

GREENHOUSE AND FIELD EVALUATION OF RESISTANCE TO FUSARIUM HEAD BLIGHT IN SOFT RED WINTER WHEAT

Brenda Kennedy, Marla Hall, Liu Hua, and Dave Van Sanford
Department of Agronomy, University of Kentucky, Lexington, Kentucky

OBJECTIVES:

- 1) To identify resistance to Fusarium head blight in the greenhouse and field screening trials.
- 2) To compare inoculum sources and methods.

INTRODUCTION:

Fusarium head blight (FHB) has caused significant losses in Ky's wheat crop in most years since 1991. The prevalent rotation in which growers are planting wheat after corn into minimally or no-tilled soil ensures abundant inoculum in most years. Therefore, breeding for FHB resistance is an essential component of the wheat breeding project at the University of Kentucky.

MATERIALS AND METHODS:

Entries in the 2000 Uniform North and Uniform South Winter Scab Screening Nurseries along with a number of advanced breeding lines were planted in the field in a randomized complete block design with four replications on 27 October 1999. Each plot consisted of four rows and measured 4ft by 4ft. The previous crop was corn and the seedbed had been chisel plowed and disked. Entries in the greenhouse were planted in a completely randomized design with a variable number of replications.

Field Inoculation

The field inoculation protocol was as described by in the 1999 Wheat Science Report with a few modifications. Approximately 100 g of sterilized water was added to the autoclaved corn in the Mason jars to provide adequate moisture for the pathogen to grow. On April 24, wheat plots were inoculated prior to heading by spreading 3.31g/ft² of the inoculated corn mixture. Plots were mist irrigated daily beginning on April 27. The irrigation system was set with an automatic timer programmed to mist irrigate the plots for 5 minutes with 15 minute intervals between the hours of 6 to 10 AM and 10 minutes with 20 minute intervals between the hours of 8 and 10 PM.

Disease evaluations were initiated on May 30 when scab symptoms were detected on several of the susceptible cultivars. Incidence was recorded as the number of infected heads per 50 heads sampled. Fifty heads per plot were visually rated for severity of infection.

Greenhouse Injections

The greenhouse injection procedure was as reported in the 1999 Wheat Science Report.

Inoculum Comparison

'Clark' and 'Ernie' were grown in replicated plots in a randomized complete block design with four inoculum treatments: 1) *F. graminearum* colonized field corn (3.31g/ft²) was spread three weeks prior to anthesis, 2) a macroconidial suspension of 175 ml/plot at 50,000 sp/ml was sprayed, once at anthesis, and again one week post-anthesis, 3) a macroconidial spray was prepared from inoculum that had been frozen 4-6 months earlier, and 4) a non-inoculated control.

RESULTS AND DISCUSSION:

Field and Greenhouse Screenings

Data for the Uniform Scab Nurseries are presented in Tables 1 and 2.

Inoculum Comparison Test

The fresh inoculum treatment produced the greatest amount of disease. For cultivar Ernie, disease incidence, head severity and FHB index were significantly higher in the fresh-spray treatment when compared to the other treatments Table (3).

Disease symptoms were first noted in the fresh-spray treatment of the cultivar Clark one week after application. As the season progressed, it became evident that discerning infected spikelets on Clark would become increasingly more difficult due to the bronzing color of its glumes. Therefore, only disease incidence data was collected. No significant differences were observed among the treatments for disease incidence.

Several factors could influence why the fresh-spray treatment was more effective. By spraying macroconidial suspensions, you have the ability to control when to place the pathogen with the host at the most crucial time of susceptibility, at anthesis. Macroconidial germination rate was more than likely higher for the fresh inoculum suspensions when compared to frozen suspensions.

TABLE 3. EFFECT OF INOCULUM TREATMENT ON CULTIVAR ERNIE.

Inoculum treatment	Incidence	Head Severity	FHB Index
1. Corn	44.44 b	12.41 b	5.53 b
2. Fresh Spray (50,000 sp/ml)	60.67 a	19.66 a	12.43 a
3. Frozen Spray (100,000 sp/ml)	42.33 b	12.53 b	5.60 b
LSD _{0.05}	9.25	3.06	2.85
CV %	28.13	30.80	54.20

