

# **Successes in Development of Fusarium Head Blight Resistant Soft Red Winter Wheat Varieties Using Phenotypic Selection**

**Frederic L. Kolb**

**Department of Crop Sciences**

**University of Illinois**



# Objectives

- **Adapted FHB resistant varieties with high yield potential and all of the other traits needed for acceptance by producers and end users**
- **Parental lines with excellent FHB resistance**



# General Approach

- Combine various types of FHB resistance

**AND**

- Every cross should have at least one high yield parent and one or more FHB resistant parents



# History – FHB program at the University of Illinois

- **First “FHB” crosses**
  - **single crosses - 1993, three-way crosses - 1994**
  - **In 1994 - 14 three-way crosses with Ning 7840**
- **First field data collected -1995**
  - **Severity & Incidence - 1996**
- **Crossing block included FHB info. – 1995-96**
- **First headrows selected - 1996**
- **FHB C-FAR proposal funded – July, 1996 (4 years)**
- **First misted, inoculated nursery – 1997**
- **First line with mod. FHB resistance released – 2006**



# Methods

- **Inoculated, mist-irrigated field nursery**
  - **Primary method**
  - **One location**
  - **One 3' row per plot, 2 or 3 reps per entry**
- **Greenhouse evaluation**
- **MAS used primarily for early generation enrichment (after Bonnett et al. 2005. Mol. Breeding 15:75-85)**



# Planting Field FHB Nursery





# Field nursery with cornstalks



# Inoculum production





# Irrigation and perithecia



# Data collected

- Heading date – to group entries
- Incidence - % of heads infected in a row
- Severity – 7 - 10 heads / row
  - **Do NOT include heads without symptoms**
- % FDK – compared to standards
- DON – samples sent to U. of MN lab





# FDK standards



# Calculated Indexes

- **FHB Index**

- **(Incidence x severity ) x 100**
- **Estimates % disease**
- **Concerns – errors are multiplied (high CV),  
does not include FDK or DON**

- **ISK index**

- **(0.3 % Incidence + 0.3 % Severity + 0.4 % FDK) x 100**

- **DISK index – Jeanne Gilbert**

- **Spring wheat**



## 2009 Advanced - Urbana FHB Nursery

Entry	Scab Incid. (%)	Scab Severity (%)	FHB Index (0-100)	Kernel Rating (% FDK)	ISK Index (0-100)	2008 DON ppm
<b>Bess</b>	68.3	30.6	20.7	30.0	41.7	13.1
<b>Pio 25R47</b>	98.3	62.9	62.2	53.3	69.7	40.3
<b>00-8061</b>	80.0	39.5	30.1	16.7	42.5	4.6
<b>01-34159</b>	60.0	20.0	11.5	7.3	26.9	1.6
<b>02-18228</b>	33.3	14.2	4.4	6.7	16.9	1.9
<b>05-8417</b>	36.7	39.2	14.7	16.7	29.4	4.8
<b>05-8435</b>	93.3	46.1	42.8	45.0	59.8	10.0
<b>06-16735</b>	46.7	50.4	21.3	16.7	35.8	6.7
<b>06-24847</b>	78.3	22.8	18.6	13.3	35.7	7.2
<b>MEAN</b>	77.4	40.4	31.9	27.6	46.4	
<b>LSD (0.05)</b>	22.9	19.0	17.7	13.5	11.5	
<b>CV (%)</b>	18.3	29.3	34.5	30.4	15.4	
<b>Ernie</b>	83.3	30.0	25.3	30.0	46.0	15.3
<b>00-8061</b>	80.0	39.5	30.1	16.7	42.5	4.6
<b>97-6755</b>	23.3	36.6	8.5	7.3	20.9	3.7





# Breeding program - Early generations

- Crosses made in the greenhouse



- $F_1$  plants transplanted to the field/pots



- $F_2$  and  $F_3$  generations grown in bulks



- Individual heads selected in  $F_3$



# Crosses

Year	Single	3 or 4-way	Total	At least one Res. parent †	% of Total Crosses
2005	337	140	477	452	95
2006	270	201	471	402	85
2007	254	233	487	446	92
2008	267	200	467	458	98
2009	243	219	462	439	95
AVE.	274	199	473	440	93

† Resistant parent defined as ISK index < or = to Ernie.



# Selection and Evaluation

- **Headrows**



- **Single plots (2 locs)**

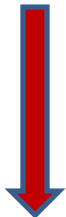


- **Preliminary Yield Test**



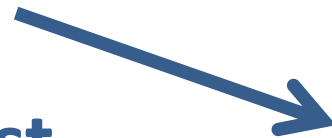
- **Advanced Perf. Test**

- Four locations
- Several years



- **Multi-state evaluation**

**Decision made to release**



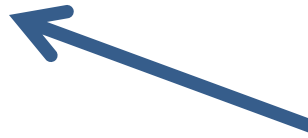
**Pure rows (F<sub>5:6</sub>)**



**Increase**



**Multiplication  
and  
Purification**



# Scale (5 year averages)

**26,688**

**Headrows**

**1846**

**Single Plots**

**314**

**Prelim. Yield Trials**

**102**

**Adv. Yield Trial**

**11**

**Regional Tests**



# Univ. of Illinois lines included in the “best lines” in the NUWWSN and PNUWWSN

Year	NUWWSN	PNUWWSN
2009	3	3
2008	3	4
2007	0	5
2006	2	5
2005	3	4
2004	5	--
2003	3	--
2002	3	--
2001	3	--





# Univ. of Illinois lines included in the “best lines” in the NUWWSN and PNUWWSN

- **NUWWSN (2001-2009)** **18 lines**
- **PNUWWSN (2005-2009)** **18 lines**
- **Lines in commercial production** **5 lines**
- **Lines in increase** **2 lines**



# Univ. of Illinois lines included in the “best lines” in the NUWWSN and PNUWWSN

- Sources of FHB resistance

- **Native** **18 lines**
- **Ning 7840 derived line** **10 lines**
- **Ning 7840** **3 lines**
- **Ernie** **2 lines**
- **Goldfield** **1 line**
- **Roane** **1 line**
- **Coker 9474** **1 line**



# Summary of Impacts

- **Eight breeding lines with moderate FHB resistance ( ~ = or < Ernie) have been released for commercialization through licensing.**
- **One breeding line is registered in eastern Canada and has been named 'Huntley'.**
- **In fall 2008 > 100,000 units of seed were sold.**



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**Thank you for your attention.  
Questions?**

