Karnal bunt testing.

Commercial wheat produced in Oklahoma in 2008 was examined for the presence of teliospores of *Tilletia indica*. Testing was conducted using methods and following protocols approved by the Animal and Plant Health Inspection Service (APHIS). In 2008, 52 samples collected from elevators representing 14 counties were tested, which satisfied APHIS's National Karnal Bunt Testing Program. Testing has been conducted every year since 1996 in Oklahoma, with no positive samples being found.

Personnel.

Faculty conducting research in wheat pathology has been greatly reduced in the past 5 years because of retirements in 2004 by Mr. Ken Jackson, Dr. Larry Singleton, and Dr. Larry Littlefield. Bob Hunger's efforts are now primarily directed toward screening wheat breeder lines for disease reaction, incorporating disease resistance into wheat germ plasm, and fulfilling the extension wheat pathology responsibilities including foliar fungicide and seed treatment testing on wheat. He also advises two Ph.D. students, Mr. Kazi Kader (Bangladesh), who is comparing isolates of the tan spot pathogen collected over the last 25 years, and Mr. Ahmed Abd-Elmajid (Egypt – Dr. Hassan Melouk, co-advisor), who is investigating the effect of water potential on diseases of peanut and wheat.

Publications.

Carver BF, Hunger RM, Edwards JT, Rayas-Duarte P, Klatt AR, Porter DR, Seabourn BW, Bai G-H, Dowell FE, Yan L-L, and Martin BC. 2008. Registration of 'Guymon' wheat. J Plant Reg 2(1):33-35.

Carver BF, Hunger RM, Edwards J, Porter D, Rayas-Duarte P, Klatt A, Yan L, and Martin B. 2008. 'OK Rising' hard red winter wheat; released by the Oklahoma Agricultural Experiment Station.

Hunger RM, Kader KA, Edwards J, and Walker R. 2008. Effect of fungicides on powdery mildew and leaf rust of hard red winter wheat in Oklahoma, 2007. Plant Dis Manage Rep 2:CF012.

Melouk HA, Brown M, Ju H-J, Hunger RM, and Conway KE. 2008. Effect of water potential on sclerotial production by *Sclerotinia sclerotiorum* in a culture medium. Phytopathology Abstr.

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2008 wheat production in the Commonwealth of Virginia.

W.E. Thomason, C.A. Griffey, and J.E. Seago

Growing Conditions. The autumn of 2007 presented challenging planting conditions for many growers due to dry soil conditions with over half the state reported to be very short of soil moisture. Growers needing to perform primary tillage waited for rain, whereas some small grain was planted into these dry seedbeds. Rains in late October improved conditions dramatically and by the end of the first week of November, wheat planting reached 53 percent of intended acres, which is the same as the five-year average. Early winter was relatively dry (Fig. 1) and although there were still concerns over subsoil moisture, most of the small-grain crop was rated good or better. Warm and favorable conditions in April resulted in wheat heading approximately 5 days earlier than the long-term average. However, generally cool conditions in May resulted in longer grain fill and an on-time harvest (Fig. 2). These cool conditions during grain fill helped produce plump kernels and generally good yields across the Commonwealth.

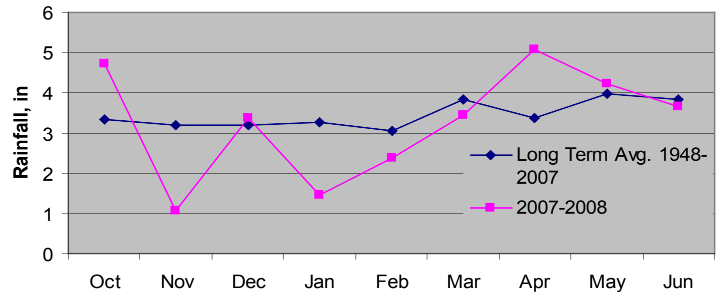

Fig. 1. Long-term mean and 2008 growing season statewide rainfall.

