44.2	44.5	44.8	45.1	45.4	45.7	
Baseline	43.6	43.9	44.2	44.5	44.8	45.1	45.4	45.7	
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percentage difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Million bushels								
Total stocks, June 1:									
Scenario	620	796	784	782	778	759	750	747	
Baseline	620	640	647	645	640	621	613	611	
Difference	0	156	137	137	138	138	137	136	122
Percentage difference	0.0	24.4	21.2	21.2	21.6	22.3	22.4	22.3	19.4
Production:									
Scenario	2,267	2,130	2,147	2,160	2,152	2,165	2,180	2,194	
Baseline	2,265	2,255	2,255	2,270	2,265	2,280	2,295	2,310	
Difference	2	-125	-108	-110	-113	-115	-115	-116	-100
Percentage difference	0.1	-5.5	-4.8	-4.9	-5.0	-5.0	-5.0	-5.0	-4.4
Imports:									
Scenario	105	110	110	115	115	120	120	125	
Baseline	105	110	110	115	115	120	120	125	
Difference	0	0	0	0	0	0	0	0	0
Percentage difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total supply:									
Scenario	2,992	3,036	3,041	3,056	3,046	3,045	3,050	3,066	
Baseline	2,990	3,005	3,012	3,030	3,020	3,021	3,028	3,046	
Difference	2	31	29	26	26	24	22	20	23
Percentage difference	0.1	1.0	1.0	0.9	0.9	0.8	0.7	0.7	0.7

Source: USDA, Economic Research Service.

Table 3

Wheat: Use and price

Item	Marketing year 2011	2012	2013	2014	2015	2016	2017	2018	2011-18 average
	Million acres								
Feed and residual use:									
Scenario	344	287	285	276	275	276	276	276	
Baseline	235	235	235	225	225	225	225	225	
Difference	109	52	50	51	50	51	51	51	58
Percentage difference	46.2	21.9	21.2	22.7	22.4	22.5	22.5	22.6	25.3
Food use:									
Scenario	986	995	1,004	1,013	1,022	1,031	1,040	1,048	
Baseline	983	992	1,001	1,010	1,019	1,028	1,037	1,046	
Difference	3	3	3	3	3	3	3	2	3
Percentage difference	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.3
Seed use:									
Scenario	78	77	77	76	76	76	76	76	
Baseline	82	81	81	80	80	80	80	80	
Difference	-4	-4	-4	-4	-4	-4	-4	-4	-4
Percentage difference	-5.1	-4.4	-4.5	-4.6	-4.7	-4.7	-4.7	-4.7	-4.7
Total domestic use:									
Scenario	1,408	1,359	1,366	1,365	1,373	1,383	1,391	1,401	
Baseline	1,300	1,308	1,317	1,315	1,324	1,333	1,342	1,351	
Difference	108	51	49	50	49	50	49	50	57
Percentage difference	8.3	3.9	3.7	3.8	3.7	3.7	3.7	3.7	4.3
Exports:									
Scenario	788	894	893	913	913	912	911	910	
Baseline	1,050	1,050	1,050	1,075	1,075	1,075	1,075	1,075	
Difference	-262	-156	-157	-162	-162	-163	-164	-165	-174
Percentage difference	-24.9	-14.9	-14.9	-15.1	-15.1	-15.2	-15.2	-15.3	-16.3
Total use:									
Scenario	2,196	2,252	2,259	2,278	2,286	2,295	2,303	2,311	
Baseline	2,350	2,358	2,367	2,390	2,399	2,408	2,417	2,426	
Difference	-154	-106	-108	-112	-113	-113	-114	-115	-117
Percentage difference	-6.6	-4.5	-4.6	-4.7	-4.7	-4.7	-4.7	-4.7	-4.9
Total stocks, May 31:									
Scenario	796	784	782	778	759	750	747	755	
Baseline	640	647	645	640	621	613	611	620	
Difference	156	137	137	138	138	137	136	135	139
Percentage difference	24.4	21.2	21.2	21.6	22.3	22.4	22.3	21.8	22.1
	Dollars per bushel								
Average farm price:									
Scenario	5.04	4.95	4.90	4.99	5.04	5.05	5.05	5.05	
Baseline	5.50	5.35	5.30	5.40	5.45	5.45	5.45	5.45	
Difference	-0.46	-0.40	-0.40	-0.41	-0.41	-0.40	-0.40	-0.40	-0.41
Percentage difference	-8.3	-7.5	-7.6	-7.5	-7.5	-7.4	-7.4	-7.3	-7.6

Source: USDA, Economic Research Service.

the baseline level. In subsequent years, the price impacts are smaller, for two reasons. First, we assume that the export shocks are relatively smaller. Second, producers are able to reduce production in response to new market conditions for wheat. As a result, wheat prices decline below baseline levels by approximately 7.5 percent, on average, over the 2012-18 period.

