



**MSU's Wheat Breeding Program;
Current Status and Future Outlook**

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55th Research Review Conference

Wooster, Ohio, March 12, 2008

Overview

- Introduction
- Current status of the MSU Wheat Breeding and Genetics program
- Recent and upcoming releases

Introduction

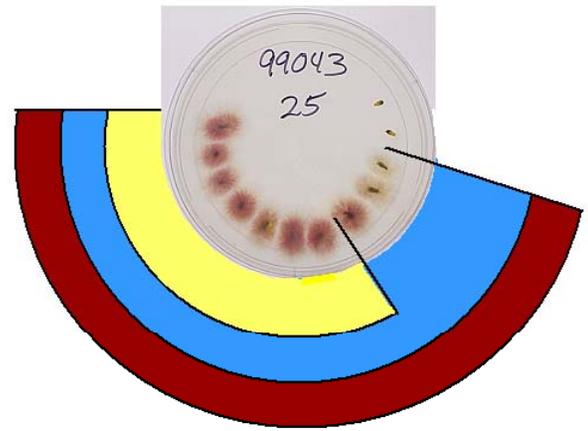
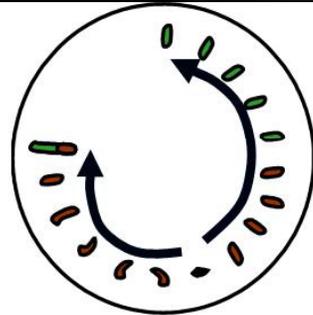
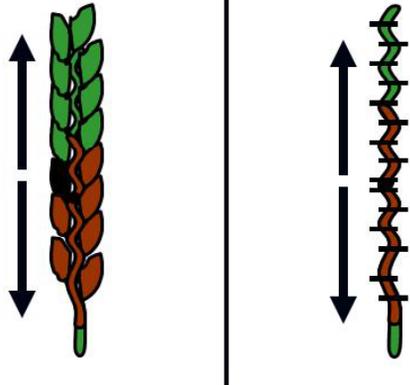
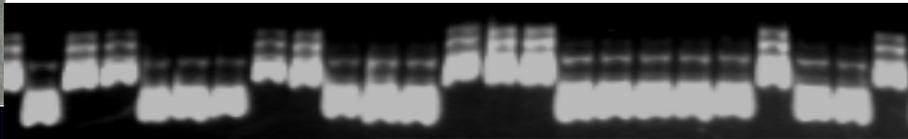
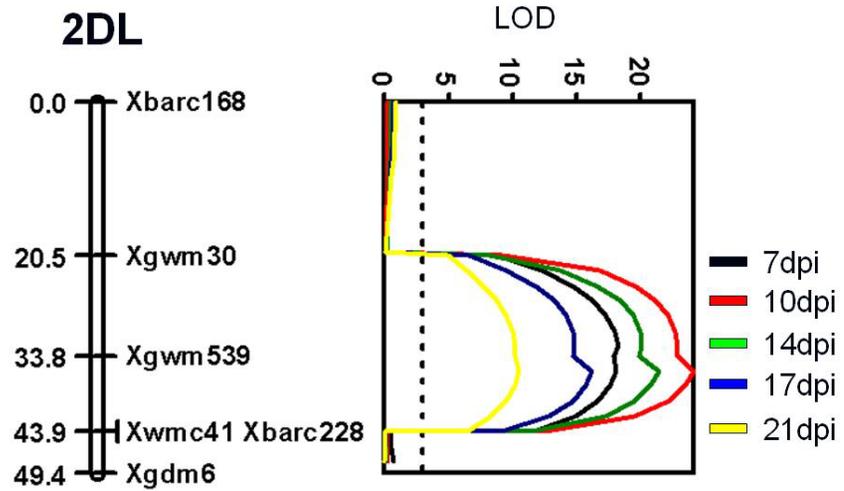
- Originally from Michigan (East Lansing)
- B.S. Botany, University of Michigan
- Ph.D. Plant Breeding and Genetics (Wheat Breeding Program) MSU
- Post-doctoral Research
 - University of Minnesota
 - CIMMYT: International Center for Maize and Wheat Improvement, Mexico

Fusarium Head Blight (FHB) Research – Laboratory, Field, Greenhouse





Scabby Spikelets



MSU Wheat Breeding and Genetics Program

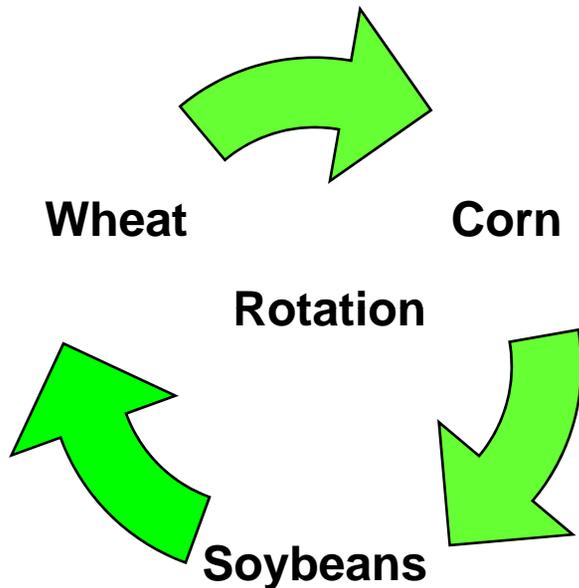


Michigan Wheat

- Soft White and Red Winter Wheat
- Cereal, cookies, cakes, crackers, pie crust, biscuits, soup thickeners, . . .
- Total value of breakfast cereal, breads, bakery, cookies crackers and pasta manufacturing > \$3.9 billion (2002)

