

BREEDING FOR SCAB RESISTANCE IN SOFT RED WINTER WHEAT

A.J. Stewart, Carrie Knott, and Dave Van Sanford
Department of Agronomy, University of Kentucky, Lexington, Kentucky

OBJECTIVES:

- 1) To identify agronomically desirable breeding lines that have head scab resistance.
- 2) To determine the amount of disease pressure in the scab nursery and quantify disease pressure over years and locations.

INTRODUCTION:

Head scab or Fusarium Head Blight (FHB) caused by *Fusarium graminearum* severe damage to Kentucky wheat producers in 2003. Wheat from infected fields had high levels of deoxynivalenol (DON). The increased level of DON prevented many producers from maximizing profits. Breeding for FHB resistance is one way to help producers limit losses to this disease. Two populations with potential scab resistance, Magnum and Mondo, were developed as part of our breeding strategy.

To ensure disease screening in the scab nursery was consistent a disease progress curve was started in 2003. This curve is developed from weekly severity readings in different environments within the scab nursery. By constructing a curve, symptom development and disease severity can be compared over years and locations. The area under disease progress curve (AUDPC) is used to quantify disease progress.

BREEDING MATERIALS:

In 2001, advanced breeding lines were evaluated in the field for yield and other agronomic traits. Approximately 80 breeding lines not advanced for further

testing were kept due to potential scab resistance. The entries were placed into two tests, the Magnum and Mondo. Some lines that were initially selected based on yield had some level of FHB resistance. Those lines with yield potential were tested in yield tests and in the irrigated scab nursery. The Magnum and Mondo were tested in irrigated field and greenhouse locations (2002 and 2003).

RESULTS AND DISCUSSION:

The results from the two-year Magnum and Mondo test have identified lines with consistent scab tolerance. The selected breeding lines also have yield potential. The lines KY92C-0158-63 and KY92C-0818-54 (Table 1) in the Magnum test had low severities over environments and years. These lines also had near to above average yield potential when compared to the test mean. The line KY94C-0094-11-2 in the Mondo has above average yield when compared to the yield test mean (Table 2). This line also has been very consistent for scab resistance and is in the 2004 Kentucky wheat variety trial. The advanced lines in 2003 (severity under 25%) were planted in increase plots for further testing. Continued testing occurs on selected breeding lines discarded in yield tests. Evaluation occurs for these lines to establish potential scab resistant parents and cultivar development.

DISEASE SEVERITY EVALUATION:

Fusarium graminearum pressure varies from year to year in the field conditions. Disease pressure can also be varied in an irrigated nursery. In addition, the location of our scab nursery changes from one year to the next.

To accurately compare disease pressure from year to year a curve of disease pressure from initial symptom to maximum expression is needed. By evaluating curves over years and environments, disease pressure can be quantified. The first year of data collection occurred this season (2003).

MATERIALS AND METHODS:

The data were collected in two locations within the scab nursery to develop an area under the disease progress curve (AUDPC). One location was on the north border pass and the other location was on the south edge of the field but not the border row. Both locations used Pioneer 2555 to collect severity data. The data were collected on a 7-day interval after anthesis (DAA), except for the first time period. The data collected in upcoming years will be used to determine the consistency of disease pressure in the scab nursery.

RESULTS AND DISCUSSION:

Results from the first year (Figure 1) had the same amount of disease severity for both

locations. However, the border row was affected by *F. graminearum* at a faster rate than row in the interior location. The disease severities in border versus interior rows recorded at day 28 were not different. At 21 DAA however, when we usually read severity, there was a significant difference between border and interior rows. The data collected displays the difficulties in determining whether a breeding line has resistance or is avoiding disease pressure.

CONCLUSIONS:

Data collected in 2004 will provide comparisons of disease severity for upcoming years. The disease severity will also be collected within the scab nursery to determine consistency of infection in the year. The use of AUDPC will be a tool to determine breeding lines with resistance levels to *F. graminearum*. This will allow for more efficient evaluation of material, which will improve resistance in scab parents over time.

Figure 1. AUDPC graph of severity in 2 microenvironments in the 2003 scab nursery at Lexington.

