



# Research Kernels

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## Updating soil surface conditions during wind erosion events using the Wind Erosion Prediction System

During significant wind erosion events the soil surface is continually modified, however, erosion models rarely account for these changes. In this work we provide an overview of the Wind Erosion Prediction System (WEPS) model equations used to update the soil surface during simulated erosion. The objectives are to show that by periodic surface updating during events one can a) improve erosion prediction accuracy and b) determine changes in erosion control by clods, crusts, and soil roughness, so model users can improve their designs. During events, the soil surface can become armored with clods. This represents a supply-limited condition and is typical of the upwind portions of a field. Conversely, when additional mobile soil is created or uncovered faster than it is removed, the surface becomes more erodible as often occurs on the downwind portions of large fields. During an event, random roughness, ridge roughness, and the fraction of mobile aggregate cover are also updated. In contrast to models that limit erosion only by storm duration, surface updating increased WEPS accuracy both by identifying field areas that limited supply of mobile aggregates and by changing wind speeds where erosion can begin to allow simulation of intermittent erosion.

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## Survival and reproduction of *Rhyzopertha dominica* on flora associated with native habitats in Kansas

This paper reports results of experiments to determine the survival of a major stored grain pest, the lesser grain borer, on alternative foods found in prairie landscapes. This pest insect has a relatively broad host range and is often trapped at locations far from grain storage and at times of year when stored grain is not as readily available, which suggests that they may be exploiting other food resources to persist. We examined the ability of lesser grain borer to feed and survive on wood and seeds of trees, and seeds of grasses, forbs, and shrubs, that are commonly found growing on Kansan prairie landscapes. We found adult survival was generally poor on the tested whole grass and forb seeds, and that, although beetles readily tunneled, survival was generally poor on twigs from a wide range of tree species. In contrast, survival and reproduction on damaged acorns of several species of oak was high, although they were unable to feed on whole acorns. From a field site where lesser grain borer had been captured, we found that the majority of the acorns on the ground were damaged, and some adult lesser grain borer were recovered from acorns collected off the ground. The use of alternative food sources may be important in enabling populations to persist in landscapes and thus contribute to the colonization of new harvested wheat.

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## Impact of mashing on sorghum proteins and its relationship to ethanol fermentation

Sorghum proteins are known to cross-link strongly when wet cooked, such as occurs during ethanol production. This cross-linking may influence ethanol yields and fermentation time by reducing access by enzymes to the starch. Thus the objectives of this research were to investigate the changes that occur to sorghum proteins during mashing and how this impacts the fermentation process. Protein solubility experiments and analysis of proteins by chromatography showed that sorghum proteins formed highly cross-linked weblike structures during mashing. The degree of protein cross-linking was different among varieties. More fluffy microstructures were observed in varieties with higher conversion efficiencies. Web-like protein matrix held not only starch granules but also some oligosaccharides or polysaccharides inside. The formation of web-like microstructures due to cross-linking reduced conversion efficiency.

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## The first genome sequence of a beetle, *Tribolium castaneum*, a model for insect development and pest biology

The red flour beetle is a major stored-product pest and a genetic model for beetles. The entire genome was sequenced, and this article presents a discussion of the findings of research groups around the world working on various aspects of the genome. Genes that target basic life processes, such those controlling developmental patterns and chemical sensing, provide interesting insights into the success of this pest in its environment. This information also is providing new leads on genes that may be targeted for new insect control products for beetles.

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## Genetic diversity in conventional and synthetic wheats with drought and salinity tolerance based on AFLP

Genetic diversity is an important foundation for breeding cultivars with desired traits. A total of 14 drought and 27 salinity tolerant conventional and synthetic wheat accessions were assessed using amplified fragment length polymorphism (AFLP) markers. A total of 918 AFLP markers were evaluated and more than 300 markers were polymorphic across all 41 wheat accessions. Cluster and principal component analysis showed that both drought and salinity tolerant accessions have different genetic makeup within each group. These accessions possess a substantial amount of genetic diversity within each group and would be very valuable materials to be used in breeding wheat for drought and salinity tolerance.

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## Estimated particulate emissions by wind erosion from the Indiana Harbor Confined Disposal Facility

A Confined Disposal Facility (CDF) is being designed for contaminated sediments dredged from the Indiana Harbor Canal at East Chicago, IN. The sediment will be placed in two storage cells enclosed by earthen berms about 30 feet tall and cover about 88 acres. New sediment will be added to each cell in alternate years for several decades before the site is closed and capped. Using small sediment bins, we determined sediment wind erodibility in response to weather over a 22-month period. We then used the Wind Erosion Prediction System simulation model to predict both potential dust emissions and needed control measures at the CDF to keep emissions below those allowed by the facility operating permit.

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## Use of near-isogenic wheat lines to determine the glutenin composition and functionality requirements for flour tortillas

The tortilla industry is one of the fastest growing segments of the U.S. baking industry with annual sales surpassing \$6 billion. Flour used in tortilla production has been typically optimized for bread making and thus the flour properties that determine good quality bread do not necessarily provide good quality tortillas. Wheat lines in which one or more of the high molecular weight glutenin subunit proteins were absent were used to make tortillas. The tortillas missing certain proteins had different quality in several parameters such as diameter, shelf stability and overall quality. The results indicated better tortillas with a longer shelf-life were obtained with higher protein content flours containing HMW-GS 5+10. This data will allow wheat breeders to target the characteristics for development of tortilla or multi-use wheat lines and decrease the addition of additives to adjust flour quality in the tortilla industry.

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