

Improving Winter Wheat Varieties for Nebraska

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In December, we finished our fall crossing block. We made about 60 crosses. While some involved our traditional parents in the crossing program, many more involved making three way crosses of transgenic wheat lines. We will probably finish up characterizing these transgenes and then decide if further transgenic research is needed. The genes we are using do not seem to be effective against FHB, so we did not receive further funding for transgenic research from the Scab Initiative. In January we completed the Plant Variety Protection (PVP) application for Infinity CL (CL for Clearfield) and sent it out for review. As required by our agreement with BASF, all CL lines must be submitted for PVP protection. In order to continue to access proprietary technology, it is very important that the University enforce its intellectual property rights in accordance to its commercial agreements.

Plants in the winter greenhouses are growing well and we will begin crossing in our main greenhouse crossing cycle in late February and early March. We are looking forward to an excellent crossing cycle. Crossing is always a tedious, but exciting time as your program depends on making the right crosses. In some populations segregating for male sterility and wheat streak mosaic virus, we infected the plants with wheat streak mosaic virus. We hope to severely stunt the susceptible types while selecting for the resistant types. By changing the population to have more resistant plants or by having the resistant types produce more seed (called enriching the population for the trait of interest); we should have a greater chance of selecting resistant progeny, thus making our program more efficient.

We purchased an all terrain vehicle and a sprayer so we can spray relatively large areas of our fields with fungicides (or insecticides if needed). Our goal will be to compare disease free to diseased plants so we can identify lines that are tolerant to the disease and really measure the impact of disease on our lines. In some of our basic studies we spray all of the plots to remove the effects of foliar diseases so we can measure grain yield in the absence of disease.

Probably the greatest change in the Wheat Breeding Program in 2006 will be the day that Mary Shipman decides to retire. The actual day is yet to be decided, but Mary has determined that she will retire sometime in 2006. To plan a smooth transition we will request to hire her successor (no one could be her replacement) in advance of her actual retirement date so that she can help train her successor. Understanding wheat quality has many defined analytical procedures that can be quickly learned, but many other assays require years of experience and unique skills. Hence it will be extremely important to have her successor learn the nuances of wheat quality from a master baker, Mary Shipman. There are no words that can describe the tremendous impact of her service to the wheat industry and consumers.

We have developed a new crossing protocol where we will make a cross in our main winter crossing block (e.g. March) and plant the seed in our following fall crossing block to make the three-way cross. As soon as the crossed F1 seed is harvested (in January), we can plant the seed and vernalize it (completed by March 15), at which time the plants are put back in the greenhouse to allow them to grow to maturity (completed by May 15 to June 1) where F2 seed will be harvested. In this way, we will complete three generations in two years and save one year for our most important crosses. The F2 seed will be planted in bulks in the field in the fall. We are able to do this because we have begun using 4 inch square pots that can be moved easily in and out of the vernalizer and greenhouse in flats of 15 pots. Hence 300 pots take up a very small area and can be handled very easily. Being in an Agronomy and Horticulture department helped us develop this protocol because

the 4 inch square pots are used routinely in horticultural greenhouses. We are also beginning to fully utilize molecular markers and the information derived from markers to design crosses. In our Fusarium head blight (FHB, syn. scab) program we are going to start crossing elite hard red spring lines that contain the main FHB tolerance gene on chromosome 3BS by soft red winter lines that contain the main FHB tolerance gene on chromosome 3BS by elite Nebraska lines that contain the main FHB tolerance gene on chromosome 3BS. By having two parents that are hard, two parents that are winter, and all the parents contain the main FHB tolerance gene on chromosome 3BS, we will create populations that should be homozygous for the FHB tolerance gene on chromosome 3BS and that will segregate for hard vs. soft kernels, spring vs. winter, and lower vs higher protein content. By growing the F2 population over the winter, the spring growth habit segregants will die. With new optical sorting techniques, we can sort the hard from the soft kernels to remove the soft winter wheat types. We can also optically sort red from white seed and higher protein from lower protein, so we can make three way crosses and after one field generation have homozygous FHB tolerant, hard winter lines with red or white seed. Again, these populations will be enriched for desirable traits and will be used for more efficient selection.