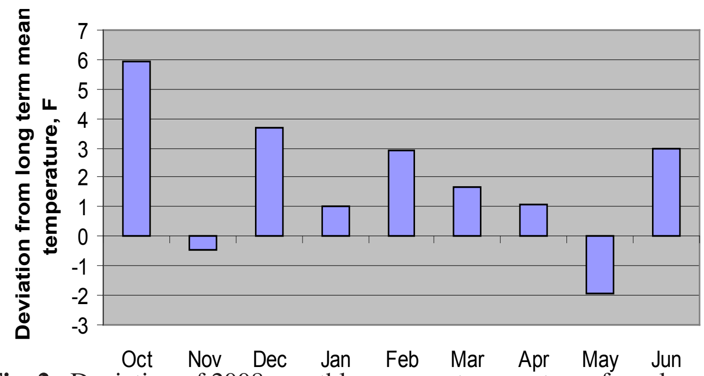

Fig. 2. Deviation of 2008 monthly average temperatures from long term average (1948–2008).

Disease and insect incidence and severity. Following four consecutive years (2004–07) of relatively low incidence of powdery mildew in Virginia, the disease reëmerged with susceptible cultivars having disease severities ranging from 50–80% at Blacksburg, Painter, and Warsaw, VA. For the first time, significant mildew infection was noted on isolated plots of the cultivars McCormick at Warsaw and Tribute at Painter both of which possess gene *Pm17*. Leaf rust infection and severity was high on susceptible cultivars (60–80%) grown in research yield trials at Blacksburg, Warsaw, and Painter, VA. Cultivars such as Sisson and USG3209 having gene *Lr26* and McCormick having gene *Lr24* were very susceptible to leaf rust. Race surveys conducted by the USDA–ARS Cereal Disease Lab on 21 samples from six regions in Virginia indentified six races (MBDSB, MFGJH, TBRKG, TCDSB, TCRKG, and TNRJJ) at Blacksburg (southwest), race TDBGH at Blackstone (southern Piedmont), race TLMJD at Orange (northern Piedmont), race TBRKG at Holland (southeast), races MFGJH and TDBGH at Painter (eastern shore), and four races (MCDSB, MCTSB, MFGJH, and TCRKG) at Warsaw (coastal plain). Virulence for the widely deployed genes *Lr24* and *Lr26* was common, whereas virulence for *Lr9* was only identified at Blacksburg and Orange, VA. Stripe rust was only found at one of the seven Official Variety Test sites in 2008. Isolated infection foci were observed in wheat headrows at Warsaw, VA, and rust samples sent to Xianming Chen at Washington State University were identified as race PST100. *Fusarium* head blight was moderately severe in no-till plots of the state variety trial at Holland, VA, with susceptible cultivars having severities exceeding 50% and DON toxin levels up to 2.8 ppm. *Barley yellow dwarf virus* infection was moderate at Blacksburg, and *Stagonospora* leaf blotch was moderate at Holland.

Production. According to the United States Department of Agriculture's National Agriculture Statistical Service (http://www.nass.usda.gov/Statistics_by_State/Virginia/index.asp), in 2007–08 Virginia wheat producers planted 310,000 acres (125,453 ha), up 80,000 acres (32,375 ha) from the previous year. The estimated area harvested was 280,000 acres (113,312 ha), a 37 percent increase over the 2006–07 total of 210,000 acres (113,312 ha). The 2008 state average grain yield of 71 bu/acre (4,771 kg/ha) was 7 bu/acre (4,771 kg/ha) higher than that in 2007, and set a new state record that was 3 bu/acre (202 kg/ha) higher than the previous record set in 2006. Overall wheat production in 2008 was 19.9 million bushels (541,000 metric tons).

State cultivar tests. In the 2007-08 tests, there were a total of 91 entries planted at seven locations across Virginia (http://www.grains.cses.vt.edu/). The test included 46 experimental lines and 45 released cultivars. No-till tests were conducted at Warsaw, Holland, and Shenandoah Valley with the Warsaw and Holland tests being planted after corn. The released cultivars Shirley, USG 3555, Branson, Pioneer 26R15, SS 560, SS 548, Renwood 3434, USG 3665, USG 3725, SS 5205, and SS 8641 all produced significantly higher yields than the overall trial average of 88 bu/acre (5,913 kg/ha). Average grain yields among the 91 lines ranged from 71 bu/acre (4,770 kg/ha) to 93 bu/acre (6,249 kg/ha). Average test weight ranged from 56.5 lb/bu (727 kg/m^3) to 61.5 lb/bu (792 kg/m^3) with an overall trial average of 59.2 lb/bu (762 kg/m^3).

