



Karnal Bunt in Texas Wheat

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Historical Information

In the spring of 1996, Karnal bunt (*Tilletia indica* Mitra) was found in a sample of durum wheat seed in Arizona. Subsequent investigation revealed that Karnal bunt had been distributed in durum wheat planting seed, and that it was widespread in Arizona and New Mexico, and found in limited regions in California and Texas. Following this discovery, movement of wheat and wheat equipment was quarantined in the entire state of Arizona, parts of New Mexico and California, and in El Paso and Hudspeth counties of Texas. A national survey was initiated over the next two years, with samples of wheat being submitted from most of the wheat producing regions of the U.S. This survey found an infestation in San Saba County in 1997 in hard red winter wheat, which was the first ever detection in this class of wheat.

Infested fields were quarantined for a period of 5 years, and around each field for a radius of 3 miles, a regulated area was established in which all wheat is examined in the field before delivery to an elevator. In quarantined fields, wheat, durum wheat and triticale may not be planted for a period of 5 years, which is the estimated longevity of bunt spores in soils.

Most of the early survey was conducted by examination of fungal spores from wheat samples by a light microscope. Spores of the Karnal bunt fungus have a size and surface markings which allow lab workers to distinguish them from most other smuts. Unfortunately, a bunt common to ryegrass has many of the same characteristics, which lead to the mistaken conclu-

sion that several states in the southeastern U.S. were positive for Karnal bunt. This led APHIS to go to the standard of finding one or more “bunted” kernels in a 4 pound sample as the definitive test for the disease.

The USDA-APHIS maintains a comprehensive web site on the disease at: <http://www.aphis.usda.gov/karnalbunt/> Refer to this site for more details on the disease including color photographs.

Disease Characteristics

Upon infection, the bunt does not generally affect an entire kernel. Typically, only a portion of a kernel, starting at the embryo end, is blackened or “bunted” and eroded with a mass a mass of black spores with the offensive odor. Although Karnal bunt and common bunt or stinking bunt have a similar “fishy” odor, they differ in that the common bunt typically decays the entire infected kernel. Karnal bunt seldom effects yield and usually effects less than 1 per cent of the kernels in a field while infested kernels have an objectionable “fishy” odor they are not usually detected in finished wheat products until infestation levels reach about 3%, which is an extremely high level for field infestations.

Karnal bunt is relatively weak as far as crop damage compared to wheat diseases common to the Texas crop or to other smuts and bunts that are common in the state. It generally enters a field on infested wheat seed, plant parts, livestock, manure or infested soil carried on agricultural equipment. While spores can move in the wind, they are relatively heavy and are not believed to be carried long distances.



A field is first infested with spores (teliospores) brought in with infested seed, contaminated equipment, etc. These teliospores then lie in the soil until conditions become favorable for germination. During a period of cool, wet weather, the teliospores near the soil surface can germinate and produce a new set of airborne spores called primary sporidia. If this primary sporidia production occurs while the wheat is flowering, the fungus can infest the ovary in the wheat flower. If the wheat is not flowering during primary sporidia release, these sporidia can produce a second set of airborne spores called secondary sporidia, which give the fungus another opportunity to attack the wheat flowers. As the kernel matures it becomes blackened with a mass of teliospores and damaged by concurrent bunting or eroding of the embryo end of the kernel. The black teliospores may be internal, covered by the pericarp, or loose on the surface of the kernels. Due to the short time of wheat bloom and the relatively dry nature of many wheat producing areas of the state, it is quite unusual to have even 1% bunted kernels in any field. The spores on and in infected mature seed, hay, livestock or agricultural equipment are quite capable of spreading the infestation to other fields in which they come in contact.

The major cause for concern relative to this disease, compared to other bunt and smut diseases is marketing. While it poses no danger to the public in food or feed, the U.S. and many wheat buying and producing countries either have quarantines or severe restrictions in place to prevent movement of infected grain into their countries. The mere suspicion of the presence of this disease in a very competitive wheat market is adequate to cancel wheat sales or at minimum significantly reduce wheat price.