- Although demand for U.S. wheat exports is shocked with a 38.6-percent decline in the initial year covered in the analysis, the actual decline in U.S. exports is much less. In response to lower wheat prices, importers who do not ban U.S. wheat will increase their demand. As a consequence, the United States will be able to make up a portion of the export loss associated with countries that ban U.S. wheat by expanding exports to the countries that do not impose the ban. In the 2011 marketing year, U.S. wheat exports decline by 24.9 percent below baseline levels under this scenario (table 3). Similarly, in subsequent years covered in the analysis, U.S. wheat exports are shocked with a 26.6-percent decline, whereas actual exports under the scenario decline on average by 15.1 percent below baseline levels over the over the 2012-18 period.

- Lower farm prices for wheat under our scenario lead to lower net returns for wheat producers, which lead, in turn, to reduced wheat production. Over the 2012-18 period, area planted to wheat declines by an average 2.9 million acres below the baseline (table 2). This decline corresponds to a 4.9-percent decline in area planted, which is accompanied by a similar decline in production. In addition, with reduced wheat area, area planted to other crops increases, reducing their prices enough to contribute to lowering U.S. farm income.

- With lower wheat prices, feed use of wheat increases under the decertification scenario by 46.2 percent above the baseline in marketing year 2011, or by 109 million bushels (table 3). Over the 2012-18 period, the impacts on wheat feeding are smaller due to smaller export shocks and reduced production. Feed use increases by approximately 22.3 percent, on average, above baseline levels over this period.[4]

- Most of the remaining adjustments in the wheat sector from decertification are to stocks. As prices decline, the opportunity costs of holding inventories decline and individuals are apt to hold more stocks. Ending stocks increase by 24.4 percent over the baseline in marketing year 2011 and by 21.8 percent, on average, over the 2012-18 period (table 3).

- Due to lower prices and lower production, cash receipts from farm marketings of wheat decline under the scenario. Receipts fall by approximately 12.4 percent from baseline levels, on average, over the 2011-18 period, which corresponds to a $1.4 billion decline in cash receipts below baseline levels in each year covered in the analysis, or an $11.4 billion cumulative decline over the 8-year period (fig. 2).

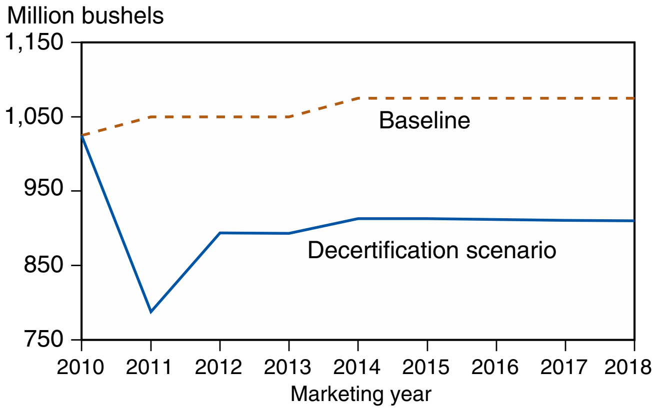
- Farm income for the agricultural sector reflects the decline in cash receipts for wheat. Net farm income for the sector declines by approximately $1 billion below the baseline in each year covered by the analysis (fig. 3). Thus, net farm income declines by less than the decline in cash

[4]Wheat is fed to livestock primarily in the first quarter of the wheat marketing year, and it competes mainly with corn in the feed ration. The national marketing year for wheat is from June through May, whereas the national marketing year for corn is from September to August, which means wheat fed within the current wheat marketing year competes with corn within the previous corn marketing year. Based upon the feeding value of wheat versus that of corn and upon other considerations, we did not allow the wheat price in the current year to fall below 130 percent of the corn price in the previous year during any year covered in the analysis. This constraint was only binding in the initial year covered in the analysis.

wheat receipts because wheat producers incur fewer expenses when they curtail production in response to lower wheat prices. Hence, some of the losses in farm income due to lower receipts are offset by lower farm production expenses. Net farm income declines, on average, by approximately 1.2 percent below baseline levels over the 2011-18 period.