2008 Virginia Small Grain Yield Contest results. The 2008 contest was divided into three separate regions and also included a statewide ranking. The results are presented in Table 1.

Table 1. Results of the 2008 Virginia Small Grain Yield Contest.

STATEWIDE			
Place	**Farm**	**Area**	**Yield (bu/acre)**
1	Grainfield Farm / Chuck McGhee	3	131.70
2	Turner Family Farms / Donald & Jamie Turner	1	130.05
3	Corbin Hall Farm / Ronnie Russell	3	111.07

Place	Farm	County	Yield (bu/acre)	Planting date	Cultivar
Area 1 – Southern Piedmont and Southern Coastal Plain					
1	Turner Family Farms / Donald & Jamie Turner	Dinwiddie	130.05	11/13/07	SS 560
Area 2 – Ridge & Valley and Northern Piedmont					
1	Alvis Farms / George Alvis	Goochland	107.11	11/07/07	SS 520
Area 3 – Northern Coastal Plain					
1	Grainfield Farm / Chuck McGhee	King William	131.7	11/03/07	USG 3665
2	Corbin Hall Farm / Ronnie Russell	Middlesex	111.07	10/12/07	Pioneer 26R15
3	Jason Benton	Middlesex	105.89	11/02/07	USG 3665
Additional entries					
	Oakland Farm / Randolph Aigner	Henrico	103.20	10/26/07	SS 8302
	Clifton "Boogie" Davis	New Kent	103.25	10/31/07	Vigoro 9510
	Heritage Farms LLC / David Black	Charles City	96.85	10/28/07	Vigoro 9553

Seeding rate effects on grain yield and yield components of winter durum wheat cultivars.

W.E. Thomason, C.A. Griffey, S. Liu, R.M. Pitman, W.S. Brooks, B. Will, J. Seago, and M.E. Vaughn.

Grain yield is the product of three components; heads/unit area, kernels/head, and weight/kernel. Yield improvement of winter durum wheat cultivars, through enhanced management, will increase the acceptance of this alternative crop by farmers. Current durum wheat lines yield approximately 80% of the best soft red winter wheat lines, but little is known about how intensive wheat management techniques affect these durum lines. Among durum lines alone, there was a significant linear increase in head density with increased seeding rate (Fig. 3). This often results in either fewer kernels per head or in lighter kernels. In this case, we did find fewer kernels/head when seeding rate was increased for VA05WD42, but we saw an increase in number of kernels/head for XVAD99147-1 (Fig. 4).

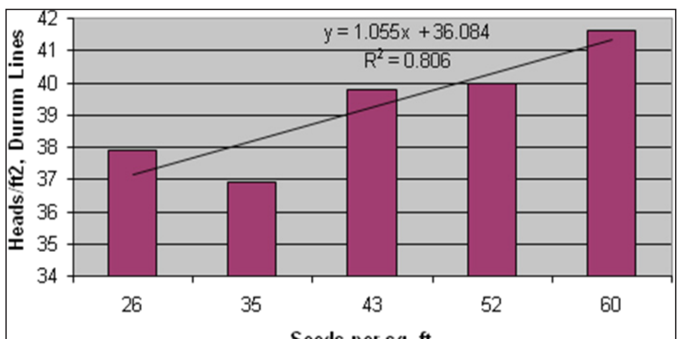

Fig. 3. Effect of seeding rate on head density for winter durum wheat lines.

