

Project Title: Effect of Spring Wheat Planting Date on Resistance to the Orange Wheat Blossom Midge (OWBM)

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Objectives: To identify spring wheat genotypes that are resistant to the orange wheat blossom midge.

Results:

This study was conducted a field with a previous history of low to moderate midge densities. The soil type was a Creston silt loam (25-50-25) and the field was fertilized with 100-30-60-24 lb/A of N, P, K and S, respectively.

Twenty six spring wheat entries were evaluated for resistance to the orange wheat blossom midge (OWBM). The 26 genotypes consisted of 6 experimental lines from Dr. Berzonsky's spring wheat breeding program at NDSU, plus twenty commercially available varieties from Dr. Talbert's uniform off-station spring wheat nursery.

The spring wheat entries were planted as three non-replicated trials, with each trial consisting of a different planting date. Since wheat is most vulnerable to midge damage from heading through pollination, the three planting dates were use in order to assure that each entry would be exposed to adequate midge pressures, regardless of individual maturity differences.

The planting dates were May 16, May 20, and May 27, with corresponding growing degree day units (base 40° F) of 179, 273, and 353, respectively. Entries were seeded at a rate of 78 lb/A to a depth of 1.5 inches. Each plot was 15 foot long and consisted of 7 rows, spaced 6 inches apart.

Heading and pollination were recorded when 50 percent of the plants in a plot had reached the corresponding growth stage. Exposure duration (ED) was calculated as the time period between these two events. Three randomly selected heads were collected in late August. Each head was dissected and the number of larvae, exuviae (cast off skins), damaged kernels and healthy kernels were determined. Larvae and exuviae numbers were added to arrive at a total larvae infestation. Entries within each of the three planting dates were harvested on September 16, September 19, and September 29, respectively. Grain yield, test weight, and moisture were determined.

There was good synchronization between adult midge emergence and spring wheat heading. Midge adults were first observed in emergence traps on June 30 (Julian 181; 923 GDD₄₀), and continued to be detected in pheromone traps well into the second week of August. Concurrently, spring wheat heading occurred from July 8 through July 24 (Julian 189 through 205) depending on the genotype and planting date (Table 1). The susceptible exposure period

for midge damage to occur (ED) ranged from 2 to 11 days depending on the cultivar/line and planting date. However, there did not appear to be any association between plant developmental rates, midge damage, or yield.

Averaged over all other factors, the first, second, and third planting dates corresponded to midge densities of 29, 33, and 35 larvae per spike, respectively (Table 2). Midge densities varied from a low of 0 larvae/spike for CAP19 to a high of 67 larvae per spike for PF906408. In addition to CAP19, NDSW0501, MT 0415, and Reeder also had low larvae numbers. CAP 19 carries the SM1 gene for resistance, but the mechanism of resistance is unknown for NDSW0501, MT 0415, and Reeder. However, the results suggest that a wide range in oviposition preference exists among the materials grown in this nursery. The most susceptible entries included Choteau, Hank, and Jedd, with each averaging 50 or more larvae per spike.

There was good agreement between larvae numbers and yield. Averaged over planting dates, yields ranged from a high of 60 bu/A for CAP19 and NDSW0608 to a low of 22 bu/A for Jedd and Choteau. Likewise, there was a close association between larvae numbers and test weight, with test weights decreasing as larvae numbers increased (Table 3). Averaged over planting dates, test weights varied from a high of 61 lb/bu for Reeder and NDSW0608 to a low of 54 lb/bu for Outlook and Choteau.

Summary:

Midge numbers were less than the previous year's high of 213 larvae per spike, which was recorded for Hank. Nevertheless, yields were negatively affected during 2008. More importantly, this year's results have provided confirmation as to which materials demonstrate resistance towards this pest. In particular, CAP 19, NDSW0608, NDSW0501, MT 0415, and Reeder have demonstrated resistance during both growing seasons.

Future Plans:

Discontinue the planting date nursery.

Table 1. Wheat development as affected by planting date (PD) and cultivar at Kalispell, MT.

