Poster 47. QTL analysis of Fusarium head blight resistance in two durum wheat backcross derived inbred line populations.

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Host–plant resistance is recognized as the most effective means of controlling Fusarium head blight (FHB) infection. Resistant FHB varieties in hexaploid wheat have been released; however, the progress toward the same goal in durum (*Triticum turgidum* subsp. *durum* (Desf.) MacKey) wheat has been limited. Sources of resistance in durum wheat are few and transferring the resistance genes from hexaploid wheat have met with limited success. The new sources of resistance in Tunisian durum wheat show a promising amount of resistance compared to hexaploid wheat sources. To incorporate the new sources of FHB resistance, two populations of 174 and 171 backcross-derived, inbred lines (BC_1F_6) were developed by crossing Tun108 with durum wheat cultivars Ben and Lebsock. Both populations were evaluated for type-II FHB resistance for two seasons in the greenhouse and two seasons in a field nursery. The analysis of variance for type-II FHB resistance showed significant effects for different environments, different genotypes, and also the 'genotype x environment' interactions (GxE). We observed transgressive segregation for FHB resistance genes in both populations and some progenies were even better than the well-known, resistant hexaploid wheat Sumai 3. A total of 280 polymorphic DArT markers were used for genotyping 168 BC_1F_7 lines of a 'Tun108/Ben//Ben' population. At a minimum LOD of 3, a total of 274 markers were mapped to 201 unique loci belonging to all 14 chromosomes. These markers representing 201 loci covered a genetic distance of 1,555.4 cM with an average distance between any two marker loci being 7.74 cM. Six different QTL were identified in 'Tun108/Ben//Ben' population located on Chromosome 1B, 5A, 5B, 7A, and 7B. The QTL on 5A and 7A were both effective in the field and greenhouse and explain ~9% of total phenotypic variation and 22.5% of genetic variation in the 'Tun108/Ben//Ben' population. One of the QTL from chromosome 1B was inherited from Ben, and the other QTL were from the resistant parent Tun108.

Poster 48. Use of generation acceleration to enhance the transfer of Fusarium head blight resistance into hard red winter wheat.

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A new, winter wheat breeding program has been established at North Dakota State University in response to a growing need for better-performing, regionally adapted cultivars. Economic losses from winter wheat disease susceptibility impact North Dakota annually with leaf rust, Fusarium head blight (FHB), and tan spot ranking among the most damaging diseases. This situation can be offset through breeding tolerant or resistant cultivars.

This project aims to speed up the transfer of FHB resistance QTL from spring wheat by first developing intermediate, semidwarf, FHB-resistant winter wheat inbred lines with reasonable levels of cold-hardiness. Such lines can then be used in crosses with well-adapted, winter-hardy, elite germplasm. Starting material were the F_1 of crosses between winter wheat and ten spring wheat varieties/lines carrying one or more of the FHB resistance QTL: *Fhb1*, *Fhb2*, *Ofhs.ifa-5A*, a Frontana-derived locus on 3A, and two 5A loci derived from PI277012. Doubled-haploid (DH) and/or modified single-seed descent (SSD) inbred lines are being developed for each of the crosses. The material is being selected for winter type, presence of the semidwarfing gene, *Rht-B1b*, and the targeted FHB resistance gene(s) during inbreeding (SSD) or at the completion of the process (DH). Marker-aided selection will be applied where possible to enhance the identification of suitable progenies. The F_5-derived, F_6 inbred lines and DH populations will then be field-tested to identify those with elevated levels of cold-hardiness, better phenotype, and FHB resistance. Selected lines will be used as parents in the pedigree breeding program. Compared to backcrossing, this approach could be quicker and simultaneously avoid a narrow genetic base inherent to the use of a small number of recurrent parents.

Generation acceleration methodology will be developed in parallel to speed up SSD inbreeding. Factorial experiments to determine which stresses and/or hormonal treatment combinations can be applied to limit and hurry plant development are being executed and the results applied to the SSD procedure. The ultimate aim is to achieve three generations of winter wheat per year. Stresses will include, but not limited to small soil volume, extension of daylight hours, elevated temperature, premature harvesting and drying, and prematurely breaking seed dormancy.