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2009 Wheat Production in the Commonwealth of Virginia.

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Growing conditions. Planting conditions in Autumn 2008 were favorable for early planting with over 20% of the state's intended acreage seeded by 20 October. The high cost of inputs influenced some growers to plant later than normal in hopes that prices would fall or fields were seeded with the intention of applying fertilizer at a later date. By 1 November, 49% of the crop was estimated as planted, which matched the 5-yr average of 50% planted by this date. Widespread rain in November provided moisture and improved groundwater supplies in many areas (Fig. 1). Although most small grain fields looked good, cool weather in November slowed crop development. Mid-winter was cooler than normal and dry, with most of the Coastal Plain region receiving two inches less precipitation than the long-term average in the month of January (Fig. 1). By February, this deficit was more than four inches and resulted in only 26% of the small grain crop rated as good or excellent. Rain in March helped make up some of this deficit ,and over 50% of the crop was rated good or better in mid-April. In May, cool, wet weather had many producers scouting fields for disease and making pesticide applications in response to threats. By the end of the month, the crop was headed but continued wet weather caused producers to be concerned over the potential for Fusarium Head Blight (FHB) as well as potential decreases in test weight due to weathering. Overall, significant FHB infection was observed in Virginia wheat fields, which lowered grain yield and grain quality. By 20 June, approximately 20% of the crop was harvested, which was significantly lower than the previous year when 44% was harvested by that date.

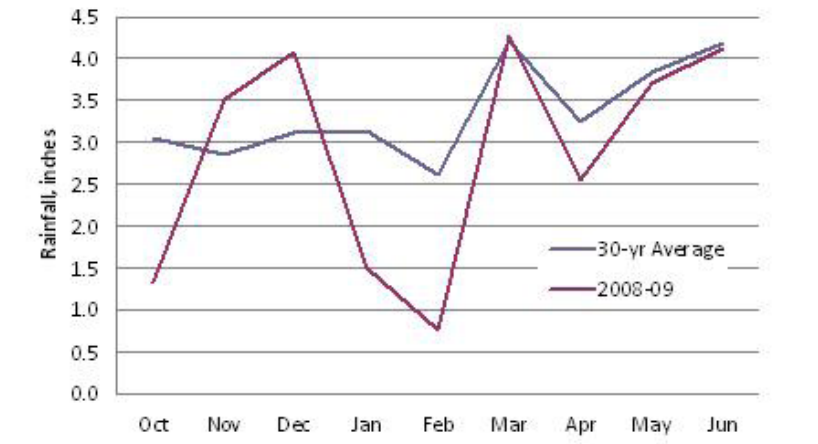

Fig. 1. Long-term mean and 2009 growing season statewide rain-

Disease and insect incidence and severity. Powdery mildew incidence and severity was significant at several locations in Virginia in 2009. Entries in state wheat variety trials were rated (0 = no infection to 9 = severe infection) at four locations with mean scores ranging from 0 to 8 at Warsaw, 0 to 7 at Painter, 0 to 7 at Orange, and 0 to 6 at Blacksburg, VA. The cultivar Tribute, with *Pm17*, received mean ratings of 5 at Warsaw and Painter, whereas virulence for *Pm17* was not predominant at Blacksburg and Orange where Tribute had mean ratings from 0 to 1. Leaf rust was prevalent and state wheat entries received mean ratings from 0 to 9 at Warsaw, 0 to 5 at Painter, and 0 to 2 at Blacksburg. Cultivars such as Sisson and USG3209 with gene *Lr26* and McCormick with gene *Lr24* were very susceptible to leaf rust. Race surveys conducted by the USDA–ARS Cereal Disease Lab on 38 samples from three regions in Virginia indentified 10

races among which three (MFBJG, MFGJG, MFPSC) had virulence for *Lr24* and *Lr26*, four (MCRKG, MCTSB, TCDSB, TCRKG) had virulence for *Lr26*, and two (MDBJG and TDBJG) had virulence for *Lr24*. Virulence for the widely deployed genes *Lr24* and *Lr26* was common, whereas virulence was not observed for gene *Lr9*. Stripe rust was only found at one of the seven Official Variety Test sites in 2009. Isolated infection foci were observed in wheat yield plots at Blacksburg, VA, and rust samples sent to Xianming Chen at Washington State University were identified as race PST98. Barley/cereal yellow dwarf virus infection was moderately low (0–2) at Blacksburg, VA, whereas wheat spindle streak mosaic virus infection was moderately high (0–7) in the state wheat no-till test at Warsaw, VA. *Fusarium graminearum* was severe throughout much of the state and resulted in significant losses in grain yield and quality accompanied by high DON toxin levels in some areas.

