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, 2009-June 30, 2010

PRINCIPAL INVESTIGATOR: Gary L. Hein, Entomologist, Panhandle Res. & Ext. Center, Scottsbluff (308) 632-1369.

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

FINAL RESEARCH PROJECT REPORT: (Oct. 2010)

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 several 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. This 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. These trials have provided data that demonstrates the levels of virus resistance in a new variety, Mace (N02Y5117), released last year.

This is the first year that the screen has been conducted in eastern Nebraska, and the processes of establishing and conducting the screen have been tested in this environment. The process that we followed in the summer of 2009 enabled us to establish wheat that served as a significant mite source in order for them to move into the screen that was planted in September. Mite populations did build up through that summer in the screen to significant levels. The advanced and commercial screen has 30 entries each replicated three times. We also tested 110 of Dr. Baenziger's advanced lines, along with 60 entries from the Nebraska Intrastate Nursery (NIN). We also were able to establish a study looking at the effects of planting date on various selected varieties – planting dates: August 25, September 10, and October 4.

Mite numbers in the screen had build up to acceptable levels by late September and movement of mites into the studies is documented by the impact of virus infection symptoms as expressed by relative chlorophyll readings (SPAD) on the plants in both the commercial screen (Figure 1) and the planting date study (Figure 2). The uniformity of infection may not be as high as preferred but the extent of damage allowed a good comparison of entries.

Separation of damage symptoms developed variably across the varieties with Tomahawk the susceptible check showing extensive viral impact. By the end of the season this variety was essentially dead and only minimal seed production was seen. Pronghorn and millennium were intermediate, but still with heavy symptomology in early June. The resistant varieties Mace and KS07HW52-5-2 from Kansas State Univ. both showed strong resistance but by the end of the

season the impact of virus presence was beginning to show. The resistance in these two lines comes from different sources -- Wsm1 for Mace and Wsm2 for the KS line. In this screen the performance of both was very good but visually you could see improved plant condition for the KS line.

It was a relatively cool spring and this delayed development of symptoms because the resistance in both lines is temperature sensitive. Symptoms stayed reasonably consistent until early June when symptoms across the board began to go down. This also occurred for the planting date study (Figure 2, 3) but the earlier symptoms for the first planting date were lower than the other planting dates. By the end of the season the Tomahawk in the first planting date was extremely stressed and little seed yield was obtained. Even Mace date was beginning to show significant symptomology in late May and early June (Figure 3). These results point out the need that even with the resistant lines other management practices will need to be targeted to make sure the impact of these wheat viruses is minimized.

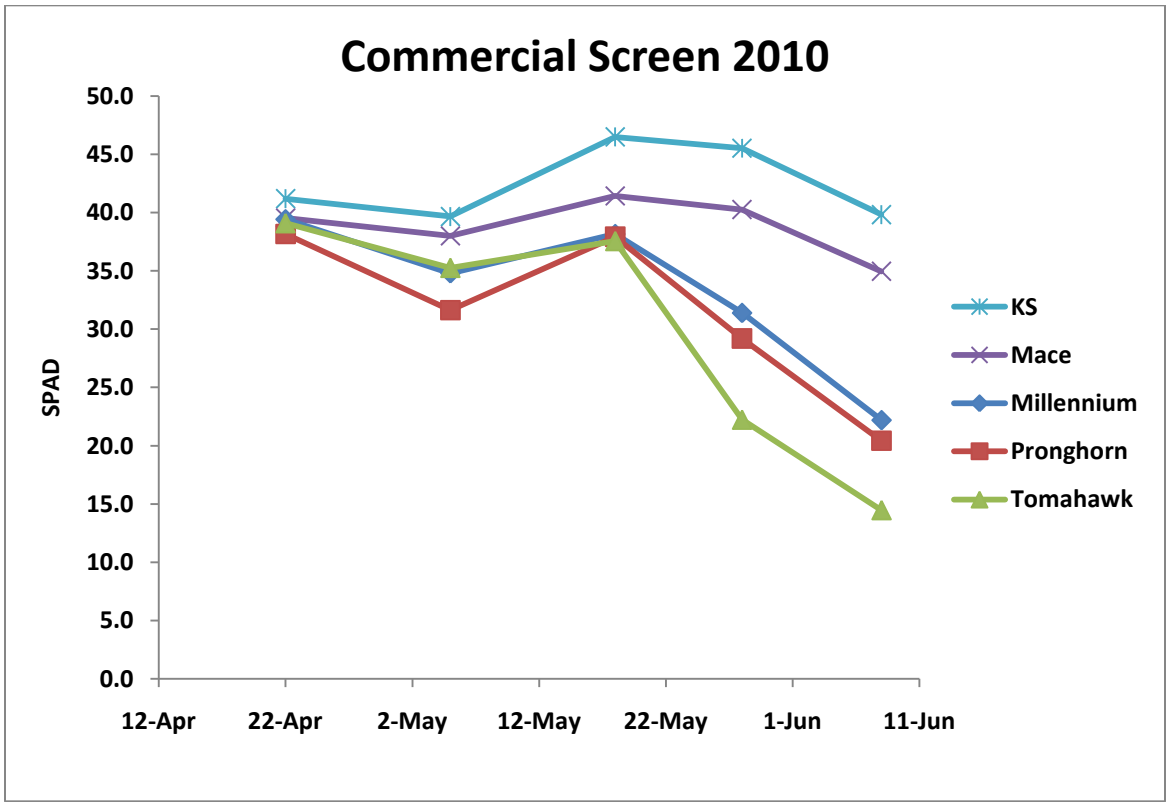

Figure 1. Relative chlorophyll (SPAD) response across five commercial lines of wheat to the presence of wheat virus infections, 2010, ARDC, Mead, NE.

