GRAIN MARKETING AND PRODUCTION RESEARCH CENTER
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The Grain Marketing and Production Research Center welcomes Dr. Thomas Herald as the new Research Leader for the Grain Quality and Structure Research Unit. Dr. Herald joins us from Kansas State University, where he served as a professor in the Food Science Institute. Dr. Herald was raised in Michigan. He earned his B.S. degree in Food Science from Michigan State University, East Lansing, in 1980. He served as a Peace Corps volunteer from 1980–83 in Swaziland, Southern Africa. Dr. Herald completed his M.S. and Ph.D. degrees in Food Science at Michigan State University in the area of food chemistry. Dr. Herald worked in the food industrial sector with Yoplait USA and Kellogg's. He recently completed a 16+ year career at Kansas State University holding the rank of professor. Dr. Herald's research focus was on the chemical and physical properties of food and food ingredients. He has 63 peer-reviewed publications and numerous invited presentations at national and international meetings. As Research Leader for the Grain Quality and Structure Research Unit, Dr. Herald will integrate his technical background into the identification and utilization of wheat cultivars and sorghum hybrids for use in value-added systems that will include both food and non-food applications.

Environmental events affecting starch size distribution in developing hard red winter wheat caryopsis.

J. D. Wilson and R. C. Kaufman.

Starch constitutes the greatest weight portion of the wheat endosperm (65–75%) and contributes its own unique functional qualities such as texture, volume, consistency, aesthetics, moisture, and shelf stability to various baked products. Starch particle size has long been recognized as an important variable in the efficiency of a range of processes including predicting rheology and flow behavior. Although genetics is the dominant determinant in caryopsis development, the environment also has a critical role in quality variability. The objective of this work is to study starch size distribution in identical varieties of developing hard red winter wheat grown in the same location over seven consecutive years and correlate differences to various environmental factors. The samples were collected from the Kansas State University Agronomy field plots in Manhattan, KS. Heads were tagged as to flowering dates and samples were collected starting at 7 days-after-flowering (DAF) and regularly sampled until harvest. Starch was isolated, then freeze-dried and starch size distribution was analyzed on a laser diffraction particle-size analyzer. Trends were observed within cultivars between starch size distribution and temperature as well as total precipitation in 10, 17, and 28 DAF and just prior to harvest. These trends included total volume fluctuations and shifts in peak diameters of 10–20% of the A-type granules. Studying starch size distribution during development of the wheat caryopsis may provide needed insight into critical environmental growth phases.

Progress on development and application of single kernel NIR sorting technology for assessment of FHB resistance in wheat germ plasm.

K.H.S. Peiris, M.O. Pumphrey, Y. Dong, S. Wegulo, W. Berzonsky, P.S. Baenziger, and F.E. Dowell.

Plant breeders working on developing *Fusarium*-resistant wheat cultivars need to evaluate kernels coming from a multitude of crosses for *Fusarium*-damaged kernels (FDKs). We are developing near-infrared (NIR) spectroscopic methods to sort FDKs from sound kernels and to determine DON levels of FDKs nondestructively to facilitate rapid varietal screening for *Fusarium* resistance by assessing proportions of sound and FDKs and estimating their DON levels. We report the progress and research highlights of the development and use of our single-kernel NIR (SKNIR) scab sorting and deoxynivalenol (DON) estimation techniques since January, 2008.

We have improved the SKNIR scab sorting technique and its feasibility as an objective, rapid, and nondestructive method for assessment of FDKs of wheat germ plasm demonstrated. Depending on the kernel DON level, FDKs can be sorted into 2–3 fractions, making it possible to get an understanding of what fraction and how much each fraction contributes to the final DON level of a composite sample. Moreover, our studies with sorting of North Dakota State University (NDSU) germ plasm showed that proportions of SKNIR sorted FDKs in wheat lines affected by FHB correlated fairly well with field FHB assessment indices. Therefore, this technique can be used by wheat breeders as a nondestructive, rapid, and objective method for comprehensive analysis of FDKs when wheat germ plasm are screened for *Fusarium* resistance. Since April 2008, we have sorted 108 samples for NDSU and 405 samples for University of Nebraska, Lincoln (UNL), wheat breeders. Another set of samples from the above two institutions will be sorted in November–December, 2008.

