VIRGINIA

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2012 wheat production in the Commonwealth of Virginia.

Growing conditions. Late summer 2011 in the Commonwealth brought significant rain to most areas. However, by September, weather was favorable and corn harvest was ahead of the normal pace. This influenced wheat seeding in many areas with 26% of intended wheat acres planted by early October, compared to the 5-yr average of 7%. Precipitation in many areas at the end of October, however, resulted in only about 35% of the intended acreage being planted by the end of the third week of October. By the first week of November, growers had planted 57% of the acres they indicated they planned to plant, which was slightly below the 5-yr average of 61%. Rain in mid to late November meant planting continued at a slightly slower pace, but rain benefitted the early planted wheat and barley. December was warmer and generally wetter than normal. January and February were very mild, which left many fields far advanced and growers concerned about applying N that early and encouraging too much winter growth and increasing the likelihood of spring freeze injury. March and April were quite dry in many areas of the Commonwealth, and many fields likely experienced some yield loss due to inadequate moisture. On 20 April, growers indicated that 70% of the wheat and 57% of the barley crop were in good condition. Grain maturity came early in many areas and by 20 May, virtually all the wheat in the state was headed compared to the 5-yr average of 77% headed by this date. This trend continued and by 17 June, 98% of barley harvest and 58% of wheat harvest was complete. Initial harvest results indicated that yield and quality of the 2012 wheat and barley crops were near the long-term trend, or about average. As of 11 July, 2012, the USDA NASS Virginia Field Office estimated that Virginia's wheat producers expected to average 65 bu/ac in 2012. Wheat production in Virginia was expected to total about 17.6 x 10^6 bushels, down 1% from last year's total wheat crop of 17.8 x 10^6 bushels. Producers expected to harvest 270,000 acres of wheat, 20,000 acres more than in 2011.

Disease and insect incidence and severity. Entries in Virginia's 2012 state wheat variety trials were rated (0 = no infection to 9 = severe infection) for disease severity at four diverse locations. The 94 entries in the 2012 trial had mean powdery mildew (*Blumeria graminis*) ratings that varied from 0 to 6 over four regions of the Commonwealth in the Southwest (0–5), Southern Piedmont (0–6), Eastern Virginia (0–6), and Eastern Shore (0–5) regions. Barley/Cereal Yellow Dwarf Virus infection was moderate at Blackstone and Warsaw (1–5) and severe at Blacksburg (2–7). Fusarium head blight (*Fusarium graminearum*) was negligible. At two locations, mean trial scores for leaf rust (*Puccinia triticina*) varied from 1.1 to 3.6. Wheat entries received mean ratings from 0 to 8 in the Eastern Virginia (Warsaw) no-till trial and from 0 to 9 in the Eastern Shore (Painter) trial. Cultivars having only genes *Lr24* or *Lr26* were susceptible to leaf rust at the Eastern Shore location, whereas cultivars with gene *Lr9* or this gene combined with other genes were moderately to highly resistant. Race surveys conducted by Dr. James Kolmer of the USDA–ARS Cereal Disease Lab on 19 isolates from four regions in Virginia indentified seven races of leaf rust including MBTNB (Richmond and Suffolk counties), MCTNB (Accomack, Suffolk, and Westmoreland), MCTQB (Accomack Co.), MCTSB (Richmond Co.), MFGJG (Accomack Co.), TBJSB (Suffolk Co.), and TBRKG (Westmoreland Co.). Three races having virulence for gene *Lr26* but avirulent to gene *Lr24* included MCTNB, MCTQB, and MCTSB. Race MFGJG has virulence for genes *Lr24* and *Lr26*. None of the races identified had virulence for resistance gene *Lr9*. Stripe rust (*Puccinia striiformis*) was found in state variety trails at Blackstone, Painter, and Warsaw, VA, in 2012 and samples were sent to Dr. Xianming Chen at USDA–ARS in Pullman, WA, for race identification. Four races were identified including PSTv-37 (virulence for genes *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr27*, *Yr43*, *Yr44*, *YrTr1*, and *YrExp2*) at all three locations, race PSTv-52 (virulence for genes *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr27*, *Yr43*, *Yr44*, and *YrExp2*) at Blackstone and Painter, race PSTv-30 (virulence for genes *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr44*, *YrTr1*, and *YrExp2*), and race PSTv-35 (virulence for genes *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr43*, *Yr44*, *YrTr1*, and *YrExp2*) only at Warsaw.