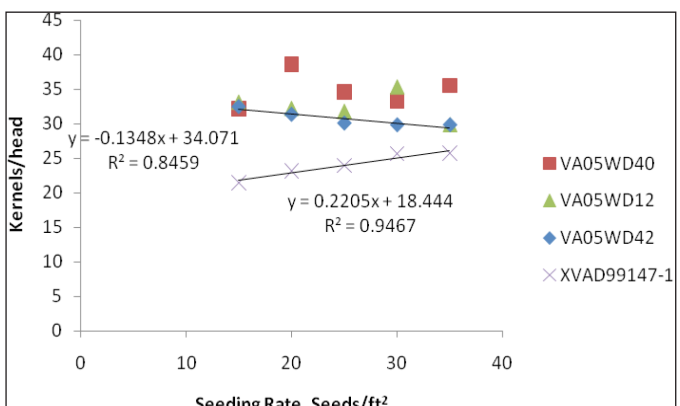

Fig. 4. Effect of seeding rate on kernels/head for winter durum wheat lines.

Update on quantitative trait loci for adult-plant resistance to powdery mildew in soft red winter wheat.

M.D. Hall, S. Liu, D. Van Sanford, J. Costa, G. Brown-Guedira, D. Marshall, and C.A. Griffey.

Three QTL for adult-plant resistance (APR) to powdery mildew were previously mapped on chromosomes 1B, 2A, and 2B in the soft red winter wheat cultivar Massey and later confirmed in a 'USG3209/Jaypee' population. A whole-genome linkage analysis was not conducted during the initial identification of these three QTL, but subsequently has been completed. Averaged over 11 environments, four genomic regions on chromosomes 1B, 2A, 2B, and 5A were associated with APR to powdery mildew. The new QTL for APR to powdery mildew identified on chromosome 5A of USG3209 is located near BARC056 and explains 9.75% of the phenotypic variation. The 5A QTL identified in USG3209 is located in the same chromosome region as a QTL conferring Fusarium head blight resistance identified in the cultivars Ernie and Massey. The relationship between these QTL controlling resistance to two different fungal pathogens is unknown at this time. However, Massey is a parent of USG3209, and we are currently mapping APR to powdery mildew and FHB resistance in a 'Becker/Massey' population to further understand this relationship on chromosome 5A.

A QTL for APR to powdery mildew located on chromosome 1B was identified in Massey and USG 3209 and is located near marker SCM09, which is the diagnostic marker for the T1RS·1AL and T1RS·1BL translocations. Although USG3209 contains the defeated major gene *Pm8* located on T1RS·1BL, which may have a residual effect on powdery mildew, Massey lacks this gene. The effect of this QTL is small accounting for only 8% of the total variation in powdery mildew severity.

Chromosome 2A has a QTL for APR to powdery mildew located near the centromere and marker GWM122. This QTL explained approximately 9% of the total phenotypic variation. The QTL for APR to powdery mildew on chromosome 2B is located near marker GWM047 and explained the most phenotypic variation (19.1%) of the four identified QTL. This QTL also had the highest LOD score of approximately 8. Markers GWM047 and GWM501 flank this QTL region, which spans approximately 6 cM.

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Identification and saturation mapping of QTL for Fusarium head blight resistance in the Virginia wheat cultivar Massey.

Shuyu Liu, Marla D. Hall, Carl A. Griffey, Anne L. McKendry, Jianli Chen, Patricia G. Gundrum, Gina Brown-Guedira, and David Van Sanford.

Massey, a cultivar released by Virginia Tech in 1985, has adult-plant resistance to powdery mildew and is moderately resistant to Fusarium head blight. A set of 589 Diversity Array Technology (DArT) markers were mapped onto all 21 chromosomes in a 'Becker/Massey' mapping population comprised of 152 RILs. Phenotypic data for FHB severity were obtained from a greenhouse test conducted in Virginia and FHB incidence, severity, index, toxin (DON) concentration, and Fusarium-damaged kernels (FDK) were collected from field tests conducted in Virginia (2007, 2008), Missouri (2008), and Kentucky (2008). Within each test, FHB incidence was significantly correlated to FHB severity ($P < 0.001$), and correlations between FHB severity and FHB index were the highest. After preliminary QTL analysis based on DArT markers, 58 simple sequence repeat (SSR) markers were mapped onto those target regions. Mapping results indicated that Massey has QTL on chromosomes 2B and 3BS centromere conferring resistance to fungus spread, which is close to the two QTL in Ernie. Two major QTL on chromosomes 4B and 4D are associated with field FHB resistance measured by incidence, severity, index, and FDK. The 4B QTL explained 8%, 6%, 12%, and 30% of phenotypic variation whereas the 4D QTL explained 21%, 33%, 28%, and 10% of phenotypic variation of corresponding FHB traits averaged over four environments. Two genes, *Rht1* and *Rht2*, were mapped onto the target QTL regions on chromosomes 4B and 4D, respectively. This result confirmed that *Rht2* gene is associated with FHB susceptibility. Another minor QTL associated with field incidence, severity, index, and DON reduction is on chromosome 2D, which explained 7% of phenotypic variation averaged over four environments. This QTL is close to the *Rht8* gene. Another QTL on chromosome 2D is close to the *Ppd1* gene and explained 8% of phenotypic variation in DON measured at Blacksburg, VA, in 2008.

