Improving Winter Wheat Varieties for Nebraska

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The winter greenhouse crossing block was completed with about 700 wheat crosses, 80 triticale crosses, and 80 barley crosses. All of the crosses have been harvested and most of the greenhouses are also nearly harvested. The winter triticale and barley breeding efforts are designed to provide wheat growers with small grains alternatives to help them with their rotations and farming operations. These alternative crops may also help preserve the end-use quality market for winter wheat. A concern is with the growing importance of grain-based ethanol is that low quality, low protein wheat may be developed for ethanol production that will eventually be blended into the bread grain market, thus hurting its reputation. Triticale, barley, and waxy wheat, which can be more easily identified in the marketplace, could be used for ethanol production.

In cooperation with Dr. Stephen Wegulo and his technologists, the greenhouses were used to screen for stem rust susceptibility. This year's efforts were very good and the observation nursery (slightly more than 1800 lines), the Duplicate (300 lines), the Triplicate (60 lines), Irrigated (40 lines), and the Nebraska Intrastate Nurseries (60 lines) were successfully screened for resistance. This assay is extremely important as the threat of stem rust, though rarely occurring, is potentially the most devastating disease facing Nebraska wheat production. The majority of lines were resistant, so we will be able to select lines for stem rust resistance, agronomic potential, and end-use quality. Our goal is not to advance any line that is susceptible and to not have a line that will be dropped from further testing take up space in our breeding program. We are able to do this because we have over 50 years of accumulating resistance genes to this important disease.

The field research has progressed very well. Currently most parts of Nebraska have adequate moisture and the crop and its diseases are progressing very quickly. So far the major diseases are leaf rust, barley yellow dwarf virus (BYDV), and Septoria leaf blotch (a leaf blotch disease that is often confused with tan spot) in eastern NE. Stripe rust has been found at Mead, which tends to be a little bit cooler, hence favors stripe rust over leaf rust. We will begin surveying our nurseries to see how far west these diseases are found. Both diseases require free moisture on the leaves for their spread, so the past drought years have generally reduced our ability to select for resistance. Two of the surprises with leaf rust have been the very susceptible nature of Jagalene and the continued resistance of Millennium and its related lines to this disease. Jagalene, which is the most popular variety in the state (about 30%), should be sprayed with fungicide to protect its yield potential where leaf rust is present. Millennium and Wahoo, both have the leaf rust resistance from Brule (*Lr16*, usually coupled with he defeated gene *Lr24*) via Arapahoe, which has been remarkably durable (e.g. continues to be resistant) for the last 30 years. Fortunately, a heavy disease season allows us to select for lines that are resistant and generally do not require fungicide application to protect their yield potential. So far, NE01643 (Husker Genetics Brand Overland) continues to have clean leaves indicating it has some resistance to leaf rust, BYDV, and Septoria leaf blotch. However, Overland is a little later than some lines and disease resistance is affected by maturity. For example, Harry was assumed to be resistant to stripe (yellow) rust initially because it was later and by the time it was susceptible to strip rust, the temperature had gotten too warm for good stripe rust infection. Only with the advent of less temperature sensitive stripe rust did we discover Harry was truly susceptible to stripe rust. Of course, we continue to screen for many other diseases (e.g. wheat streak mosaic virus in cooperation with Gary Hein), and insects (Hessian fly in cooperation with Ming Chen at Manhattan, KS). Stephen Wegulo and his crew is rating the Duplicate, the Triplicate, Irrigated, and the Nebraska Intrastate Nurseries which will provide an unbiased and high quality evaluation, as well as, save the breeding program time. Their efforts are truly appreciated.

We will know in the next 14 days if our Fusarium head blight screening nursery was successful in differentiating resistant and susceptible lines.

Our Clearfield qualification trials continue to perform well. NH03614, an excellent line for the northern Great Plains continues to impress us and seems to be earlier than Infinity CL, which will allow growers greater choices among winterhardy, high quality lines.

Lan Xu and the Plant Quality Laboratory continue to do an excellent job of getting data back to us in a timely fashion. She discovered a discrepancy between the dye-binding method for protein estimation and other protein estimates, hence is devoting considerable time to identifying the most accurate method of protein measurement. The standard method has evolved from the dye binding method (the least expensive) to the NIR method which is approved by the American Association of Cereal Chemists (AACC), hence Lan has trained her technician to use the NIR and is beginning to develop a dataset to ensure the NIR calibration curves are accurate for the diverse samples a breeding program needs analyzed. While she is working through developing the best calibration data set, the data are still very useful because they are "relative" values and lines that are high will be high in any protein test and lines that are low will be low in any protein test, hence the lines can be easily ranked even if we are not sure of their exact protein content.

The efforts of program technologists, Greg Dorn and Mitch Montgomery, in the field and greenhouse, respectively, have been essential to the continuity and excellence of the breeding program.

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