Three New Winter Triticale Agronomy Experiments at Lind

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Winter triticale shows excellent potential as an alternative crop in Washington's low-precipitation (<12 inch annual) zone where winter wheat-summer fallow is the dominant crop rotation (see related winter triticale articles on previous two pages). Three new winter triticale agronomy experiments were initiated in late August 2014 at the WSU Dryland Research Station near Lind. These experiments are briefly described below. All experiments were planted into summer-fallowed ground.

1. Early versus late planting date experiment. The variety 'TriMark 099' was planted deep into carryover soil moisture at a seeding rate of 40 lbs/acre on 16-inch row spacing on August 26. The same variety was "dusted in" at a shallow depth at a seeding rate of 60 lbs/acre in paired rows on 12-inch spacing on October 21. The winter wheat variety 'Otto' was planted with the same seeding rates and drills on the same two dates. Each treatment is replicated six times in a randomized complete block arrangement. Early-planted stands of triticale and wheat are good. Appreciable fall rain did not begin until November, and late-planted triticale and wheat did not emerge until February; but stands are good.

2. Seeding rate for late-planting experiment. For the past five years, WSU researchers in the dry region have used a 60 lbs/acre seeding rate for late-planted winter triticale in cropping systems trials near Ritzville. Due to relatively low number of head-bearing tillers with late-planted winter triticale, we are curious to see if increasing seeding rate will affect grain yield. The variety 'TriMark 099' was planted at a shallow depth at a seeding rate of 30, 60, 90, and 120 lbs/acre on October 27 with a paired-row drill on 12-inch row spacing. The winter wheat variety 'Otto' was planted using the same four seeding rates and with the same drill on the same date. Neither triticale nor wheat emerged until February. This spring there are striking differences in plant stands among the treatments. Grain yield components (number of heads per unit area, kernels per head, and kernel weight) as well as grain yield will be determined. Beginning in the 2016 crop year, this experiment will also be conducted on the Mike Nichols farm in the western part of the Horse Heaven Hills in Benton County.

3. Winter triticale variety experiment. Work by Howard Nelson, Central Washington Grain Growers, in Douglas and northern-Lincoln Counties has shown that 'TriMark 099' is generally the highest-yielding winter triticale variety. No such testing of triticale varieties has taken place in the Adams, Franklin, or Benton Counties where precipitation is considerably lower. We are evaluating six winter triticale varieties planted both deep into stored moisture in late August as well as planted shallow in mid-October. We use a deep-furrow small-plot drill with 16-inch row spacing for early planting and a single-disc drill on 6-inch row spacing for late planting. The winter wheat variety 'Otto' is also included for both planting dates. There are four replicates of each treatment for both planting dates. In addition to the Lind site, this experiment will be conducted on the Mike Nichols farm in the western Horse Heaven Hills in the 2016 crop year.

Stripper Header Stubble May Conserve Fallow Moisture

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The 2013-2014 growing season was very dry for both farmers and researchers, with the site of the Ralston Project receiving only 7.4'' of rain, 1.4'' of which fell from May 1 to October 15, 2014. Triticale and tall winter wheat ('Farnum') are being grown in the cereal phase of the rotation for their high residue production. These cereals are harvested with a stripper header to leave a tall standing stubble that is managed with chemical fallow and compared to a system where wheat is harvested with a cutter bar (shorter stubble) and managed under a reduced tillage fallow. Soil sheltered by tall

(36 in) triticale stubble experienced lower wind speeds than soil that had undergone reduced tillage operations that removed the standing stubble buffer. When measured 6 inches above the soil surface, the maximum recorded wind speed over reduced tillage soil was 12.17 mph, while its counterpart that was sheltered by stripper header triticale residue recorded a maximum speed of only 4.34 mph. These differences in wind speed likely contributed to the difference in seed zone soil moisture that was recorded at planting. Establishment of winter canola was better in the stripper header triticale residue than in the reduced tillage fallow as a result of these moisture differences, allowing us to meet our goal of being able to establish winter canola in no-till fallow in the low rainfall zone.

Video presentation available at REACCH PNA YouTube channel, https://youtu.be/XTxAq-F3V10.

Part 3. Pathology

Identifying New Sources of Stripe Rust *(Puccinia striiformis f. sp. tritici)* Resistance in East African Bread Wheat Accessions

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Improving crop resistance to diseases of economic importance is a key element of increasing crop productivity. Stripe rust, caused by the fungus *Puccinia striiformis* f. sp. *tritici*, is a widespread and major threat to wheat production in the Pacific Northwest of the US and the world. Characterizing new sources of resistance and incorporating multiple genes into elite cultivars is required to develop cultivars with diversified resistance genes that can provide protection against the dynamics of pathogen virulence. The aim of this research was to identify quantitative trait loci (QTL) or genes conferring resistance to stripe rust in a germpasm panel composed of 190 east African bread wheat landraces. The accessions were characterized for stripe rust resistance under field conditions in six disease environments in Washington. Seedlings of the accessions were also tested for resistance to important races of the pathogen under greenhouse conditions. The germplasm were genotyped with 90,000 Single Nucleotide Polymorphism (SNP) markers that are distributed across the whole genome. Analyses of genotypic data and phenotypic trait values were carried out to identify regions conferring stripe rust resistance in this germplasm. Twenty five (25) accessions showed a high level all-stage resistance to stripe rust across all test locations, while 27 accessions exhibited good level of resistance at later stage wheat plant growth. Genotype-phenotype analyses detected 83 loci associated with stripe rust resistance in at least three tests. Eleven of these genomic regions showed strong and stable association for conferring stripe rust resistance. For seedling resistance, seven significant genomic regions were detected, two of which were among the eleven QTL detected at adult plant stage. The molecular markers of the genomic regions detected in this study for resistance to stripe rust should be useful in marker-assisted selection in wheat breeding after validation using proper germplasm and populations.

Searching for New Sources of Resistance to Stripe Rust in Diverse Accessions from the USDA-ARS Spring Wheat Core Collection

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Developing wheat cultivars adapted to the Pacific Northwest region is challenging due to stripe rust epidemics that are often triggered by emergence of new virulent races of the fungal pathogen, *Puccinia striiformis* f. sp. *tritici*. As part of the Triticeae Co-ordinated Agricultural Project (TCAP) funded by the USDA-NIFA, the wheat improvement program of WSU was tasked with the identification of new sources of resistance to stripe rust. To achieve this objective, 1,000 diverse accessions of spring wheat from the USDA-ARS wheat core collection were evaluated for resistance under natural disease