Cultivar	Heading date (Julian days)				Anthesis (Julian days)				Exposure duration (days)			
	1st PD	2nd PD	3rd PD	mean	1st PD	2nd PD	3rd PD	mean	1st PD	2nd PD	3rd PD	mean
CAP19	196	199	205	200	198	204	210	204	2	5	5	4
NDSW0501	189	194	199	194	196	199	204	200	7	5	5	6
MT 0415	192	196	200	196	196	200	205	200	4	4	5	4
REEDER	193	196	201	197	196	202	205	201	3	6	4	4
VOLT	198	202	205	202	203	205	211	206	5	3	6	5
NDSW0608	191	196	199	195	196	204	207	202	5	8	8	7
AC Lillian	193	198	202	198	199	202	211	204	6	4	9	6
CAP20	190	196	202	196	196	198	205	200	6	2	3	4
KELBY	189	196	198	194	196	203	204	201	7	7	6	7
FORTUNA	191	196	201	196	196	204	211	204	5	8	10	8
VIDA	193	198	204	198	196	202	211	203	3	4	7	5
CONAN	192	196	202	197	199	207	212	206	7	11	10	9
NDSW0449	193	198	203	198	198	203	207	203	5	5	4	5
NORPRO	193	198	203	198	197	204	207	203	4	6	4	5
ONEAL	192	196	202	197	198	205	211	205	6	9	9	8
FREYR	192	197	202	197	196	203	207	202	4	6	5	5
KUNTZ	194	198	201	198	198	204	207	203	4	6	6	5
CORBIN	191	196	201	196	196	202	211	203	5	6	10	7
MCNEAL	193	197	203	198	196	204	211	204	3	7	8	6
PF906408	190	195	200	195	197	205	211	204	7	10	11	9
NDSW0601	194	198	203	198	197	203	207	202	3	5	4	4
MTHW0471	195	198	204	199	202	204	211	206	7	6	7	7
OUTLOOK	195	199	203	199	198	202	211	204	3	3	8	5
JEDD	189	195	199	194	196	199	205	200	7	4	6	6
HANK	189	195	201	195	196	202	207	202	7	7	6	7
CHOTEAU	189	196	203	196	195	199	211	202	6	3	8	6

Data is sorted based on cultivar rankings for susceptibility to OWBM infestation.

Table 2 OWBM Infestation, kernel damage, and yield as affected by planting date (PD) and cultivar at Kalispell, MT.

Cultivar	Total OWBM				Percent damaged seed				Yield (bu/A)			
	1st PD	2nd PD	3rd PD	mean	1st PD	2nd PD	3rd PD	mean	1st PD	2nd PD	3rd PD	mean
CAP19	0	0	0	0	0	0	0	0	64.6	56.9	58.9	60.1
NDSW0501	16	9	1	8	27	19	2	16	64.5	51.8	50.2	55.5
MT 0415	7	9	11	9	18	23	19	20	60.1	49.4	51.9	53.8
REEDER	10	6	18	11	20	14	38	24	63.9	58.9	51.6	58.1
VOLT	9	19	14	14	17	38	18	24	59.5	53.0	64.0	58.9
NDSW0608	13	21	14	16	23	33	19	25	68.2	57.7	55.9	60.6
AC Lillian	32	12	22	22	60	29	41	43	31.8	35.9	36.4	34.7
CAP20	13	27	28	23	24	59	58	47	28.8	15.7	15.7	20.1
KELBY	20	34	23	26	51	62	34	49	35.9	26.2	23.3	28.4
FORTUNA	10	19	55	28	48	47	73	56	37.1	28.1	22.5	29.3
VIDA	23	27	48	33	40	53	60	51	34.7	26.2	29.0	30.0
CONAN	21	41	36	33	40	58	57	52	30.6	26.2	26.3	27.7
NDSW0449	30	37	32	33	52	54	47	51	37.9	26.2	30.2	31.4
NORPRO	27	28	54	36	52	33	67	50	38.8	30.4	36.0	35.1
ONEAL	43	42	30	38	57	65	39	54	35.5	27.8	34.8	32.7
FREYR	26	58	33	39	55	69	45	56	34.7	27.2	36.5	32.8
KUNTZ	24	46	51	41	42	56	58	52	30.2	31.0	36.8	32.7
CORBIN	31	51	44	42	55	63	59	59	28.0	19.2	22.2	23.1
MCNEAL	26	50	53	43	54	71	72	66	46.8	38.2	29.5	38.2
PF906408	67	36	32	45	67	64	52	61	33.4	24.5	30.3	29.4
NDSW0601	66	35	35	45	81	59	59	66	22.7	20.0	26.7	23.2
MTHW0471	66	34	40	47	76	48	47	57	22.0	22.8	27.7	24.2
OUTLOOK	42	34	65	47	63	62	84	69	26.3	27.9	26.6	27.0
JEDD	57	56	36	50	81	72	60	71	25.5	17.6	23.9	22.3
HANK	30	54	66	50	39	80	63	61	37.9	28.9	32.0	32.9
CHOTEAU	38	60	60	53	67	71	62	67	26.8	20.1	19.3	22.1

