

# Karnal Bunt

## Screening for Resistance and Distributing KB Free Seed



Karnal bunt (KB) is a seedborne disease of wheat caused by *Tilletia indica*. The disease is known to occur in parts of India, Pakistan, Iran, Iraq, Mexico and the USA, generally characterized by a semi-arid climate with hot summers and cool winters. The main host of *T. indica* is bread wheat; durum wheat and triticale are less susceptible. Plants are infected within 2-3 weeks of heading. The primary sources of inoculum are seed and teliospores present in soil. Teliospores germinate at or near the soil surface in response to temperature (8-20°C) and moisture (high relative humidity associated with light rain showers and cloudy weather). Teliospores can be carried over long distances by wind, and can pass through the digestive tracts of animals undamaged. However, the main mode of international spread is through infected or contaminated wheat seeds. Typically, the infection is noticed after harvest, and only a few kernels within the spike are affected by KB. Kernels are usually partially infected; hence the disease is also known as partial bunt.

Chemical seed treatments that reduce teliospore germination of *T. indica* appear to be limited in how long they remain effective, and, with the possible exception of the mercurial compounds, none is capable of killing teliospores when applied to infected seed. Chlorothalonil and carboxin + thiram have been used as seed treatments in the USA and Mexico. Foliar spraying with propiconazole, triadimefon and carbendazim can control the incidence of *T. indica* on wheat.

Karnal bunt is regarded as a disease of moderate economic importance everywhere it occurs; in Mexico direct losses do not exceed 1%. However, indirect costs to the economy are more significant due to quarantine measures that must be applied to grain exports, since the pathogen is quarantined in more than 40 countries.



**Karnal bunt-infected wheat kernels (top), and *T. indica* teliospores (bottom)**

### CIMMYT's Stringent Seed Health Procedures for KB Zero Tolerance and Safe Movement of Wheat Germplasm

Due to KB's quarantine importance, CIMMYT is compelled to assign considerable resources to applying a zero tolerance policy against this disease. CIMMYT seed testing policies control and ensure the implementation of the international and national phytosanitary regulations on KB on the seed that is distributed every year. CIMMYT Seed Health Laboratory has operated since 1998 under the approval of the Mexico's Ministry of Agriculture (SAGARPA) (*Norma Oficial Mexicana* 036-FITO-1995), and since April 2007 with ISO accreditation under standard ISO/IEC NMX-EC-17025-IMNC-2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. These essential legal recognitions guarantee that CIMMYT seed exchange activities do not jeopardize Mexican agriculture, and that CIMMYT standard procedures are internationally recognized and constantly controlled through internal and external audit processes.



**Before distribution the seed undergoes a filter test for the presence of *T. indica***

All seed increase for international nurseries is carried out during winter at a KB free location in Mexicali (north-west Mexico), where dry air conditions prevail during the wheat growing season. The crop is also protected by several fungicide applications to avoid any potential disease. Seed from Mexicali is transported under special conditions to CIMMYT's headquarters at El Batán, where it is tested, washed and treated. This seed is handled separately from any other seed.

### Research into Resistance to KB

Durum wheat is much more resistant to Karnal Bunt than bread wheat, which explains the large area sown to durum wheat in the Yaqui Valley, where CIMMYT's Obregón research station is located. CIMMYT started a breeding program for KB resistance in the early 1980s to obtain more resistant cultivars of bread wheat. Collaboration with and expertise from Mexican and Indian scientists proved to be very productive in this effort.

CIMMYT's screening system in Obregón is effective: two planting dates are used; up to 10 tillers are artificially inoculated at booting stage (1 ml per tiller of a 10,000 sporidia/ml suspension); and plots are equipped with a misting system to ensure sufficient moisture around flowering. At maturity spikes are graded for percentage of infection.

In Mexico, a few bread wheat lines showed good to moderate resistance in the early years, such as Aldan/IAS58 from Brazil, Shanghai-7 from China, and Roek//Maya/Nac, Star, Vee#7/Bow, and Weaver from CIMMYT. Some synthetic hexaploids also showed very low levels of infection and were crossed to elite bread wheats. Today the best bread wheat and durum wheat cultivars available are:

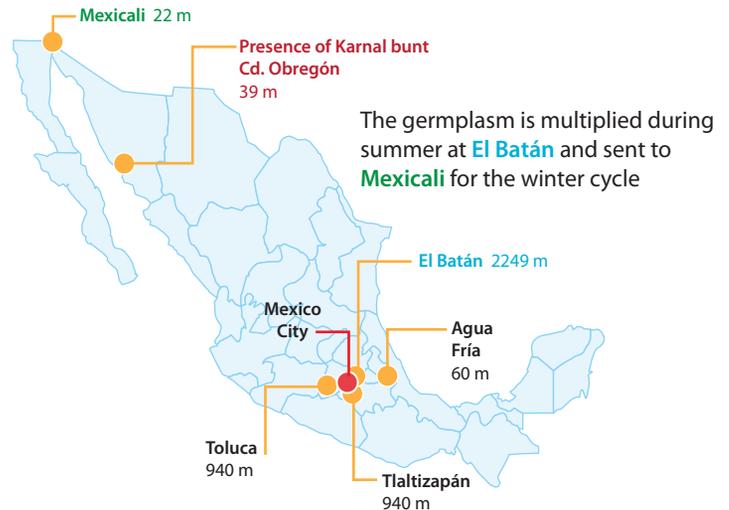
**Bread wheat:** Arivechi M92, HD 29, HD 30, Navojoa M2007, INIFAP M97;

**Durum wheat:** Altar C84, Jupare C2001, Aconchi C89, Atil C2000, Banamichi C2004.

The search for resistance continues; every year CIMMYT breeders submit advanced lines for KB screening at Obregón. CIMMYT also has a long-standing collaboration with US wheat breeders, who send a series of lines for testing every year as part of an agreement with USDA. Between 1984 and 2001 CIMMYT distributed the Karnal bunt screening nursery (KBSN) to numerous collaborators, to test and make available lines with a degree of KB resistance in breeding programs in disease prone areas. The nursery, like certain other wheat disease nurseries, is no longer systematically distributed. However, KB resistant materials can be sent upon request.

### Karnal bunt certification starts with the production of the seed in an internationally recognized Karnal bunt free area, Mexicali

Seed is multiplied in winter in Mexicali, harvested in June and transported under controlled conditions to El Batán, where it is tested, washed, treated and packed



The seed is disinfected with a water solution of chlorine at 1.2% for 3 minutes



The seed is treated with a slurry formulation of carboxin (3g/kg of seed) and chlorothalonil (2g/kg of seed)

#### For further information:

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March 2009