Current Situation

In the 2001 infestation, large numbers of positive samples were found in San Saba County. Approximately 42% of all samples tested in that county were determined to be infested. In addition, one positive sample was found in a field on the eastern side of McCulloch County, near the western San Saba County border. A new region of infection was also found, with several positive samples being found in Throckmorton, Archer, Baylor and Young Counties. This new region with several positive samples prompted the USDA-APHIS to declare the entirety of these counties as "Regulated". In addition to quarantining the fields from which positive identification was made, the regulated status will require that all elevators be tested for presence of the disease, all wheat harvested be checked for presence of the disease before hauling to an elevator or out of the county, a prohibition of hauling of wheat or triti-

cale hay from the regulated area, requiring all harvest and tillage equipment to be subjected to steam cleaning prior to movement from the regulated area and other restrictions designed to reduce the possibility of spread of the disease to other locations or into commerce. Wheat that is found to be positive must be heat treated to kill the organism before it can be used. One effective way to treat such wheat is processing in steam flaking equipment. Other options available are listed in the regulatory website cited below.

Best Management Practices

Upon wheat harvest, growers must make plans for the coming crop year. If a field is quarantined and the grower still wants to plant a winter grain and/or forage crop, choices would include oat, barley and cereal rye. If in a regulated area but not a quarantined field, this would leave the options open for wheat and triticale as well as oat, barley and rye. Be especially conscientious about using best management practices in regulated areas. Best management practices to reduce the potential for contamination from Karnal bunt would include:

- † Purchase and plant only high quality, conditioned seed that is inspected or from an area known to be free of the disease.
- † Use an effective seed treatment fungicide at planting.
- † Plant rye, oats or barley rather than wheat or triticale in infested fields or those in question.
- † Prevent infestation by using only equipment known to be free of the disease (includes tillage, planting and harvest equipment). Thorough steam cleaning may be required to prevent the spread of the disease from infested fields.
- † Make certain that animals grazing wheat fields have not previously been in infected fields or been fed with infected wheat or triticale grain or hay.
- † Don't import hay from infected or suspected fields, either your own or from elsewhere.

The USDA-APHIS will be screening wheat seed samples planted in the quarantined areas for the presence of Karnal bunt. APHIS will not screen wheat seed grown outside of the treated areas. Dr. David Marshall's lab at the Texas Agricultural Experiment Station at Dallas will be screening wheat seed grown outside of the quarantined areas for the presence of Karnal bunt. A \$50 fee will be charged for these samples. Samples must be taken by the USDA-APHIS protocol and submitted to TDA officials for transfer.

Detection Efforts and Regulatory Aspects

There is a voluntary national survey ongoing at this time to help discover the magnitude of the infestation. The Texas Department of Agriculture assists the USDA in collecting grain samples from elevators in the National Karnal Bunt Survey and in other regulatory activities.

The Federal Karnal bunt quarantine regulations are given in the 7 Code of Federal Regulations, Part 301.89-1 through 301.89-14 and can be accessed at the following website:

http://www.access.gpo.gov/nara/cfr/waisidx_01/7cfr301_01.html

The Texas Department of Agriculture (TDA) has adopted by reference the above quarantine to regulate intrastate movement of regulated articles listed in the quarantine. A partial list of regulated articles include, wheat grain, seed and straw; equipment and structures used in handling and storing wheat; trucks and railroad cars; and soil. Section 301.89-3 lists regulated areas in the United States and Section 301.89-13 mentions treatments to be used to clean and disinfect all conveyances, harvesting equipment, etc.

Apart from routine surveys, new pests are often detected when concerned farmers, commodity handlers, Extension Agents, or anyone notices something unusual. If you come across wheat that you suspect to be infected with Karnal bunt, or if someone contacts you expressing a similar concern, please acquire a sample of suspect wheat kernels and call TDA at (512) 463-5025 for address to send the sample for analysis. It is recommended that grain from the suspect field, or a storage bin should not be moved until analysis shows the sample to be negative for Karnal bunt. The results of a sample analysis should be available in approximately two days. Please call TDA at the above number if you need any additional information. Your cooperation in early detection of Karnal bunt is greatly appreciated.

The most feasible way to remediate the problem appears to be through voluntary cooperation between farmers, elevator operators, the grain industry and government agencies. Early detection and awareness are vital in preventing the spread of this disease which can have major impacts on the marketing of Texas wheat.

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