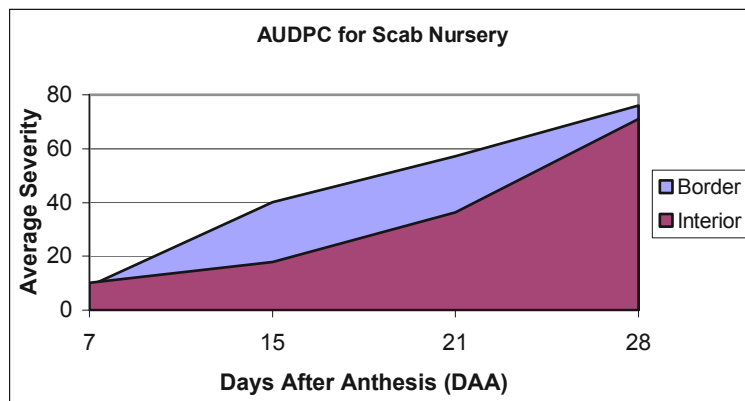


Table 1. Magnum yield and FHB disease data over years and locations

		2003 Magnum			2002 Magnum									
		LEXINGTON 2 REPS			LEXINGTON 2 REPS				PRINCETON 1 REP				GREENHOUSE	
Entry	Yield/ Test Avg	Field FHB Incidence	Field FHB Severity	Field FHB Index	Field FHB Incidence	Field FHB Severity	Field FHB Index	Rank Index/ 32	Field FHB Incidence	Field FHB Severity	Field FHB Index	Rank Index/ 32	Field FHB Severity	Rank Index/ 32
	(Bu/ A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
KY92C-0158-63	81.2/80.2	39.4	18.8	7.4	16.0	15.4	2.5	2	26.0	15.7	4.1	6	25.6	15
KY92C-0230-15-1	65.3/ 67.6	59.9	34.1	20.4	17.4	8.0	1.4	1	7.4	39.0	2.9	2	41.7	21
KY92C-0360-77-2	65.8/ 67.6	75.1	49.5	37.1	51.8	11.9	6.2	11	55.3	19.5	10.8	16	5.9	2
KY92C-0818-54	82/80.2	67.2	17.5	11.7	38.4	27.4	10.5	18	18.9	17.4	3.3	4	17.8	8
KY93C-0232-15	68.3/ 69.7	73.7	44.6	32.9	19.9	11.9	2.4	3	39.0	18.3	7.1	12	49.6	22
Average		63.1	32.9	21.9	40.8	16.8	8.4		40.5	21.5	8.7		25.8	

Table 2. Mondo yield and FHB disease data over years and locations

		2003 Mondo			2002 Mondo									
		LEXINGTON 2 REPS			LEXINGTON 2 REPS				PRINCETON 1 REP				GREENHOUSE	
Entry	Yield/ Test Avg	Field FHB Incidence	Field FHB Severity	Field FHB Index	Field FHB Incidence	Field FHB Severity	Field FHB Index	Rank Index/ 30	Field FHB Incidence	Field FHB Severity	Field FHB Index	Rank Index/ 30	Field FHB Severity	Rank Index/ 30
	(Bu/ A)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
KY93C-1365-17-1	72.5/ 76.0	60.2	26.7	16.1	28.6	6.7	1.9	6	14.0	12.3	1.7	7	16.0	18
KY94C-0246-46-2	74.9/ 79.8	50.3	22.1	11.1	48.8	10.3	5.0	21	34.0	18.0	6.1	15	32.3	21
KY94C-0258-14-3	80.7/ 85.3	46.6	18.1	8.4	31.1	7.8	2.4	9	11.0	8.8	1.0	1	6.5	27
KY94C-0270-44-3	70.1/ 71.3	73.4	22.4	16.4	35.4	10.1	3.6	17	18.0	9.5	1.7	6	6.0	4
KY94C-0850-20-1	77.5/ 79.8	38.3	19.6	7.5	15.7	7.5	1.2	4	15.0	26.5	4.0	12	28.4	3
KY94C-0850-20-2	79.0/ 79.8	71.1	29.1	20.7	25.9	9.1	2.4	10	20.0	7.5	1.5	4	16.0	24
KY94C-0850-20-3	79.0/ 79.8	70.7	27.7	19.6	11.5	7.5	0.9	2	56.6	22.4	12.7	21	41.3	18
KY94C-0094-11-2	76.6/ 70.4	39.5	17.6	6.9	9.4	7.2	0.7	1	21.0	7.6	1.6	5	16.9	32
Average		56.3	22.9	13.4	42.6	16.3	8.7		40.0	19.9	9.7		18.7	