These QTL and their relationship with *Rht* genes and *Ppd1* will be further validated with field data from two locations in Virginia in 2009. The similarity between QTL mapped in Massey with other known QTL will be compared and potentially novel QTL and/or tightly linked markers will be reported.

Acknowledgments. This material is based upon work supported by the U.S. Department of Agriculture, under Agreement No. 59-0790-4-102. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.

Saturation mapping of FHB-resistance QTL in Ernie and the identification and application of diagnostic markers for breeding.

Shuyu Liu, Carl A. Griffey, Anne L. McKendry, Marla D. Hall, Patricia G. Gundrum, and Gina Brown-Guedira.

Fusarium head blight decreases wheat yields and quality significantly under epidemics in the eastern and southern U.S. Many QTL for FHB resistance have been mapped in exotic and native sources. However, only a few QTL have been widely deployed in breeding programs using marker-assisted selection due to the lack of diagnostic and tightly linked markers for most QTL. Four major QTL for type-II resistance were mapped on chromosomes 5A, 4B, 3BS, and 2B of the SRW wheat cultivar Ernie. A set of 243 RILs were evaluated in inoculated, mist-irrigated FHB nurseries at Columbia, MO, and Blacksburg, VA, in 2008. Phenotypic data were obtained for resistance to initial infection, to severity, to DON toxin accumulation and to Fusarium-damaged kernels (FDK) in irrigated and inoculated field experiments.

Fifty-five new microsatellite markers were mapped to saturate these four QTL target regions and other regions based on field scab resistance. Overlapping and distinct QTL were identified for different types of resistances in Ernie. The major QTL on chromosome 4B conditioning type-II FHB resistance explained 12.2% of the phenotypic variation for greenhouse severity based on point inoculation. This same QTL also explained 4%, 4.6%, 4.4%, 6.5%, and 8% of phenotypic variation in field incidence, severity, index, FDK, and grain weight, respectively. The awn-suppresser gene B_1 explained 5.8%, 7.9%, 7.5%, of the phenotypic variation in field incidence, severity, and index in two environments, respectively. One major QTL for DON reduction on chromosome 3A explained more than 20% of phenotypic variation. All these field FHB resistance QTL will be further validated in two experiments in Virginia in 2009.

Tightly linked markers were tested in a wide range of Chinese, European, and America resistance sources. The most diagnostic markers were used to screen top-cross breeding populations to pyramid scab resistance QTL from Ernie and Ning7840. Lines with native and exotic sources of scab resistance are being evaluated in the field.

Acknowledgments. This material is based upon work supported by the U.S. Department of Agriculture, under Agreement No. 59-0790-4-102. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.

Release of the soft red winter wheat cultivar Shirley.

Shirley is a broadly adapted, high-yielding, short-stature, full-season soft red winter wheat cultivar developed and released in March 2008 by the Virginia Agricultural Experiment Station. The cultivar was derived from the three-way cross 'VA94-52-25/Coker 9835//Sisson sib'. The cultivar name Shirley was selected in commemoration of the Shirley Plantation, which is Virginia's first plantation founded in 1613 and the oldest family-owned business in North America dating back to 1638. The name also was selected in honor and memory of the cultivar developer's grandmother Nannie Jane Shirley. The cultivar Shirley provides producers and end users in the mid-South, mid-Atlantic, Corn Belt, and Northeastern regions of the U.S. with a cultivar that has very high-yield potential and good milling and pastry-baking qualities. In Virginia's State Variety Trial, Shirley had the highest three year (2006–08) average grain yield (6,316 kg/ha) and an average grain volume weight of 75 kg/hl. Shirley is notably resistant to leaf rust, stem rust, and powdery mildew. Certified seed of Shirley will be available to producers beginning in autumn 2009.

