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Project ID: FY20-DU-007
ARS Agreement #: *N/A*
Research Category: DUR-CP
Duration of Award: 1 Year
Project Title: Developing Elite Durum Lines with Scab Resistance Derived from Wheat-related Species

PROJECT 1 ABSTRACT

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Durum wheat (*Triticum durum*) is known to be highly vulnerable to Fusarium head blight (FHB) or scab. The objective of this project is to continue developing elite durum germplasm with improved FHB resistance derived from diploid, tetraploid and hexaploid wheat accessions. We previously crossed three durum lines (D151343, D151344, and D151345) carrying *Fhb1* with a high level of FHB resistance, low DON, and good agronomic traits to five new ND durum breeding lines carrying *Cdu1*. Approximately 7,600 F_2 plants were genotyped with the STARP markers for *Fhb1* and *Cdu1* and approximately 400 F_2 plants homozygous for *Fhb1* and *Cdu1* were selected. Although the durum lines derived from these F_2 plants carrying *Fhb1* exhibited further improved agronomic traits, none of them showed a high level of FHB resistance comparable to the three durum lines used as parents. In addition, 14 durum lines evaluated in a yield trial all had lodging problem in Prosper (ND) in 2018. These results suggest that the pre-breeding process based on the simple crosses might not be so effective to improve these lines. Therefore, we proposed to use marker-assisted backcross method to improve the elite durum lines previously developed. In FY20-21, we will develop and genotype approximately 10,000 BC_1F_2 and 10,000 BC_2F_2 plants derived from backcrosses of elite durum lines such as D151343, D151344, D151347, etc. with ND durum variety 'ND Riveland'. An estimated 1,500 – 2,000 BC_1F_2 and BC_2F_2 plants carrying the homozygous alleles for *Cdu1*, *Fhb1*, and QTL from PI 277012 will be selected and rapidly advanced to BC_1F_5 and BC_2F_5 generations using optimal single seed descend procedure. From these BC_1F_5- and BC_2F_5-derived lines, we will select the lines that maintain the high level of FHB resistance and superior agronomic traits as breeding-ready germplasm by disease evaluation and marker analysis. Meanwhile, we will transfer *Fhb7* from wheat-*Thinopyrim ponticum* chromosome 7D/7el2 translocation to 7A or 7B in durum wheat using *ph1b*-mediated homoeologous recombination by backcrossing a wheat 7D/7el2 introgression line RWG52 to the *ph1b* mutant of durum 'Divide'. In the current on-going project, we have identified approximately 24 *T. monococcum* and *T. urartu* accessions with moderate levels of FHB resistance. To transfer the FHB resistance into durum wheat, we have crossed 13 *T. monococcum* accessions to ND Riveland. We are currently developing backcross (BC_1) populations by backcrossing the F_1 hybrids to ND Riveland. In the FY20-21 funding period, we will develop BC_1-derived advance lines with FHB resistance by disease evaluation and selection in greenhouse and field nurseries.