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 the autumn of 2011 Virginia growers planted 300,000 acres (121,500 hectares) of wheat and in the spring 270,000 acres (109,350 hectares) of wheat were harvested. The average yield was 65 bu/ac (4,367 kg/ha), which was lower than the previous year. Virginia growers harvested a total 17.6 x 10^6 bushels (475,200 metric ton) of wheat in 2012.

State cultivar tests. In the 2011–12 tests, there were a total of 94 entries planted in seven environments across Virginia (http://www.grains.cses.vt.edu/). The test included 55 SRW wheat cultivars and 39 experimental lines. No-till tests, planted after corn, were conducted at Warsaw and Holland, VA. Mean grain yields varied from 67 bu/ac (4,522 kg/ha) in southwestern Virginia to 99 bu/ac (6,652 kg/ha) in the Shenandoah Valley with a mean yield over all seven locations of 78 bu/ac (5,227 kg/ha). Commercial cultivars SS 5205, USG 3555, USG 3120, Pioneer Brand 26R15, Shirley, USG 3612, USG 3251, and Merl all produced yields (82–85 bu/ac, 5,503–5,704 kg/ha) that were significantly higher than the overall trial average. Average grain yields among the 94 entries ranged from 61.4 bu/ac (4,125 kg/ha) for the long-term check cultivar Massey to 84.9 bu/ac (5,704 kg/ha) for SS 5205. Test weight means among the seven locations varied from 57.2 lb/bu (73.7 kg/hl) in the northern Piedmont to 61.3 lb/bu (78.9 kg/hl) in the Shenandoah Valley. Average test weights of the 94 entries over all seven environments ranged from 56.6 lb/bu (72.9 kg/hl) to 60.9 lb/bu (78.4 kg/hl) with an overall trial average of 59.0 lb/bu (76.0 kg/hl).

Other tests. A report at Kansas State University raised concerns about planting wheat following sorghum. In their study, it appeared that sorghum can express allelopathic effects on wheat germination and emergence when planted after sorghum with effects on yield. To evaluate this effect on our sandy soils, seedling counts were taken on 28 January, 2013, on wheat following sorghum and cotton in three fields at the Tidewater AREC, Suffolk, VA. Wheat was broadcast planted in November 2012 as a cover crop at 1 bu/a seed population. In each field, two for sorghum and one for cotton as previous crops, 5 × 1 m^2 areas were counted. The average seedling population was 85/m^2, and there were no significant differences due to previous crop, either sorghum or cotton.

Mapping studies on Fusarium head blight resistance (FHB) in the SRW wheat cultivars Roane and Jamestown were conducted using data from field and greenhouse experiments. Preliminary results indicated that QTL on chromosomes 1A, 2A, 2B, 2D, 5A, and 7B co-segregate for FHB related traits. The QTL on chromosomes 1A and 7B were associated with both resistance and susceptibility for FHB related traits, while the QTL on 2A, 2B, 2D, and 5A were associated with resistance for multiple FHB traits. Once these QTL are validated, diagnostic markers will be recommended for use in marker assisted selection for FHB resistance in wheat breeding programs.

Virginia Wheat Yield Contest Results. The 2012 contest was conducted statewide and the results can be found in the table below. The top contestants all planted no-till following corn. Congratulations to our winners!

2012 Virginia Wheat Yield Challenge Winners						
Place	Grower	FARM	COUNTY	YIELD BU/AC	PLANTING DATE	VARIETY
1	**Ronnie Russell**	Corbin Hall Farm	Middlesex	111.9	10/10/2011	Pioneer 26R20
2	**Evan Perry**	Corbin Hall Farm	Middlesex	111.1	10/12/2011	USG 3555
3	**Bill Nelson**	Colonial Acres Farm, LLC	Henrico	110.9	10/25/2011	Shirley
4	**John Copland, Jr.**	North Bend Farm	Charles City	105.9	10/17/2011	Shirley
Other Entries in the 2012 Virginia Wheat Yield Challenge						
	Tony Jones	Corbin Hall Farm	Middlesex	108.7**	10/15/2011	Pioneer 26R22
** Contest rules state that there can be no more than two prize-willing entries from the same operation						

Release of the soft red winter wheat cultivar 2013412.