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 2008–09 Virginia wheat producers planted 250,000 acres (101,250 ha), down 60,000 acres (24,300 ha) from the previous year. The estimated area harvested was 210,000 acres (85,050 ha), a 25% reduction compared to the 2007–08 crop at 280,000 acres (113,400 ha). The 2009 statewide wheat yield average was 13 bu/ac (874 kg/ha) lower than the record yield 71 bu/ac (4,770 kg/ha) set in 2008, and losses due to FHB accounted for a majority of this yield difference. Overall, wheat production in 2009 was 12.2 x 10^6 bushels (331, 500 metric tons) compared with 19.9 x 10^6 bushels (541,000 metric tons) in 2008.

State cultivar tests. In the 2008–09 tests, total of 89 entries were planted at seven locations across Virginia (http://www.grains.cses.vt.edu/). The test included 45 commercial cultivars and 44 experimental lines among which seven were subsequently released as cultivars. No-till tests were conducted at Warsaw, Holland, and Shenandoah Valley and planted after corn. The released cultivars Branson, Vigoro V9723, Shirley, Progeny 185, USG 3120, Merl, Pioneer Brands 26R15, 26R20 and 26R32, NC-Yadkin, SS 520, SS-MPV 57, USG 3555, USG 3665, Coker 9553, Renwood 3434, and Vigoro V9922 all produced significantly higher yields than the overall trial average of 73 bu/ac (4,905 kg/ha). Average grain yields among the 89 entries ranged from 64 bu/ac (4,300 kg/ha) to 82 bu/ac (5,510 kg/ha). Average test weight ranged from 53.4 lb/bu (687 kg/m3) to 59.3 lb/bu (763 kg/m3) with an overall trial average of 56.3 lb/bu (725 kg/m3).

2009 Virginia Wheat Yield Contest Results. The 2009 contest was conducted statewide, and the results are presented in the table below. Average yield of all entrants was 93 bu/ac (Table 1). Congratulations to our winners.

Table 1. 2009 Virginia Wheat Yield Contest Statewide Winners.

Place	Farm	County	Yield bu/ac	Planting date	Cultivar	Rate	Row width	Previous crop	Soil type	Tillage	Total N lb/ac	Seed treatment	Herbicides	Fungicides	Insecticides
1	George Alvis, Jr.	Goochland	108.3	26/10/08	SS 560	150 lb/ac	7.5	corn	N/A	minimum	100 lb/ac, 3 apps, 6,000 gal manure	Raxil	Harmony GTXP, 0.75 oz/ac	Headline, 6 oz/ac	Warrior II, 1.5 oz/ac
2	John Black and Sons / Jon L. Black	Charles City	103.5	24/10/08	Dominion	28 sd/row ft	7.5	cotton	Pamunkey	no-till	130 lb/ac, 3 apps	Dividend Extreme	Harmony Extra, 0.75 oz/ac	Stratego, 12 oz/ac	None
3	Dennis Alvis	Goochland	96.9	1/11/08	SS 9404	150 lb/ac	7.5	corn	N/A	minimum	100 lb/ac, 3 apps	Raxil	Harmony GTXP, 0.75 oz/ac	Headline, 6 oz/ac	Warrior II, 1.5 oz/ac
4	Randy Alvis	Goochland	96.7	24/10/08	SS 8309	150 lb/ac	7.5	corn	N/A	minimum	100 lb/ac, 3 apps, 6,000 gal manure	Raxil	Harmony GTXP, 0.75 oz/ac	Headline, 6 oz/ac	Warrior II, 1.5 oz/ac

Relationships of dwarf and photoperiod insensitive genes with Fusarium head blight resistance in U.S. soft red winter wheat cultivars.