Data is sorted based on cultivar rankings for susceptibility to OWBM infestation.

Table 3. Wheat height and grain quality as affected by planting date (PD) and cultivar at Kalispell, MT.

Cultivar	Height (cm)				Test weight (lb/bu)				Moisture (%)			
	1st PD	2nd PD	3rd PD	mean	1st PD	2nd PD	3rd PD	mean	1st PD	2nd PD	3rd PD	mean
CAP19	90	88	66	81	60.6	60.7	58.3	59.9	12.0	11.5	15.3	12.9
NDSW0501	104	96	95	98	61.2	61.5	58.4	60.4	11.9	11.4	14.5	12.6
MT 0415	90	89	85	88	61.4	61.2	57.9	60.2	11.7	11.5	14.4	12.5
REEDER	80	83	70	78	62.2	61.3	59.2	60.9	12.3	11.9	15.5	13.2
VOLT	78	77	63	73	61.4	59.7	60.1	60.4	12.1	11.8	14.9	12.9
NDSW0608	93	93	87	91	61.7	61.5	59.5	60.9	12.4	11.7	15.1	13.1
AC Lillian	98	98	87	94	57.2	58.6	55.6	57.1	11.3	11.1	14.3	12.2
CAP20	100	94	91	95	56.6	56.8	52.2	55.2	11.2	10.9	13.9	12.0
KELBY	67	67	67	67	58.6	57.6	55.0	57.1	11.4	10.7	13.7	11.9
FORTUNA	105	91	89	95	57.5	57.3	54.6	56.5	11.9	11.3	14.4	12.5
VIDA	83	83	63	76	59.2	58.1	55.9	57.7	11.9	11.7	15.5	13.0
CONAN	76	72	61	70	59.6	57.9	54.9	57.5	12.9	15.1	18.1	15.4
NDSW0449	96	84	69	83	58.9	58.8	55.9	57.9	11.8	11.0	14.6	12.5
NORPRO	75	70	60	68	59.1	58.4	57.0	58.2	11.4	12.0	14.8	12.7
ONEAL	81	74	74	76	59.9	58.8	57.6	58.8	12.0	12.8	15.1	13.3
FREYR	82	79	65	75	58.6	57.9	56.4	57.6	12.5	14.5	15.8	14.3
KUNTZ	77	72	68	72	60.1	60.1	58.8	59.7	12.2	12.5	14.7	13.1
CORBIN	83	72	69	75	60.4	58.6	56.9	58.6	11.8	12.2	15.0	13.0
MCNEAL	79	82	65	75	57.3	55.4	54.3	55.7	10.9	10.3	14.0	11.7
PF906408	75	65	73	71	57.0	55.4	55.1	55.8	11.1	11.1	13.9	12.0
NDSW0601	80	77	62	73	55.8	55.7	53.4	55.0	10.8	9.9	13.4	11.4
MTHW0471	95	95	85	92	59.0	60.0	57.6	58.9	11.6	11.2	14.4	12.4
OUTLOOK	74	81	70	75	55.1	54.9	53.4	54.5	10.8	10.3	13.8	11.6
JEDD	61	55	58	58	58.9	57.1	55.5	57.2	11.5	11.9	14.2	12.5
HANK	72	70	69	70	57.3	54.5	53.7	55.2	11.5	11.6	15.7	12.9
CHOTEAU	81	76	61	73	57.0	55.2	53.9	55.4	11.1	10.9	14.5	12.2

Data is sorted based on cultivar rankings for susceptibility to OWBM infestation.