The soft red winter (SRW) wheat cultivar **2013412**, formerly designated as VA06W-412, was derived from the cross 'Tribute (PI 632689) / AGS 2000 (PI 612956) // VAN99W-20 (VA90-54-631 / VA90-52-49)'. Cultivar 2013412 is a broadly adapted, high yielding, full-season, short height semi-dwarf (gene *Rht2*) producing grain that is well suited for dual end uses in both pastry and cracker products. Spikes of cultivar 2013412 are apically awnletted, inclined, mid-dense, tapering in shape, and creamy white in color at maturity. Straw is yellow in color with trace anthocyanin visible near physiological maturity.

In the southern SRW wheat region, average head emergence of cultivar 2013412 (119 days) was 1 day later than USG3555. Average mature plant height of cultivar 2013412 has varied from 32 to 36 inches (81.3–91.4 cm) and is about 1.5 inches (3.8 cm) taller than USG 3555 and 2 inches (5.1 cm) shorter than Coker 9553. On average, straw strength (0 = erect to 9 = completely lodged) of cultivar 2013412 (0–1.3) is very good being most similar to that of Shirley (0.7–1.0) and better than that of cultivar 5187J (1.9–3.8). Cultivar 2013412 has moderate winter hardiness. In Virginia's State Variety Trial, cultivar 2013412 had a three-year (2009–2011) mean grain yield of 84.9 bu/ac (5,704 kg/ha) that was significantly ($P < 0.05$) higher than the overall trial average. Grain volume weight of cultivar 2013412 (59.6 lb/bu, 76.7 kg/hl) was significantly higher than those of nine of the ten top-yielding cultivars.

Cultivar 2013412 is resistant to powdery mildew, leaf rust, and stem rust, and has genes *Pm17*, *Lr*/*Sr24*, and the T1RS·1AL rye–wheat translocation. Cultivar 2013412 expresses an intermediate level of resistance to stripe rust in the adult-plant stages. Cultivar 2013412 is resistant to Barley and Cereal Yellow Dwarf Viruses and moderately resistant to Wheat Soil Borne Mosaic Virus and Wheat Spindle Streak Mosaic Virus. Cultivar 2013412 is moderately resistant to Septoria tritici leaf blotch, Stagonospora nodorum glume blotch, and Fusarium head blight. Although seedlings of cultivar 2013412 are susceptible to Hessian fly (*Mayetiola destructor*) biotypes B, O, and L, it expresses moderate resistance in the field.

Release of soft red winter wheat cultivar Yorktown.

Soft red winter wheat cultivar **Yorktown**, previously designated as VA08W-294, was derived from the cross '38158 (PI 19052) / VA99W-188 [(VA91-54-343 / Roane (PI 612958) sib] // Tribute (PI 632689)'. Yorktown is a broadly adapted, high yielding, full-season, short height semi-dwarf (gene *Rht2*). At maturity Yorktown has yellow colored straw, creamy white colored, slightly-tapering strap shaped, awnletted spikes. On average, head emergence of Yorktown (133 days) in the eastern SRW wheat region is similar to that of Shirley, whereas in the southern SRW wheat region, average head emergence of Yorktown (117 days) has been 1 day later than USG 3555. Average mature plant height of Yorktown has varied from 30 to 35 inches (76–89 cm) and is about one inch (2.5 cm) taller than Branson and two inches (5 cm) shorter than Bess and AGS 2000. On average, straw strength (0 = erect to 9 = completely lodged) of Yorktown (0.8–2.0) is good being most similar to that of USG 3555 (0.7–2.2) and better than that of Bess (1.2 vs. 2.3) and AGS 2000 (1.9 vs. 3.2). Winter hardiness of Yorktown is greater than that of AGS 2000 and USG 3555. Yorktown has exhibited milling and baking qualities that are most similar to those of the strong gluten cultivars Coker 9553, USG 3555, and 5187J. Yorktown was evaluated at 26 locations in the 2011 USDA–ARS Uniform Southern SRW Wheat Nursery, and ranked third in grain yield (77.8 bu/ac, 5,227 kg/ha) among 28 entries. Average grain volume weight of Yorktown (59.6 lb/bu, 76.7 kg/hl) was significantly ($P < 0.05$) higher than that of USG 3555 (58.0 lb/bu, 74.7 kg/hl). In the 2011 USDA–ARS Uniform Eastern SRW Wheat Nursery, Yorktown ranked tenth in grain yield (72.4 bu/ac, 4,865 kg/ha) among 38 entries evaluated over 28 environments. Average grain volume weight of Yorktown (58.8 lb/bu, 75.7 kg/hl) was significantly ($P < 0.05$) higher than those of the check cultivars Shirley (55.8 lb/bu, 71.9 kg/hl) and Branson (56.7 lb/bu, 73.0 kg/hl).