A calibration was developed for estimation of DON concentration in single wheat kernels by the SKNIR system, which can estimate DON levels in single kernels having more than 60 ppm DON. Experiments will be carried out in collaboration of UNL researchers to further test and refine this calibration to estimate DON levels of FHB-affected wheat samples. NIR spectra of pure DON also were studied, and DON absorption peaks identified. A SKNIR wheat moisture calibration also was developed that will be integrated to determine moisture content of kernels concurrently when DON levels are estimated so that it is possible to compare DON levels of kernels having different moisture contents or to express DON content of kernels with specific moisture content.

Automated single-kernel sorting to enhance end-use quality in wheat breeding lines.

F.E. Dowell, E.B. Maghirang, and P.S. Baenziger.

An automated, single-kernel, near-infrared system was used to select kernels to enhance the end-use quality of hard red wheat breeder samples. Twenty breeding populations and advanced lines were sorted for hardness index, protein content, and kernel color. To determine if the phenotypic sorting was based upon genetic or environmental differences, the progeny of the unsorted control and sorted samples were planted at two locations two years later to determine if differences in the sorted samples were transmitted to the progeny (e.g., based on genetic differences). The average hardness index of the harvested wheat samples for segregating populations improved significantly by seven hardness units. For the advanced lines, hardness index was not affected by sorting indicating little genetic variation within these lines. When sorting by protein content, a significant increase from 12.1% to 12.6% was observed at one location. Purity of the red samples was improved from about 78% (unsorted control) to about 92% (sorted samples), whereas the purity of the white samples improved from 22% (control) to about 62% (sorted samples). Similar positive results were found for sorting red and blue kernel samples. Sorting for kernel hardness, color, and protein content is effective and based upon genetic variation.

Modified omega gliadins as chain terminators in Pegaso near-isogenic lines.

R. Jonnala, S. R. Bean, D. Lafiandra, and F. MacRitchie.

Unextractable polymeric protein (UPP) is a parameter that gives a relative measure of the molecular weight distribution (MWD) of the polymeric protein, based on solubility. For any glutenin subunit to participate in a growing polymer, it has to have at least two cysteine residues. Modified (mutated) gliadins of LMW-GS having an odd number of cysteines or LMW compounds having one thiol group can act as chain terminators and this should shift the MWD towards lower values that in turn would be reflected in lower UPP values. Thus, a higher number of omega-gliadins cross-linked to glutenins should correlate with UPP. Twenty-four NILs in the background of Pegaso bread wheat with variation at the *Glu-1*, *Gli-1*/*Glu-3*, and *Gli-2* loci were used for investigation. The goal of the study was to seek evidence for the role of chain terminators in decreasing UPP values and to examine the influence of chain terminators on the MWD of gluten proteins. A novel method was developed to extract the omega-gliadins. Capillary electrophoresis (CE) and SEC-MALLS were used to quantify the omega-gliadins and to estimate the MWD, respectively. The moderately high negative correlation (R squared = 0.65) between reduced (SDS-RA) polymeric protein and modified omega-gliadins in CE suggests that these omega-gliadins act as chain terminators, resulting in smaller polymers, thus causing a reduction of UPP values. Results from SEC-MALLS indicated the significant differences among Pegaso NILs for MWD of the SDS-insoluble fraction.

Wheat starch size distribution and its impact on quality

J.D. Wilson and S.H. Park.

