

RESEARCH GRANT REPORT NEBRASKA WHEAT BOARD

PROJECT TITLE: Advanced screening for evaluating wheat streak mosaic virus resistance for quality Nebraska wheats

PROJECT TIME PERIOD: July 1, 2008-June 30, 2009

PRINCIPAL INVESTIGATOR: Gary L. Hein, Department of Entomology, University of Nebraska–Lincoln, Scottsbluff (402) 472-3345.

COLLABORATORS: P. Stephen Baenziger, Dept. of Agronomy, UNL; Robert Graybosch, USDA-ARS, UNL; Stephen Wegulo, Plant Pathologist, Dept. of Plant Pathology, UNL.

Wheat streak mosaic has been the most damaging disease in winter wheat in the major growing areas of Nebraska. For a number of years wheat breeding efforts have been directed at developing varieties that are resistant to wheat streak mosaic, but limited progress was made. Recently, breeding efforts have identified much more effective sources of resistance to wheat streak mosaic. Our virus screen trials over the last few years have verified that the varietal response in the field for some of these lines is very strong. We have also been able to characterize the resistance levels of many current varieties. In addition, we have performed this screening in the field and have been able to expose the screened lines to the newly identified virus, Triticum mosaic virus, that is also transmitted by the wheat curl mite. Recent testing of frozen samples collected through the last several years from the screen indicates that Triticum mosaic has been present in our screen for several years. This virus screening project is aimed at assisting the UNL and ARS wheat breeding programs at UNL by screening for virus resistance under relatively natural conditions in the field to allow for more effective and efficient development and evaluation of Nebraska wheat varieties for WSMV resistance.

The 2008-09 screen again showed significant severity of wheat streak mosaic. However, the severity was not as extreme as we have seen in the last few years. Factors related to the mite infestation procedures did impact the screen this year. During the summer of 2008, the volunteer wheat for building up mite populations for the screen did not grow well because it was severely impacted by stress from virus presence and rust. As a result, mite populations crashed as the volunteer died back. We planted another planting of volunteer wheat early enough to become infested with mites, but it was infested at a low level. We sought to supplement mite populations by collected pre-harvest volunteer that we located near Gordon, NE. We have done this supplementing regularly in the past with good success; however, the resulting virus infection in the plots was a bit different than we have seen in the past. First, because mite populations were somewhat lower than we have had in the past, infections were spotty with more severe and less severe patches of infected wheat across a single treatment row. This type of spotty infections are unusual for wheat streak but do result when mites infest isolated plants, build up on these plants and then spread to adjoining plants. Another unusual situation was seen in the performance of RonL, a WSMV resistant line that is susceptible to Triticum mosaic virus. For the first time in several years in our screen, RonL performed very well (see Table 1). This indicates that there

was likely not extensive presence of Triticum mosaic virus in the screen. These results suggest that mite populations collected around Gordon did not carry Triticum mosaic virus like populations of mites we have collected in the past from other areas around the panhandle. This is surprising, but apparently, we have a lot to learn about this new virus.

The virus symptoms for the entire trial show that the impact on the plants was apparent (see Table 1 for yellowing, stunting and SPAD readings). RonL, Mace and the other highly resistant line (NW04Y2188) remained green well into the heading stages as demonstrated by the higher relative chlorophyll (SPAD) readings. The overall severity of the screen was down but still very significant. SPAD readings for Tomahawk (susceptible check) and other susceptible lines were in the low 20's, indicating very severely yellowed plants, and the stunting values for several of these lines indicated stunting in the range of 30-50%. Yield samples for the entries in this trial are currently being cleaned and weighed, and they will be provided at a later time.

The 2008-09 screen also contained 52 entries from Dr. Baenziger's advanced lines. We were able to rate these lines based on virus symptoms and selected several good heads from the top 15 lines to provide to Dr. Baenziger for additional development.

Also in the screen was a study that compared the extent of virus that developed in three lines, ranging from susceptible to resistant, and across three planting dates. The three planting dates were August 19, September 5 and September 25. Data from the study are shown in Figure 1. Damage symptoms, as measured by decreased relative chlorophyll ratings, increased with the earlier plantings. This was most dramatic for the more susceptible varieties, Tomahawk and Millennium. Tomahawk, the most susceptible variety, even showed very significant impacts from the disease for the last planting date. In addition, Mace, the resistant variety, showed increasing symptoms for the earlier planting dates. These data indicate that planting date can dramatically impact damage from this disease complex even with the more resistant lines.

Table 1. Wheat virus screen of various advanced and commercial winter wheat lines, Panhandle Research and Extension Center, Scottsbluff 2008-09.

Variety	Yellowing	Stunting	SPAD
RonL	40.2	81.7	1.7
Mace	36.4	93.3	1.3
NW04Y2188	35.4	91.7	1.7
Ripper	33.9	71.7	2.7
NE02558	33.9	63.3	2.0
NW03654	33.3	58.3	2.7
Winterhawk	33.1	66.7	2.0
NX04Y210	32.2	53.3	3.3
2145	31.6	61.7	2.7
NI04420	29.6	61.7	3.0
NuDakota	29.4	48.3	3.7
Keota	29.1	51.7	2.0
NE05549	28.7	56.7	3.0
NE03490	28.2	61.7	3.0
NE05496	28.1	68.3	3.3
Apsen	28.0	78.3	2.7
Wesley	27.9	43.3	3.0
NI04421	27.9	68.3	2.7
NE05548	27.1	53.3	3.0
Overland	27.0	66.7	2.0
NE04490	26.9	58.3	3.0
NW03666	26.5	53.3	2.7
Pronghorn	25.4	65.0	3.0
Arrowsmith	25.4	71.7	2.3
NE05426	25.3	41.7	4.0
Infinity	24.7	68.3	2.3
Turkey	24.4	71.7	2.3
Millennium	24.0	58.3	3.0
Bond CL	23.7	56.7	3.0
Hawken	23.7	41.7	4.0
Smokey Hill	23.7	33.3	3.3
Tomahawk	23.7	36.7	4.0
Scout 66	23.0	68.3	3.3
NE02533	22.3	46.7	3.3
Bill Brown	21.7	30.0	3.0
	P>F	<.0001	<.0001
LSD	5.42	14.70	0.77

Figure 1. Relative chlorophyll readings for three wheat varieties planted at various planting dates in the wheat streak mosaic virus screen, PREC, Scottsbluff, 2008-09.