Release of the soft red winter wheat cultivar 3434.

Wheat cultivar **3434** was derived from the three-way cross 'Roane/Coker 9835//VA96W-270' and released by the Virginia Agricultural Experiment Station in March 2008. The cultivar provides producers and end users in the mid-South, mid-Atlantic, northeast, and southern Corn-Belt regions of the U.S. with a high-yielding, full-season cultivar that is very short in stature with stiff-straw and good milling and baking qualities. In Virginia's State Variety Trial, 3434 had a three year (2006–08) average grain yield of 5,980 kg/ha and an average grain volume weight of 76 kg/hl. The cultivar is resistant to powdery mildew and moderatley resistant to leaf rust. Certified seed of cultivar 3434 will be available to producers beginning in autumn 2009.

Release of the soft red winter wheat cultivar 5205.

Cultivar **5205** was derived from the three-way cross 'Pioneer Brand 2684/VA93-54-185//Pocahontas' and released by the Virginia Agricultural Experiment Station in March 2008. The cultivar provides producers and end users in the Deep South, mid-South, and mid-Atlantic regions of the U.S. with a high-yielding, mid-season cultivar that is short in plant height and has excellent milling and baking qualities. In Virginia's State Variety Trial, wheat cultivar 5205 had a three year (2006–08) average grain yield of 6,114 kg/ha, and an average grain volume weight of 77 kg/hl. Cultivar 5205 is notably resistant to leaf rust and stripe rust, and moderately resistant to Fusarium head blight. Certified seed of cultivar 5205 will be available to producers beginning in autumn 2009.

Release of the winter durum wheat cultivar Snowglenn.

Snowglenn was derived from the three-way cross 'N1291-86/N1439-83//Alidur' and is the first winter durum cultivar developed and released in March 2008 by the Virginia Agricultural Experiment Station. Snowglenn is a full-season, medium-height cultivar that has consistently expressed resistance to Fusarium head blight with low DON toxin accumulation. The three year (2006–08) average grain yield of Snowglenn in Virginia is 4,898 kg/ha with a grain-volume weight of 80.4 kg/hl. Snowglenn provides identity preserved producers in Virginia with a high-value specialty wheat cultivar that purveys to millers and end-users in the eastern U.S. locally grown durum wheat for pasta production.

Publications.

Das MK, Griffey CA, Baldwin RE, Waldenmaier CM, Vaughn ME, Price AM, and Brooks WS. 2007. Host resistance and fungicide control of leaf rust (*Puccinia hordei*) in barley (*Hordeum vulgare*) and effects on grain yield and yield components. Crop Protect 26:1422-1430.

Mammadov JA, Brooks WS, Griffey CA, and Saghai Maroof MS. 2007. Validating molecular markers for barley leaf rust resistance genes *Rph*5 and *Rph*7. Plant Breed 126:458-463.

Markell SG, Griffey CA, and Milus EA. 2008. Inheritance of resistance to stripe rust in three lines of soft red winter wheat. Crop Sci 49:521-528.

Sohn M, Himmelsbach DS, Barton II FE, Griffey CA, Brooks W, and Hicks KB. 2008. Near-infrared analysis of whole barley: Comparison of three spectrometers. Applied Spectroscopy 62(4):427-432.

Souza EJ, Griffey C, Kweon M, and Guttieri M. 2008. Sources of variation for long-flow experimental milling. Crop Sci 48:1432-1440.

Sohn M, Himmelsbach DS, Barton II FE, Griffey CA, Brooks W, and Hicks KB. 2007. Near-infrared analysis of ground barley for use as a feedstock for fuel ethanol production. Applied Spectroscopy 61(11):1178-1183.