Starch constitutes the greatest weight portion of the wheat endosperm (65–75%) and contributes its own unique functional qualities such as texture, volume, consistency, aesthetics, moisture, and shelf stability to various baked products. Wheat gluten proteins have received the greatest amount of attention due to their unique properties of extension and elasticity, which gives them their unique dough forming properties and are what allows wheat to be such a unique and versatile raw material for so many food products. Cereal starches have been well studied in dilute aqueous systems, but the functionality of starch in concentrated water-limiting systems such as that in dough and breads is far from understood. Particle size and shape have long been recognized as important variables in the efficiency of a range of processes including predicting rheology and flow behavior. A feature of the endosperm of mature Triticeae is the multimodal starch granule size population. The larger-sized granules are called the A-type granules, are thought to form soon after anthesis, and may continue to grow throughout grain filling. The intermediate sized (B-type) and the smallest (C-type) granules are thought to be initiated a number of days after anthesis, depending on cultivar, growing location, and isolation method, and both classes of granules remain smaller than A-type granules. Different size starch granules have different physical, chemical, and functional properties. However, limited research has been conducted to find relationships of starch granules size distribution to final product quality. The objectives of this work were to investigate and correlate starch size distribution to flour, dough mixing, and bread-making properties of hard red winter, hard red spring, and spelt wheat.

A modified extensigraph test method feveloped for wheat breeding lines and vommercial wheat.

Y. R. Chen, B. W. Seabourn, and F. Xie

Dough rheological characteristics, resistance to extension and extensibility, are very important wheat flour quality traits for the milling and baking industries and for new wheat varietal selection in wheat-breeding programs. Current available techniques or test methods, such as the AACCI Extensigraph standard method or the small-scale TA-XT2 Kieffer method, have some limitations with respect to flour sample size, testing time, water absorption, sample throughput, data interpretation, and results. A modified extensigraph test method utilizing 100-g flour and 2-g salt and adapting 50-g Farinograph optimum water absorption for dough prepared in a 100-g mixer with an orbital speed of 86 rpm was developed to measure dough rheological characteristics. The dough is mixed until fully developed. Mix time was much shorter and dough preparation much easier in the 100-g mixer than that in the 300-g Farinograph. Data generated by the modified method is highly correlated with data obtained by the standard extensigraph method (AACC method 54-10). The correlation coefficients (r) for 93 pairs of each of six extensigraph dough characteristics of 31 different tested wheat samples, grown in Texas, Oklahoma, Kansas, Colorado, Nebraska, South Dakota, and Montana were 0.95 for resistance to extension, 0.93 for maximum resistance to extension, 0.80 for extensibility, 0.93 for ratio of resistance to extension to extensibility, 0.92 for ratio of maximum resistance to extension to extensibility, and 0.81 for the area under the curve. There also were significant correlation coefficients for the data of extensigraph dough characteristics evaluated at each of three tests (30, 60, and 90 min) between the modified and standard methods. Therefore, the modified extensigraph test method is a useful and valuable alternative for wheat-breeding programs, milling and baking industries, crop quality surveys, and wheat quality research due to its smaller flour sample requirement and the reduced time required for dough preparation.

Selecting and sorting waxy wheat kernels using near-infrared spectroscopy.

F.E. Dowell, E.B. Maghirang, R.A. Graybosch, W.A. Berzonsky, and S.R. Delwiche.

An automated, single kernel, near-infrared (NIR) sorting system was used to separate single wheat kernels with amylose-free (waxy) starch from reduced-amylose (partial waxy) or wild-type wheat kernels. Waxy kernels of hexaploid wheat are null for the granule-bound starch synthase alleles at all three *Wx* gene loci; whereas, partial-waxy kernels have at least one null and one functional allele. Wild-type kernels have three functional alleles. Our results demonstrate that automated single-kernel NIR technology can be used to select waxy kernels from segregating breeding lines or to purify advance breeding lines for the low-amylose kernel trait. Calibrations based on either amylose content or the waxy trait performed similarly. Also, a calibration developed using the amylose content of waxy, partial waxy, and wild-type

durum wheat enabled adequate sorting for hard red winter and hard red spring wheat with no modifications. Regression coefficients indicated that absorption by starch in the NIR region contributed to classification models. Single-kernel NIR technology offers significant benefits to breeding programs developing wheat with amylose-free starches.