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Two US soft red winter wheat cultivars, Ernie and Massey, have moderate FHB resistance. Recombinant inbred line mapping populations 'Becker/Massey' (BM) and 'Ernie/Mo 94-317' (EM) were derived from them and have been screened for FHB resistance in the field in multiple years (2008 and 2009) and locations (Blacksburg and Warsaw, VA). *Rht1*, *Rht2*, and *Ppd1* segregated in both populations with *Rht8* for BM in addition. Based on field data from two years, FHB incidence, severity, and Fusarium-damaged kernels (FDK) are significantly correlated for BM (r = 0.34~0.54) and EM (r = 0.37~0.60) within year and for EM across year (r = 0.15~0.57). Height is very significantly, and negatively, related to FHB resistance for BM in 2008 (r = –0.49~–0.57) and for EM in both years (r = –0.43~–0.72), whereas heading date and flowering date are only related to FHB incidence and severity at lower significance levels in some cases (r = –0.14~–0.36) and are positively related to FDK (r = 0.15~0.23). FHB resistance QTL have been mapped onto chromosomes 4B and 4D where two major dwarf genes *Rht1* and *Rht2* reside. *Rht8* and the photoperiod insensitive gene *Ppd1* were mapped on chromosome 2D of Massey and associated with a minor QTL for FHB resistance. Further analyses showed that both *Rht1* and *Rht2* are significantly associated with FHB incidence, severity, and FDK in 2008 for BM and both years for EM. They can explain the phenotypic variations at 14 to 32% based on data from the two mapping populations in two years. However, *Rht8* is not significant in any case. *Ppd1* was significant for FHB incidence only in 2008 for BM and in 2009 for EM. It is also significant for FHB severity in both years for EM. Because FHB infection is complicated by many genetic and environmental factors, further studies are needed to clarify the effects from these genes and other morphological traits.

Release of the soft red winter wheat cultivar Merl.

Merl, developed and tested as VA03W-412 by the Virginia Agricultural Experiment Station, was released in March 2009. The name Merl was selected in honor and memory of G. Merl Longest, who served for 16 years on the Virginia Crop Improvement Association's Board of Directors as a member and three terms as president. Merl was derived from the three-way cross 'Roane/Pioneer Brand 2643//38158' (PI 619052). Merl is a broadly adapted, mid-season, moderately short, semidwarf (*Rht2*) cultivar having very good straw strength. Merl is resistant to powdery mildew and moderately resistant to stripe rust. In Virginia, Merl ranked among the top five cultivars for grain yield with a three year (2007–09) average of 5,725 kg/ha. Merl had a grain volume weight (76.4 kg hl-1) that was significantly ($P < 0.05$) higher (1.9–3.0 kg/hl) than the other top-yielding cultivars. Merl provides producers and end users in the mid to deep South, mid-Atlantic, southern Corn Belt, and Northeastern regions of the U.S. with a wheat cultivar that has high yield potential, high grain volume weight, and good milling and pastry baking qualities. A limited amount of Certified seed of cultivar Merl may be available to producers in autumn 2010.

Release of the soft red winter wheat cultivar SW049029104.

SW049029104 was developed and released by the Virginia Agricultural Experiment Station in March 2009. SW049029104 was derived from the cross '38158 (PI 619052)/Pioneer Brand 2552//Roane' and was tested under the experimental number VA04W-90. SW049029104 is a broadly adapted, high yielding, moderately short, semidwarf (*Rht2*) cultivar. This cultivar provides producers and end users in the mid to deep South, mid-Atlantic, and southern Corn Belt regions of the U.S. with a cultivar that is resistant to powdery mildew and Fusarium head blight. In the 2009 USDA–ARSUuniform Southern SRW Wheat Nursery conducted at 25 locations, SW049029104 ranked first among 40 entries for grain yield (4,889 kg/ha) and fourth for grain volume weight (73.2 kg/hl). Milling and baking quality of SW049029104 exceed those of USG 3555 and Pioneer Brand 26R61. A limited amount of Certified seed of SW049029104 may be available to producers in autumn 2010.

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A multipronged approach to develop nutritionally improved, celiac safe, wheat cultivars.

Wheat and its products are potential elicitors for two types of immune responses in human beings: the first being the immunoglobulin E (IgE)-mediated occupational responses (e.g., bakers' asthma) and the second being non-IgE-mediated responses due to ingestion of seed storage proteins of Triticeae (celiac disease). In general, wheat proteins also are poor in nutritional quality because of their imbalanced amino acid composition and deficiency of one of the essential amino acids, lysine. Among the known food allergy cases triggered by wheat and wheat products, most belong to celiac disease, constituting >24.4 million registered cases worldwide. The only effective therapy known to date is strict dietary adherence to a gluten-free diet, which often leads to nutritional deficiencies in celiac patients. In view of the above, we undertake a profound project with the ultimate objective of eliminating the prolamins from wheat grains that contain a majority of epitopes causing celiac disease. Eliminating these proteins also will address the issue of imbalance in the amino acid profile of wheat proteins.