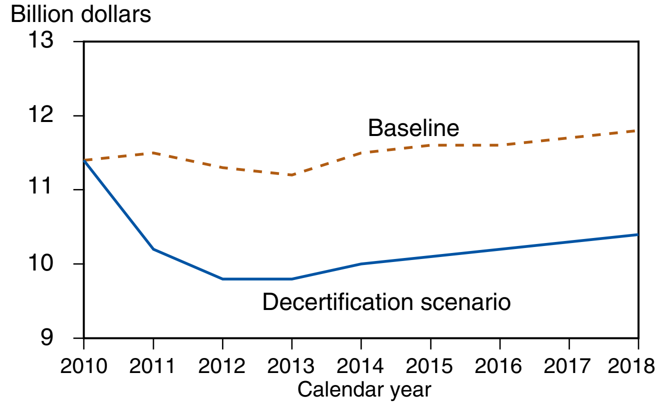
- The wheat export value declines under the decertification scenario with lower export volumes and prices. Total value of agricultural exports declines approximately 1.5 percent, on average, over the 2011-18 period, which corresponds to a $1.6 billion decline per year, or a $12.8 billion cumulative decline over the entire period (fig. 4).

Figure 1
U.S. wheat exports



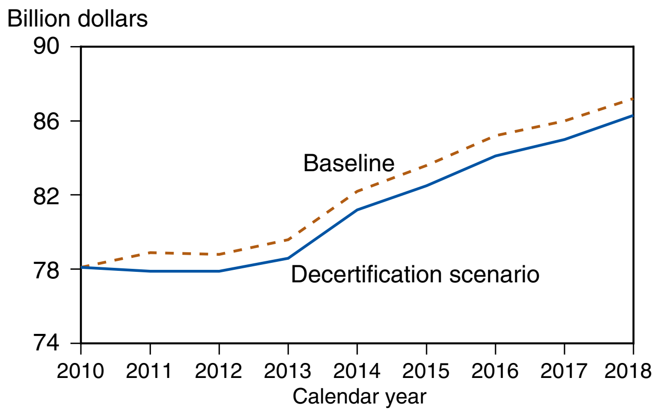
Source: USDA, Economic Research Service.

Figure 2
U.S. wheat cash receipts from farm marketings



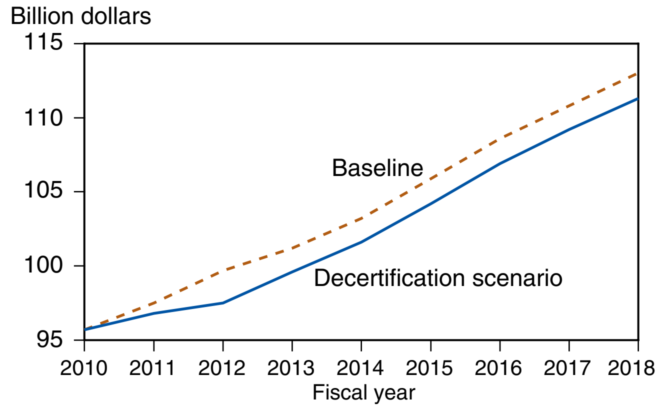
Source: USDA, Economic Research Service.

Figure 3
U.S. net farm income



Source: USDA, Economic Research Service.

Figure 4
Value of U.S. agricultural exports



Source: USDA, Economic Research Service.

Other Concerns Related to Decertification

- If even a few important wheat-importing countries maintain KB prohibitions, shipping companies might have concerns about shipping wheat from a deregulated U.S. wheat sector. Shipowners, 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 KB spores.

- Shipping vessels that carried uncertified wheat to countries without prohibitions would have to be sanitized to ensure that later cargoes to countries that continue to have prohibitions will not be contaminated. Under U.S. decertification, spores could spread through 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.

- Transshipment through the St. Lawrence Seaway would become an issue if the United States deregulates KB. Currently, Canada prohibits the entry of wheat from States with KB. Any wheat that crosses the Canadian border needs a declaration that the grain originated in an area free of KB on the basis of official surveys.

- Finally, the importance of these issues will likely depend on whether KB becomes widespread across the U.S. wheat sector. However, whether, how far, and how rapidly the disease might spread if the quarantine system is eliminated is uncertain.

Conclusions

The results of the model show that loss in foreign demand for U.S. wheat in the decertification scenario leads to a decline in the farm price of wheat. Wheat prices decrease from $5.50 to $5.04 per bushel in the 2011 marketing year, the initial year that exports decline. In the subsequent years of the scenario, the price impacts are smaller for two reasons. First, the export shocks are relatively smaller. Second, producers reduce production in response to the new market conditions for wheat.