Comparison of waxy vs. nonwaxy wheats in fuel ethanol fermentation.

R. Zhao, X. Wu, B.W. Seabourn, S. Bean, L. Guan, Y. Shi, J.D. Wilson, R. Madl, and D. Wang.

Fermentation performance of eight waxy, seven nonwaxy soft, and 15 nonwaxy hard wheat cultivars was compared in a laboratory dry-grind procedure. With nitrogen supplemented into the mash, the range of ethanol yields was 368–447 L/ton. Nonwaxy soft wheat had an average ethanol yield of433 L/ton, higher than nonwaxy hard and waxy wheat. Conversion efficiencies ranged from91.3–96.2%. Despite having higher levels of free sugars in grain, waxy wheat had higher conversion efficiency than nonwaxy wheat. Although there was huge variation in protein content between nonwaxy hard and soft wheat, no difference in conversion efficiency was observed. Waxy cultivars had extremely low peak viscosity during liquefaction. Novel mashing properties of waxy cultivars were related to unique pasting properties of their starch granules. With nitrogen supplementation, waxy wheat had a faster fermentation rate than nonwaxy wheat. Fermentation rates for waxy cultivars without nitrogen supplementation and nonwaxy cultivars with nitrogen supplementation were comparable. Ethanol yield was highly related to both total starch and protein content, but total starch was a better predictor of ethanol yield. We saw strong negative relationships between total starch content of grain and both yield and protein content of distillers dried grains with solubles.

Investigating the effect of dough preparation using hot water and pregelatinized starch on tortilla quality.

F. Xie, B.W. Seabourn, M. Tilley, and Y.R. Chen.

One of the traditional ways to make Lao Bing, a Chinese tortilla-like flatbread, is to mix dough in which one-half of the added water is heated to 60~80°C. The product is preferred due to its softness, but the reason for this increased softness is unknown. Our hypothesis is that addition of hot water gelatinizes part of the starch, which could hold more moisture, and, hence, increase the softness. The objective of this study was to determine if pregelatinized (pre-g) starch could improve tortilla quality. A complete randomized block design was applied. Tortillas were made using a commercial tortilla flour with the addition of 0%, 10%, 20%, and 30% pre-g starch. To examine the effects of hot water on tortilla quality, tortillas were prepared using the commercial flour and 50% of the total water at 75°C. Samples were kept in plastic ziplock bags at room temperature immediately after cooling. A rollability test was conducted on days 1, 7, and 14 of storage, and samples were rated on a 1–5 scale with 5 the best. Stretchability (maximum force (MF) and distance) was analyzed on days 0, 1, 7,, and 14 after baking using a Texture Analyzer (TA-XT2; Texture Technology Corp., Scarsdale, NY). At least six replicates were tested for rollability, and 12 were tested for stretchability. The control had the lowest rollability compared to the others at all timepoints. At day 14, the rollability of the 30% pre-g was 3.85, which was 1.71 times of that of the control. The MF of all the samples was about the same at day 0 and increased during storage. However, the 30% pre-g had the lowest rate of increase. On day 14, the control had the highest MF, which was 1.5 times that of the 30% pre-g. The results indicated that pr-gelatinized starch could improve tortilla quality. Increasing water temperature could easily gelatinize starch and, hence, improve tortilla quality with minimal cost. This method would largely benefit the commercial tortilla producer.

Mechanism of gas cell stabilization in breadmaking. II. The primary gluten-starch matrix.

B.S. Sroan, S.R. Bean, and F. MacRitchie.

