

# **SELECTION FOR FUSARIUM HEAD BLIGHT RESISTANCE IN THREE WINTER WHEAT POPULATIONS**

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Fusarium head blight (FHB) causes significant losses in the soft red winter (SRW) wheat crop in Kentucky and in small grain crops worldwide. FHB epidemics result in significant yield losses, and the toxin deoxynivalenol (DON) can cause serious problems with grain quality and food safety. Breeding FHB-resistant wheat cultivars is the main goal of the UK breeding program. With this objective in mind two different selection schemes were conducted for three winter wheat populations.

In 2003 two selection schemes were begun and the results were measured in 2004.

## **Within-Family Selection:**

Five heads with low severity and five unselected heads were harvested from each plot in 2003. Approximately 10 seeds of each line were planted in hill plots with three replications at Lexington and two at Princeton in 2004.

## **Among-Family Selection:**

The 8 families in each population in 2003 with the lowest FHB index were planted in 4 row plots with three replications at Lexington and two at Princeton in 2004.

## **Field Inoculation:**

Scabby corn was spread in wheat plots prior to heading (GS 7). Plots were mist irrigated daily beginning just prior to heading for five minutes every ten minutes between 6 and 8 AM and between 10 PM and 12 AM.

## **Field Disease Evaluations:**

Disease was measured approximately 21 days after flowering. Average head severity was determined by counting the number of infected spikelets divided by the total number of spikelets per head on 10 infected heads per plot. Also the percentage of Fusarium damaged kernels (FDK) was estimated and a DON test was done on grain samples.

## **Actual Selection Gain:**

The effect of both types of selection was measured in 2004.

## **RESULTS:**

At Lexington (Table 1), one cycle of within family selection for scab resistance reduced the percentage of diseased spikelets from 50.8 to 40.3% in Population 1, from 38.9 to 29.5% in Population 2 and from 41.6 to 39.3% in Population 3. At the second location, Princeton (Table 2), one cycle of recurrent selection for FHB resistance reduced the percentage of diseased spikelets from 32.2 to 27.8% in Population 1, from 34.7 to 27.1%

in population 2 and from 39.4 to 37.1% in population 3. The selection response was higher at Lexington than at Princeton.

One cycle of among-family selection for low FHB index reduced the mean severity in some families compared to the population mean (Table 3). FDK and DON also showed significant progress. The top families in Population 2 showed the highest progress in selection: 6 of 8 families showed lower mean severity and FDK than the population mean, and the 8 families showed lower DON than the mean DON concentration. Population 1 and 3 also showed progress with one cycle of selection.

Many of the most promising families have been planted in 2005 in preliminary trials of the University of Kentucky breeding program.

**TABLE 1. AVERAGE SCAB SEVERITY (%) OF THE ORIGINAL THREE WINTER WHEAT POPULATIONS IN 2003 AND 2004 AND THE RESPONSE TO ONE CYCLE OF WITHIN FAMILY SELECTION, LEXINGTON, KY, 2004.**

	2003 Avg. Severity (%)	2004 Average Severity (%)		Reduction in Severity (%)
		After 1 Cycle of Selection	Unselected	
Population 1	29.5	40.2	50.8	-10.6
Population 2	30.1	29.5	38.9	-9.4
Population 3	31.2	39.3	41.6	-2.3

**TABLE 2. AVERAGE SCAB SEVERITY (%) OF THE ORIGINAL THREE WINTER WHEAT POPULATIONS IN 2003 AND 2004 AND THE RESPONSE TO ONE CYCLE OF WITHIN FAMILY SELECTION, PRINCETON, KY, 2004.**

	2003 Avg. Severity (%)	2004 Average Severity (%)		Reduction in Severity (%)
		After 1 cycle of Selection	Unselected	
Population 1	29.5	27.8	32.2	-4.4.6
Population	30.1	27.1	34.7	-7.6

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Population 3	31.2	37.1	39.4	-2.3

**TABLE 3. EFFECT OF ONE CYCLE OF AMONG-FAMILY SELECTION FOR LOW FHB INDEX ON SEVERITY OF INFECTION, FUSARIUM DAMAGED KERNELS (FDK) AND DON CONCENTRATION IN THREE WINTER WHEAT POPULATIONS, LEXINGTON, KY. 2004.**

Entry	Population 1			Population 2			Population 3		
	Severity DON (%) (ppm)	FDK (%)		Severity DON (%) (ppm)	FDK (%)		Severity DON (%) (ppm)	FDK (%)	DON (ppm)
C <sub>0</sub> (un-selected)	50.8	65.8	13.2	38.9	42.6	18.8	41.6	57.2	13.6
C <sub>1</sub> -1 (selected)	57.4	38.4	15.2	29.3	28.1	5.8	36.2	53.3	7.8
C <sub>1</sub> -2	61.8	55.2	9.3	31.6	37.5	16.5	32.8	38.6	9.4
C <sub>1</sub> -3	54.0	75.0	11.7	38.3	33.1	10.9	39.4	75.4	15.8
C <sub>1</sub> -4	44.9	51.1	11.1	40.4	17.1	7.5	44.9	61.1	9.2
C <sub>1</sub> -5	52.8	80.0	13.4	36.6	32.8	12.1	33.5	61.4	10.6
C <sub>1</sub> -6	54.4	40.2	11.6	36.3	69.2	10.9	33.0	25.8	12.4
C <sub>1</sub> -7	41.0	33.5	12.4	36.4	50.4	12.2	30.0	42.6	16.5
C <sub>1</sub> -8	37.7	43.5	16.2	22.5	47.9	10.2	42.0	75.2	11.5
LSD (0.05)	9.2	10.1	4.6	8.0	9.1	3.4	7.8	8.5	4.3