The lower farm prices for wheat under the decertification scenario lead to lower net returns for wheat producers, which, in turn, lead to a decline in wheat production. Over the 2012-18 period, the FAPSIM model shows that the area planted to wheat declines by an average of 2.9 million acres below the baseline. With lower wheat prices, feed use of wheat increases under the scenario. Most of the remaining adjustments in the wheat sector are to stocks. As prices decline, the opportunity costs of holding inventories decline and individuals are apt to hold more stocks.

The model results show that because of lower prices and production, cash receipts from farm marketing of wheat decline under the scenario. Net farm income for the agricultural sector declines by approximately $1 billion (or 1.2 percent) below the baseline in each year of the analysis.

Appendix

Chronology of KB-Quarantined Fields or Areas[5]

[5]The APHIS notices for these events can be found at http://www.aphis.usda.gov/plant_health/plant_pest_info/kb/notices.shtml.

March 20, 1996. Declaration of extraordinary emergency because KB found in Arizona, and potentially contaminated seed is sent to New Mexico and Texas.

March 28, 1996. All of Arizona, four counties in New Mexico, and two counties in Texas are quarantined.

April 25, 1996. Portions of California are quarantined because KB is found in seed that was either planted or stored in the State.

July 5, 1996. Certain areas of Arizona, New Mexico, and Texas are removed from quarantine. Amended regulations provide compensation to certain growers and handlers, owners of grain storage facilities, and flour millers to mitigate losses and expenses incurred because of actions taken to prevent the spread of KB.

October 4, 1996. Final rule is published that establishes, among other things, the sub-division of regulated areas into restricted or surveillance areas.

November 24, 1997. Because of KB detections, new areas are added to the regulated list in Texas and boundaries of regulated areas in Arizona are expanded.

April 28, 1999. Amended KB regulations replace the restricted and surveillance categories with a single classification category. This change sharply reduces the area in the southwestern United States regulated for KB. Areas in Arizona are added to the regulated areas because KB is detected.

August 21, 2000. The regulations are amended to remove from regulation any noninfected acreage that is more than 3 miles from a field or area with a bunted wheat kernel. This change reduces the size of regulated areas in Arizona. Also, only harvesting equipment that has been used to harvest a crop testing positive for KB must be cleaned and disinfected.

April 20, 2001. Regulated areas are expanded in southern Arizona because a survey discovered bunted kernels. Some areas in southern Arizona and southwestern New Mexico are deregulated based on the determination that they meet the criteria for release from regulation. One field is deregulated in southern Arizona because it has been converted to residential housing.

June 8, 2001 and July 13, 2001. Two counties are added to regulated areas in northern Texas because KB is detected.

October 3, 2002. Regulated areas are added in southern and southwestern Arizona and northern Texas because KB is detected or because the areas fall within the 3-mile-wide buffer zone around fields or areas affected by KB. Areas and fields are deregulated in southern Arizona and southwest New Mexico based on determination that they meet the criteria for release from regulation. This leaves New Mexico with no regulated areas.

January 5, 2004. Regulated areas are added in southern Arizona because KB is detected or because they fall within the 3-mile-wide buffer zone around fields or areas affected by KB. Certain areas in southwestern California are deregulated based on determination that they meet the criteria for release from regulation.

May 17, 2004. Certain areas in southern and southwest Arizona and in central and northern Texas are deregulated based on determination that they meet the criteria for release from regulation.

March 28, 2005. Regulated areas are added in southern Arizona and southwestern California because KB was detected or because they fall within the 3-mile-wide buffer zone around fields or areas affected by KB. At the same time, other areas in Arizona and California are deregulated based on determination that they meet the criteria for release from regulation.

December 7, 2005. Regulated areas are added in southern Arizona because KB is detected or because they fall within the 3-mile-wide buffer zone around fields or areas affected by KB. At the same time, other areas in southern Arizona are deregulated based on determination that they meet the criteria for release from regulation.

March 9, 2007. Certain areas in southern Arizona and central and northern Texas are deregulated based on determination that they meet the criteria for release from regulation.

April 7, 2008. Certain areas or fields in north central Texas are deregulated based on determination that they meet the criteria for release from regulation.

June 4, 2009. Certain areas or fields in southern California are deregulated based on determination that they meet the criteria for release from regulation.

April 16, 2010. Certain areas or fields in southern Arizona, southern California, and north central Texas are deregulated based on determination that they meet the criteria for release from regulation. Following this action, there are no remaining Karnal bunt quarantine areas in Texas. At the same time, one regulated area in southern Arizona is expanded because Karnal bunt is detected within the 3-mile-wide buffer zone around fields or areas affected by Karnal bunt.