A key parameter in the primary stabilizing dough film (gluten-starch matrix) is thought to be the property of strain hardening. The hard red winter wheat,Jagger gave a higher test-bake loaf volume than a soft wheat and higher strain hardening index for the dough. Rheological properties of the doughs were varied by the addition of flour protein fractions prepared by pH fractionation. Fractions were characterized by SE-HPLC and MALLS. The molecular weight distribution (MWD) of fractions progressively shifted to higher values as the pH of the fractionation decreased. Changes

in mixograph peak development time paralleled the changes in MWD. However, the strain-hardening index and the test-bake loaf volume increased with increasing MWD up to a point (optimum), after which they declined. At a given strain rate, the behavior at the optimum is thought to result from slippage of the maximum number of statistical segments between entanglements, without disrupting the entangled network of polymeric proteins. The shift of MWD to s molecular weight higher than the optimum results in a stronger network with reduced slippage through entanglement nodes, whereas a shift to lower molecular weights will decrease the strength of the network due to a lesser number of entanglements per chain.

Effect of frying conditions and yeast fermentation on the acrylamide content in you tiao, a traditional Chinese fried twisted-dough roll.

W. Huang, S. Yu, Q. Zou, and M. Tilley.

The effects of frying temperature, frying time, and dough pH on the formation of acrylamide in the processing of you tiao, a traditional Chinese fried twisted-dough roll, were analyzed using response surface methodology. The results obtained showed that the frying temperature and time had a notable impact on the formation of acrylamide. Dough pH also had a significant effect on the amount of acrylamide resulting in the products. Lowering the frying temperature to 175°C, prolonging the frying time to 86 seconds, and adjusting the dough pH to 6.0 with citric acid reduced the acrylamide content by 71% in the finished products. T he addition of different levels of yeast ranging from 0.1% to 1.2% to the traditional formulation was examined. We found that dough, with the addition of 0.8% yeast fermented for 1 h, could significantly reduce the amount of acrylamide formed in the fried twisted-dough roll by 66.7%. An examination of the influence of yeast fermentation on the free asparagine and reducing sugars revealed that when the reducing sugars reach the maximum content, the acrylamide content was reduced, and the free asparagine was decreased. As a result, the asparagine reduced by yeast fermentation is more important than the rise in reducing sugar in the reduction of acrylamide content in you tiao.

NIR optical characteristics of deoxynivalenol.

K.H.S. Peiris and F.E. Dowell.

We have developed rapid, near-infrared (NIR) techniques for nondestructive automatic sorting of *Fusarium*-damaged wheat kernels and for estimating deoxynivalenol (DON) levels in single wheat kernels. We studied NIR optical characteristics of DON to identify NIR absorption bands and to assess the applicability of NIR technique for direct measurement of DON in order to improve the calibrations. The NIR transmission spectra of DON (0.5–2,000 ppm) dissolved in acetonitrile and that of water (0–640 ppm) in acetonitrile were studied to identify NIR absorption bands of DON and water and to see how strong NIR absorption bands of water interact with DON NIR absorption bands.

Deoxynevalenol crystals were dissolved in acetonitrile to prepare a 2,000-ppm stock solution, which was serially diluted to prepare a series of DON solutions up to 0.5 ppm. The solutions in IR quartz (10-mm path length) cuvettes were scanned using an ASD spectrometer. Solutions were scanned three times to collect three different spectra per each DON concentration. Likewise, water was added to acetonitrile and spectra were recorded. The collected DON spectra were used to develop a calibration to predict DON levels in an acetonitrile solution. Two spectra from each concentration were used for developing the calibration by the PLS regression method, and the other spectra used to validate the calibration. The optical density spectra of DON and water in various concentrations were used to study DON and water absorption peaks. Difference spectra and second derivative spectra of DON and water were used to identify and resolve absorption peaks.

In the 95–2,200 nm range, two DON absorption bands were identified at 1,390–1,440 nm and 1,880–1,950 nm having peaks at 1,410 and 1,905 nm, respectively. The absorbance at 1,905 nm is approximately one magnitude stronger than the absorbance at 1,10 nm. Water absorption bands were found around 970 and 1,420 nm in increasing intensity. The water absorption bands above 1,850 nm were much stronger being unable to measure even at 40 ppm using 10 mm path length.