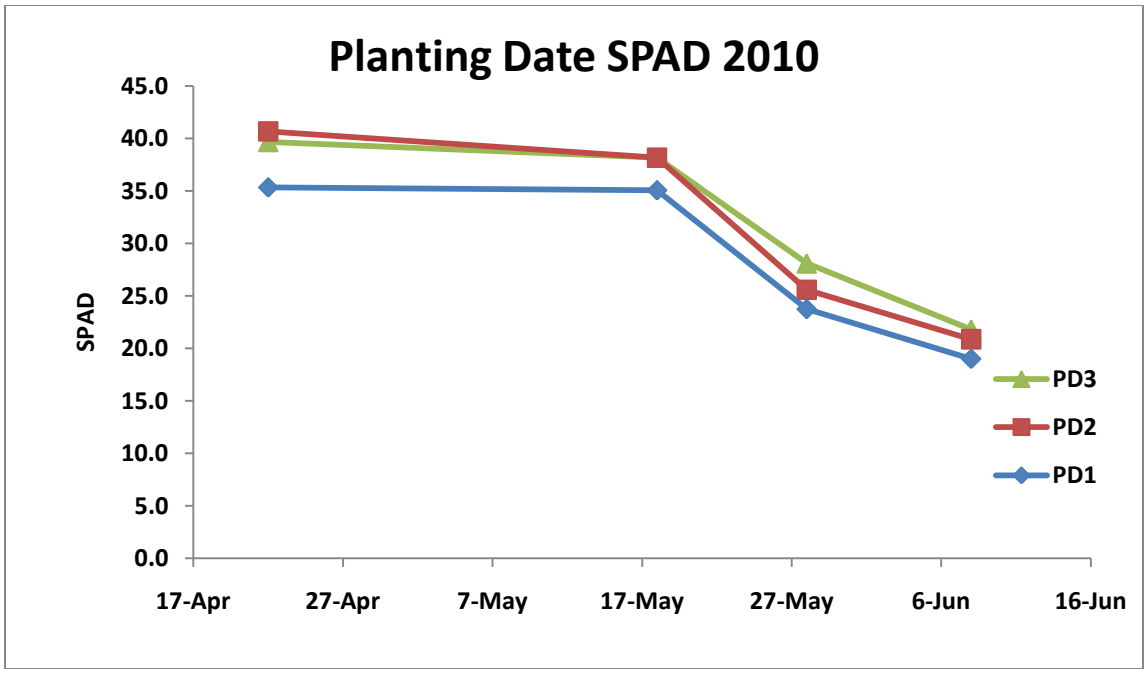

Figure 2. Relative chlorophyll (SPAD) response to the presence of wheat virus infections across three planting dates, 2010, ARDC, Mead, NE.

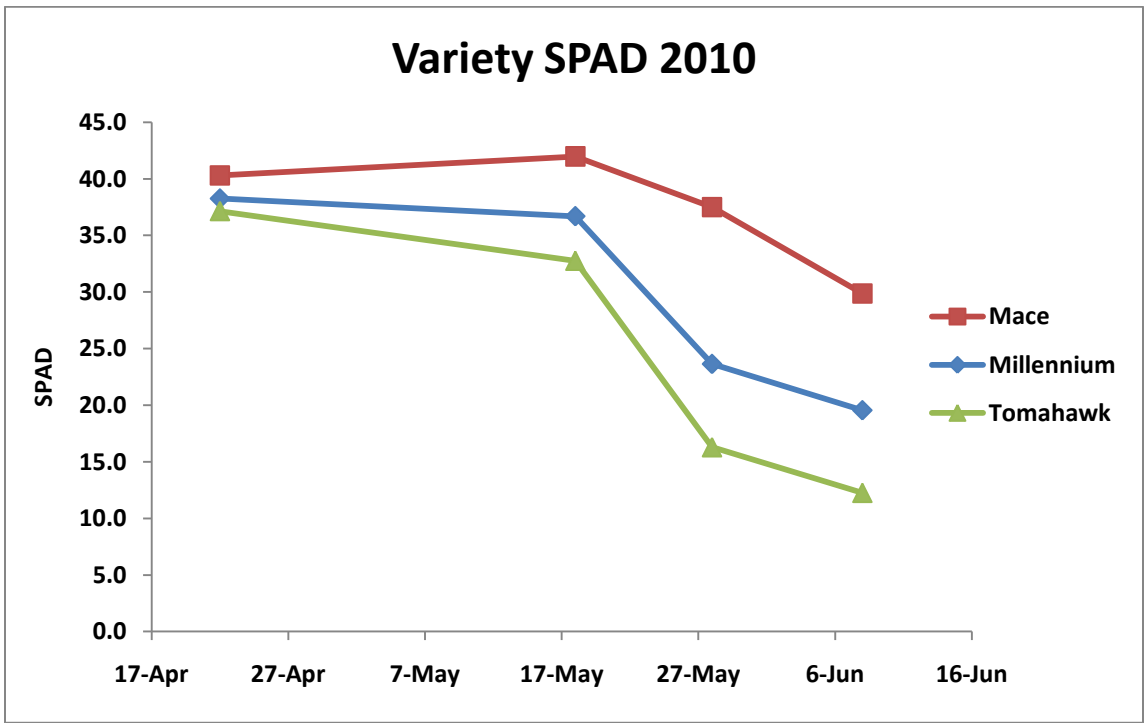

Figure 3. Relative chlorophyll (SPAD) response across three varieties averaged across three planting dates, 2010, ARDC, Mead, NE.