**TABLE 1. 2000 UNIFORM SOUTHERN WINTER WHEAT SCREENING NURSERY,
LEXINGTON, KENTUCKY**

		Field Data				Greenhouse Data			
		Height	Average	Average Head	Average Plot				
Entry	Name	(inches)	Incidence*	Severity ^	Severity#	21 dpi ⌘	Min	Max	Rank
South-1	Ernie	32.25	9.50	8.83	0.95	7.00	6.30	7.70	2
South-2	Futai 8944	37.25	8.50	12.59	0.89	9.70	4.50	30.00	7
South-3	SC 921285	31.50	18.00	10.07	1.67	68.00	5.90	100.00	20
South-4	SC 921299	30.50	16.50	7.44	1.23	71.70	17.60	100.00	22
South-5	SC 941292	36.50	25.50	9.38	2.34	38.20	5.00	100.00	15
South-6	Coker 9474	34.75	23.00	9.68	2.22	16.70	5.90	50.00	12
South-7	B950799	36.00	26.00	9.20	3.06	36.10	5.60	76.50	14
South-8	B930390	38.25	16.00	8.71	1.40	14.10	5.90	35.30	9
South-9	B961092	32.75	26.00	1.56	2.95	13.60	6.70	43.80	8
South-10	GA 89482-E7	35.75	21.00	14.22	2.32	62.20	6.30	100.00	19
South-11	GA 901146-E15	31.50	16.00	10.61	2.09	33.90	5.90	88.20	13
South-12	GA 90524-E35	30.00	26.00	8.65	2.40	14.90	5.60	50.00	11
South-13	GA 90552-AE33	36.00	27.50	8.77	2.42	48.30	5.00	100.00	17
South-14	Roane	33.50	29.00	8.21	2.54	8.00	4.80	26.30	4
South-15	VA96W-329	34.25	29.00	9.14	2.78	14.40	5.30	58.80	10
South-16	VA96W-326	36.00	22.50	8.20	2.00	68.80	6.30	100.00	21
South-17	VA96W-158	38.25	26.50	9.25	2.50	58.20	5.60	100.00	18
South-18	VA96W-348	35.50	9.50	7.44	0.77	39.80	5.30	100.00	16
South-19	NC96-13848	35.00	25.00	12.34	3.10	6.50	5.30	11.80	1
South-20	NC96-13965	34.75	17.50	10.18	2.16	8.50	6.30	17.60	6
South-21	NC96-13374	33.50	3.00	7.88	0.25	8.30	5.60	25.00	5
South-22	NC96-14629	32.50	10.50	10.94	1.16	7.90	5.90	18.80	3
	Average	34.38	19.64	9.24	1.96	29.76			
	CV	3.06	71.06	31.67	84.81	88.10			
	LSD (0.05)	1.48	0.20	4.31	2.35	26.10			
Footnotes apply to both Table 1 and Table 2.									
* Incidence is reported as the percentage of scab infected heads per 50 heads.									
^ Head Severity is reported as the percentage of scab infected spikelets per 50 heads excluding non-infected heads.									
# Plot Severity is reported as the percentage of scab infected spikelets per 50 heads including non-infected heads. This measurement is the same as the FHB Index.									
⌘ Percentage of infected spikelets ((number of infected spikelets/total number of spikelets per head) x 100) 21 days post-inoculation.									
● Data was not recorded due to late flowering.									

TABLE 2. 2000 UNIFORM NORTHERN WINTER WHEAT SCREENING NURSERY, LEXINGTON, KENTUCKY

		Field Data					Greenhouse Data			
Entry	Name	Height (inches)	Heading Date (May)	Average Incidence*	Average Head Severity ^	Average Plot Severity #	21 dpi ☞	Min	Max	Rank
North-1	Patterson	38.50	3.75	17.00	15.18	2.45	55.40	5.00	95.50	27
North-2	Freedom	38.75	4.50	35.50	9.94	3.44	6.10	4.50	14.30	3
North-3	Pioneer 2545	38.00	5.25	47.00	12.42	6.08	18.60	4.50	56.00	18
North-4	Ernie	33.00	2.00	15.50	7.73	1.26	6.50	5.90	7.10	6
North-5	NY87047W-6048	40.00	11.75	54.00	11.86	6.66	8.60	3.80	13.60	11
North-6	NY87047W-6041	40.00	14.00	35.50	9.43	3.32	11.80	4.20	23.10	13
North-7	NY87047W-7405	35.00	4.75	23.00	10.26	2.53	8.50	4.80	30.00	10
North-8	NY87048W-7387	43.00	13.75	25.50	8.24	2.10	6.00	4.50	10.50	2
North-9	NY87048W-7388	41.25	15.00	18.50	8.00	1.48	7.00	4.30	16.70	8
North-10	IL95-4162	38.00	3.25	20.00	7.84	1.65	6.20	5.60	6.70	4
North-11	IL96-7654	37.00	3.50	18.00	9.30	1.81	7.80	0.00	27.80	9
North-12	IL97-2945	40.75	3.25	16.50	7.00	1.16	16.00	4.30	41.20	16
North-13	IL96-3073	36.75	5.00	8.00	7.93	0.63	6.40	5.00	15.00	5
North-14	Roane	34.00	4.50	35.50	9.48	3.58	13.50	4.80	72.70	14
North-15	VA96W-329	33.25	5.00	33.00	11.91	3.93	54.30	5.90	100.00	26
North-16	VA96W-326	35.25	1.75	30.00	12.28	4.17	84.40	43.80	100.00	28
North-17	VA96W-250	33.25	2.00	39.00	11.24	4.33	21.20	5.00	35.00	20
North-18	VA96W-749	34.75	5.00	48.00	9.72	4.58	23.20	4.50	100.00	22
North-19	NE94654	38.00	10.00	30.50	10.12	2.98	22.60	4.30	40.90	21
North-20	MO 982030	32.00	1.00	35.50	8.26	2.94	20.80	6.30	88.20	19
North-21	MO 971022	32.25	1.25	21.50	9.16	1.93	26.30	5.60	100.00	23
North-22	MO 980725	35.75	5.00	30.50	9.97	3.02	16.60	4.30	100.00	17
North-23	MO 980525	39.50	10.50	22.50	12.10	2.66	●			
North-24	KY 90C-049-31	39.00	6.50	49.00	13.52	6.92	6.70	4.80	15.80	7
North-25	KY91C-117-33	37.75	5.00	21.50	10.08	2.37	9.40	4.80	20.00	12
North-26	OH645	38.00	4.75	27.50	9.66	2.52	52.30	5.90	100.00	25
North-27	OH650	39.50	4.00	32.50	9.65	3.09	26.90	5.60	56.30	24
North-28	OH661	37.50	4.00	31.50	11.88	3.71	5.60	4.80	6.30	1
North-29	OH688	41.70	9.75	28.50	8.33	2.38	14.10	5.30	35.30	15
Average		37.29	5.85	29.33	10.09	3.09	20.10			
CV		3.45	23.53	36.78	26.76	54.76	100.90			