The calibration developed for DON in acetonitrile (R^2=0.995 SECV=38.8 with six PLS factors) predicted DON levels in acetonitrile with an R^2=0.998 and shows that NIR absorbance can be used to accurately estimate DON levels in acetonitrile. However, when it comes to predicting DON in cereal grains, such an accuracy is difficult to achieve due to interference with stronger water absorption bands that overlap DON absorption bands. Our present SKNIR technique for scab sorting and DON estimation use a 950–1,650 nm waveband. Based on the observations of this study, it may be possible to further improve calibrations by extending NIR scanning range above 1,950 nm to include the stronger DON absorption band at 1,905 nm.

Measuring grain and insect characteristics using NIR laser-cluster technology

F.E. Dowell, E.B. Maghirang, and V. Jayaraman.

The potential of using an eight-wavelength, near-infrared (NIR), laser-cluster spectrometer for measuring wheat quality (hardness index, protein content, moisture content, and waxy character) and determining tsetse fly pupae sex was investigated and compared to a commercial single-kernel, near-infrared (SKNIR) system. Wheat hardness was predicted accurately by both NIR systems and results were in close agreement with reference values. Predicted protein content followed the same trend as the reference values, but the laser cluster system over predicted low protein content values and under predicted high values by about 1 percentage point. The accuracy of predicting moisture content by either system was similar with predicted values within 0.5% moisture content of the reference values. the waxy character was predicted by the laser system with less accuracy than the SKNIR system, but tsetse fly pupae sex was predicted with similar accuracies for both systems. Prediction equations derived from the laser spectra show that wavelengths influencing classification models generally agree with published literature. Thus, this research shows that a NIR laser-cluster system can be used to predict some grain and insect traits with acceptable accuracy, and some predictions can likely be improved if other wavelengths are used in the laser cluster system.

An NIRS method for the precise identification of Fusarium-damaged wheat kernels.

K.H. Peiris, M.O. Pumphrey, Y. Dong, and F.E. Dowell.

Development of FHB-resistant wheat cultivars may be enhanced by nondestructive evaluation of kernels for *Fusarium*-damaged kernels (FDKs) and deoxynivalenol (DON) levels. *Fusarium* infection generally affects kernel appearance, but insect damage and other fungi can cause similar symptoms. Also, some kernels may have high DON levels but appear asymptomatic. We are developing technology to correctly identify FDKs using an automated, single-kernel NIR (SKNIR) system. A calibration developed to select sound kernels from scabby kernels had an accuracy of more than 99%, but the fraction sorted as FDKs contained kernels that were not totally scabby or sound (grey kernels). Comparison of the NIR spectra of sound and FDKs (both tombstones and grey kernels) showed distinguishable NIR absorption patterns at 960–985, 1,110–1,180, 1,210–1,230, and 1,310–1,350 nm wavebands. These differences may be due to changes in food (carbohydrates and proteins) reserves and/or DON levels. Additional research is ongoing to determine DON levels of grey kernels and to assess the accuracy of sorting FDKs. We also are developing a calibration to estimate DON levels of single wheat kernels. Kernels from artificially inoculated and control wheat spikes were used for the collection of spectra in order to get a concentration gradient of DON for calibration and validation samples. Analysis of single-kernel DON by wet chemical methods also will yield additional information regarding the changes in DON kevels in kernels above and below the point of infection . The findings of these studies will be helpful to develop a rapid and automated single-kernel evaluation technology to correctly identify sound and FDKs in wheat samples and/or to sort wheat kernels based on DON level. This will facilitate quick evaluation of a large number of breeding lines for scab resistance to identify better FHB-resistant cultivars or parent materials for crossing. Furthermore, this technique may be extended as a cost-effective and environmentally friendly technique for analysis of DON in wheat samples for grading commercial grain lots by replacing the time-consuming and expensive methods that use various other chemicals for extraction of DON. This technique may also be extended to other grains such as barley.