Yorktown is resistant to powdery mildew, leaf rust, and stem rust and has genes *Pm17* and *Lr9* and the T1RS·1AL rye–wheat translocation. Yorktown is moderately resistant in the adult plant stages to stripe rust races (PST-114 and PST-100) prevalent in the eastern U.S. Yorktown is resistant to Barley and Cereal Yellow Dwarf Viruses, but is susceptible to Wheat Soil Borne Mosaic Virus. Yorktown is moderately resistant to Septoria tritici leaf blotch and to Stagonospora nodorum leaf and glume blotch. Yorktown is most similar to the moderately resistant check cultivar Ernie in reaction to Fusarium head blight. Although seedlings of Yorktown are susceptible to Hessian fly biotypes B, C, D, O, and L, it expresses moderate resistance in the field.

Publications.

Christopher MD, Liu S, Hall MD, Marshall DS, Fountain MO, Johnson JW, Milus EA, Garland-Campbell KA, Chen X, and Griffey CA. 2012. Identification and mapping of adult plant stripe rust resistance in soft red winter wheat VA00W-38. Crop Sci 52:871-879.

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A natural dietary-therapy for gluten intolerance, sensitivity, and allergenicity.

Wheat, with its various cytological forms and different ploidy levels, is nourishing the world population from millennia. Wheat is believed to be a determining factor in the human transition from a hunting gathering to an agricultural society. Domestication of durum and bread wheats was a boon to humans, but it also brought unforeseen problems to the society, and continued to be a major cause of premature deaths until recently. The cause of these abdominal disorders, named 'koiliakos' by Aretaeus of Cappadocia, was long unknown until l953 when Willem-Karel Dicke declared 'gluten' from wheat and rye to be the source of these disorders. With the improvement in understanding of etiologies of a number of food-born disorders, and refinement in the diagnostic procedures we now know that 'gluten' is a cause of many diet induced health issues including gluten intolerance, sensitivity, allergies, ataxia, and dermatitis herpetiformis with a cumulative incidence of >8% in the US population.

In view of the magnitude of the problem, we undertook a multipronged approach to develop a natural dietary therapy for the gluten-induced disorders collectively referred as 'gluten syndrome'. The three approaches undertaken in this direction are i) epigenetic elimination of immunogenic prolamins (namely low-molecular-weight (LMW) glutenins and gliadins) using transgenic and nontransgenic approaches, ii) post transcriptional silencing of immunogenic prolamins via RNA interference, and iii) post translational detoxification of prolamins by ectopic expression of 'glutenases' in the wheat grains (the enzymes were selected such that they will degrade prolamins in the human gut only after their intake with food but not within the grains).

Epigenetic elimination of immunogenic prolamins. Earlier research performed on the high-lysine barley mutant Risø 1508 (*lys3a*) revealed two-types of transcriptional regulation for the prolamin genes in the barley endosperm, i) genes whose transcription depend on demethylation of their promoters in the endosperm, such as LMW glutenins and gliadins, and ii) genes whose transcription solely depend on expression of specific transcription factors, such as high molecular weight (HMW) glutenins. Based on the functional similarity between the barley *Lys3* and Arabidopsis *DEMETER* genes, we undertook cloning of barley and wheat homologues of the *DEMETER* gene (Wen et al. 2012 for details).

Induced mutagenesis of DEMETER homoeologues. The *DEMETER* sequences obtained from the wheat genome were used to develop homoeologue specific primers that were utilized to screen for mutations in the hexaploid wheat Express and tetraploid wheat Kronos TILLING populations. The screen for mutants resulted in identification of a total of 191 mutants in the Express and 77 mutants in the Kronos backgrounds.