

Project Title: Effect of seed color on spring wheat resistance to the orange wheat blossom midge

Objective: Determine if spring wheat resistance to the orange wheat blossom midge varies by market class

Materials and Methods:

Ten hard red and ten soft white spring wheat varieties were evaluated for resistance to the owbm as well as for agronomic performance. This study was established in a field which had been in spring wheat for the previous five years and had a history of moderate to high midge densities. The study was conducted using conventional tillage and was fertilized with 97-30-120-24 lb/A of N-P-K-S. Treatments were seeded at a rate of 75 lb/A in six inch wide rows, to a depth of two inches on May 7, 2010. Individual treatments consisted of seven, 15 foot long rows, with each treatment replicated three times in a randomized complete block design.

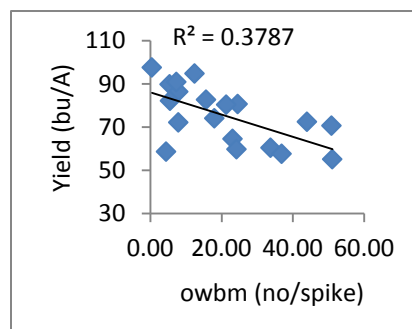
Heading was recorded when 50 percent of the plants in a plot had half the spike exposed. Plant height measurements were taken the first week of August. Three spikes were sampled from each plot on August 9. Each spike was dissected and the number of larvae and seeds counted. Plots were harvested on September 13 to determine grain yield, protein, test weight, thousand kernel weight, falling numbers, and polyphenol oxidase (PPO).

Results:

Midge densities varied depending on variety, ranging from a low of 0.44/spike for Treasure, to a high of 51.11/spike for Eden (Table 1). Nonetheless, market class did not influence infestation levels. Larval densities were lower than normal and averaged 20.6/spike among the soft white varieties and 23.67/spike with the hard reds. The lack of adequate insect pressure may have negated any meaningful effect attributed to market class.

Midge densities were low, but still had a negatively affect on yield (Figure 1). Midge densities did not differ between market classes, but yields did. The soft white class averaged 80.47 bu/A as compared to 67.96 for the hard red class. Treasure and Eden were the highest and lowest yielding soft white wheats, while Faller and Solano were the highest and lowest yielding hard red wheats.

Figure 1. Effect of owbm density on yield.



Not surprisingly, protein also varied between market classes since yield is inversely related to protein. The soft white and hard red varieties averaged 11.34 and 14.06 percent protein, respectively. The range in protein levels was greater with the hard reds, which varied from a high of 15.97 for Solano to a low of 12.43 for Faller. In contrast, soft whites varied from a high of 12.37 for Eden to a low of 10.53 for Treasure.

Polyphenol oxidase content was the only other trait that varied by market class, with the hard red varieties averaging 1.0293 compared to 0.5790 for the soft white varieties. This study was predicated on the fact that hard red varieties would have higher phenolic levels than soft white varieties. As such, it's not surprising that hard reds would have higher PPO levels. Polyphenol oxidase levels increased as thousand kernel weight increased, as protein increased, and as plant height increased ($r^2 = 0.49, 0.48,$ and 0.45 , respectively).

There were no significant differences between market classes for any of the other response variables. Test weights were low and averaged 57.86 lb/bu. Reeder had the highest test weight while Solano had the lowest. Solano was also the shortest variety in the experiment, while Fortuna was the tallest. Heading occurred over seven days, with the average being 187 (July 6). Choteau was the earliest while Volt was the latest.

Overall, the results demonstrate that while midge densities vary among varieties, there are no differences in oviposition preference between hard red and soft white varieties.

Table 1. Agronomic performance among hard red and soft white spring wheats.

Variety	Yield bu/A	Protein %	TWT lb/bu	TKW g	Heading Julian	Height inches	owbm no/spike	PPO	FN sec.
<i>soft white</i>									
Treasure	97.60	10.53	57.53	36.68	190.00	37.40	0.44	0.4376	335
Nick	94.80	11.10	58.53	44.71	185.30	38.45	12.44	0.5354	344
Cataldo	89.80	10.90	57.70	44.35	184.70	38.85	5.44	0.4069	327
Calorwa	86.40	11.03	56.73	39.00	186.70	36.09	7.89	0.3747	409
Pettit	82.70	11.07	57.77	38.52	184.70	32.81	15.67	0.3755	269
Alturas	80.70	11.07	58.00	45.19	188.30	38.85	24.55	0.5113	316
Louise	80.40	10.83	57.93	51.77	188.70	41.21	21.33	1.0150	254
Jubilee	72.50	12.27	58.90	38.39	191.30	40.94	44.00	0.3493	335
Alpowa	64.60	12.27	57.93	45.40	189.00	40.55	23.11	1.2916	262
Eden	55.20	12.37	57.90	39.11	189.00	37.93	51.11	0.4926	261
<i>hard red</i>									
Faller	90.90	12.43	57.97	42.30	188.30	41.08	7.33	1.1559	447
Reeder	82.20	13.50	60.33	41.40	186.00	40.68	5.56	1.2520	392
Amidon	74.10	12.87	58.60	40.33	185.00	47.11	18.00	1.0369	442
Choteau	72.20	13.87	58.17	39.51	184.00	36.22	7.89	0.8029	418
Hank	70.70	13.27	56.97	46.59	185.70	37.80	50.89	1.1784	331
McNeal	60.50	14.57	57.60	40.11	188.30	38.58	33.78	0.7781	456
Vida	59.80	14.33	58.73	41.74	188.70	40.03	24.22	1.4159	253
Fortuna	58.70	15.37	57.20	45.53	187.30	47.51	4.45	1.4795	336
Volt	57.70	14.37	57.20	29.85	191.70	37.66	36.89	0.4666	309
Solano	52.80	15.97	55.47	39.32	190.00	31.50	47.67	0.7272	267
<i>white vs red</i>									
LSD (P=.05)	7.17	0.60	NA	NA	NA	NA	NA	0.17	37.30
CV	18.69	9.17	2.03	11.18	1.32	10.04	104.56	42.28	21.30
TRT Pr>F	0.0009	0.0001	0.8183	0.1753	0.6799	0.1417	0.6097	0.0001	0.0054
<i>among varieites</i>									
MIN	52.80	10.53	55.47	29.85	184.00	31.50	0.44	0.3493	253
MAX	97.60	15.97	60.33	51.77	191.70	47.51	51.11	1.4795	456
MEAN	74.22	12.70	57.86	41.49	187.64	39.06	22.13	0.8042	338
LSD (P=.05)	12.13	1.49	1.30	2.00	1.91	2.23	32.02	0.2532	70.56
CV	9.90	7.11	1.36	2.91	0.62	3.47	87.67	19.08	12.61
TRT Pr>F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0183	0.0001	0.0001

Planted May 7, harvested September 13.