NIR absorbance characteristics of deoxynivalenol and of sound and Fusarium-damaged wheat kernels.

K.H.S Peiris, M.O. Pumphrey, and F.E. Dowell.

The near-infrared (NIR) absorption spectra of deoxynivalenol (DON) and single wheat kernels with or without DON were examined. The NIR absorption spectra of 0.5–2,000 ppm of DON in acetonitrile were recorded in the 350–2500 nm range. A second derivative processing of the NIR spectra and spectral subtractions showed DON absorption bands at 1,408, 1,904, and 1,919 nm. The NIR spectra of sound and *Fusarium*-damaged scabby kernels also were acquired using two instruments. Subtraction of average absorption spectra and second derivative spectra were evaluated to identify different NIR signatures of the two types of kernels. Differences in peak heights and positions of the NIR absorption bands of the kernels were noted. At 1,204, 1,365, and 1700 nm, the differences were in the heights of the absorption peaks. Such differences may be attributed to changes in the levels of grain food reserves and other structural compounds. Shifts in absorption peak positions between the two types of kernels were observed at 1,425–1,440 nm and 1,915–1,930 nm. These differences may arise from other NIR active compounds, such as DON, which are not common for the two types of grains. Because the NIR absorption of DON may have contributed to the shifts between sound and *Fusarium*-damaged kernels, this study indicates the potential for NIR spectrometry to evaluate *Fusarium* damage in single kernels based on the DON levels.

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Wheat rusts in the United States in 2008.

Wheat stem rust (*Puccinia graminis f. sp. tritici*). The first report of wheat stem rust in 2008 was from a plot of the susceptible soft wheat McNair 701 in South Texas at Castroville on 3 April. The pustules developed from spores that were likely rain deposited approximately a week earlier and the severity of the infections was low. On 9 April, wheat stem rust was found scattered throughout plots in south central Louisiana at Crowley. One soft wheat cultivar, CK 9553, had significant stem rust infection. Hot dry weather accelerated the crop to maturity in these plots.

On 22 April, low levels of wheat stem rust were found scattered throughout susceptible cultivars and experimental lines at Castroville in south Texas. On 24 April, low levels of wheat stem rust were found on the susceptible variety McNair 701 in plots at College Station in central Texas. On 28 April, traces of wheat stem rust were found in plots of McNair 701 and an unknown cultivar at Bardwell in central Texas. In late April, low levels of wheat stem rust were found in plots at Prosper in northern Texas. Traces of wheat stem rust were also found in a field near Abilene, Texas.

On 24 April, traces of stem rust were found at Baton Rouge, Louisiana. On 29 April, low levels of stem rust were found in plots at Quincy in the panhandle of Florida. In both cases, the wheat was near maturity and, therefore, rust did not increase much more.

The first wheat stem rust identifications of 2008 from Castroville, Texas, and Crowley, Louisiana, were identified as race QFCS. This race has been the most commonly identified race from U.S. collections in the past few years, and is avirulent to most of the winter and spring wheats in the U.S.

In mid May, low levels of stem rust were found on stems in plots of the cultivars Winmaster and Deliver at College Station, Texas. Uredinia were found on only 4–5 stems. In mid-May, low levels of stem rust were found in plots of McNair 701 at Stillwater, Oklahoma, and 40 miles west at Marshall. On 24 May, low levels of wheat stem rust were found in the susceptible McNair 701 plot at Lahoma in north-central Oklahoma. In late May, stem rust was severe in some wheat head-rows of a late planted nursery at Chillicothe in north Texas.

In late May, wheat stem rust was found in east-central and northeastern Arkansas. The disease developed too late to cause much damage, but these are the first reports of stem rust in Arkansas in the past 10 years.

On 8 May, low levels of stem rust were found in a wheat nursery at Blackville in south-central South Carolina. In late May, during harvest, wheat stem rust was found in a breeding nursery at Plains and in early June stem rust was found in a Pike County plot in west-central Georgia.