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Scab has made wheat the least reliable/predictable crop in eastern and central NE. There is a great need for cultivars with improved scab resistance coupled with improved management to reduce the detrimental effects of scab and DON, such as Overland and Settler CL with native resistance to FHB and lower DON. Our project will emphasize breeding for scab resistance to reduce the level of DON to acceptable levels in our milling and baking industry. The main approaches will be: 1. Use our scab mist nurseries to identify lines with improved scab tolerance and reduced DON; 2. Use markers to introgress and pyramid known QTLs (Fhb1, Fhb3, 5As, etc.) and track known QTLs in later generations; 3. Use sorting technology to remove undesirable kernel types from segregating populations; and 4. Advance lines through a full range of agronomic, scab and other disease, winter hardiness, and end-use quality tests. In order for a line to be successfully adopted, it must meet more than low levels of DON. In reviewing our database on Nebraska FHB screening, it is clear that native resistance remains an important aspect of our low DON lines. As such, we will continue to screen our preliminary (300 lines), intermediate (60 lines) and elite nurseries (60 lines) in replicated FHB screens. Beginning in 2011-2012, we are modifying our mist nursery to have reticulating sprinkler heads, similar to those at KSU for their highly successful scab testing. Previously we used fine misting heads (as do most FHB screens), but with our constant winds, we believe a heavier droplet will improve our ability to infect and screen for FHB tolerance and low DON. The data from this screen and from our greenhouse screen (60 lines/year) will be added to our database to create a history of DON responses. Based upon these trials and our database, we will identify 10 to 15 lines per year with superior native resistance. These lines will be crossed to adapted elite (identified from our routine marker testing of the preliminary nursery and further agronomic testing) and backcross lines with known Fhb alleles and QTLs (e.g. Wesley Fhb1 and the soon to be developed Overland Fhb1 by collaboration with Dr. Guihua Bai). We expect to make 50 crosses each year. We have decided to narrow the germplasm we are using as parents because many of the spring by winter and hard by soft crosses have not finished well in our hot, dry environments. Of course, as elite soft and spring material are identified we will make crosses, but they will be fewer than in the past. The segregating progeny of these crosses will be screened with molecular markers to enrich the proportion of Fhb alleles and QTLs. They will be advanced through our normal breeding procedure (estimated to be 50 F₂ bulks, 50 F₃ bulks, 4000 headrows, 200 observation plots, 30 preliminary lines annually; the number of lines in the intermediate and elite nurseries will depend upon DON level and agronomic performance) to select for the additional traits that are needed (Baenziger et al., 2001). The elite lines will be tested and compared to existing cultivars with the understanding that reduced DON will be a key trait in the release decision and that many currently grown cultivars are too high in DON. As breeding programs are ongoing, we will evaluate our breeding lines every year, make new crosses every year, inbreed and select every year, and release new cultivars as appropriate. To enhance this effort we will work closely with the efforts of Dr. Guihua Bai to evaluate the best lines from his backcrossing program for scab tolerance, low DON, and adaptation. We will also continue testing new FHB alleles and QTLs to determine if they have pleiotropic effects on agronomic performance in our environments. We will cooperate in the regional public and private scab screening nurseries and screen the state variety trial and RGON (approximately 300 lines/year) for FHB tolerance and possibly for DON.