(“The Economic Impact Potential of Michigan’s Agri-Food Industry”, Peterson et al., 2006)

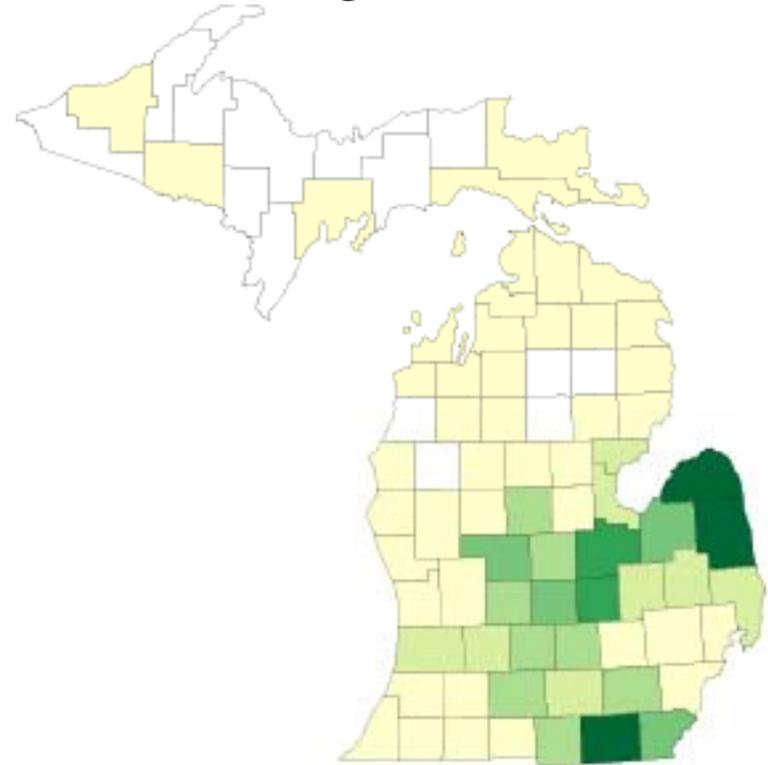
Michigan Wheat



Important in crop rotations

Provides income and activity for farmers at a different time of year

*National Agriculture Statistics Service:
2002 Census of Agriculture.*



**4th Largest acreage among MI
field crops.
~ 700,000 acres planted in 2007**



http://www.css.msu.edu/varietytrials/wheat/Variety_Results.html



Several photos by Wanessa D. Wight

MSU's Wheat Breeding Program – Resources

- Wheat Research Farm
- Equipment
- Multilocation Yield Testing at 6 Sites
- Greenhouse Facilities (Sue Hammar)
- Laboratory Facilities (Sue Hammar)
- Germplasm
- Lee Siler (technician)

<http://www.css.msu.edu/varietytrials/wheat/>

MCPT Home @Michigan State University - Windows Internet Explorer

http://www.css.msu.edu/varietytrials/wheat/Variety_Results.html

File >> Google G Go >> Bookmarks >> 81 blocked

MCPT Home @Michigan S... Michigan State University

S MICHIGAN STATE UNIVERSITY MICHIGAN WHEAT PERFORMANCE TRIALS

Wheat Testing Research Extension Terms Links Contacts Applications Home

[MSU Variety Trials](#)
[CAT Alert](#)
[US Wheat and Barley Scab Initiative](#)
[The Great Lakes Wheat Management Manual](#)
[The North Central Crop Evaluation Committee](#)
[Center For Intergrated Plant Systems](#)
[MSU College of Agriculture and Natural Resources](#)
[MSU Extension](#)
[Michigan State University Home Page](#)

2008 MSU WHEAT TRIALS LOCATION MAP

MIDLAND
SAGINAW
INGHAM
HURON
SANILAC
LENAWEE

2008

Lee Siler
Department of Crop and Soil Sciences
Michigan State

STATE PERFORMANCE TRIALS 2008

➤ 76 – VARIETIES AND EXPERIMENTAL LINES ENTERED THIS YEAR.

14 contributing organizations, including MSU.

~45% white, 55% red lines. (MSU 13 white/1 red experimental)

2007/08 MICHIGAN STATE UNIVERSITY WHEAT STATE PERFORMANCE TRIAL



| ENTRY NUMBER | ENTRY NAME | GRAIN COLOR | ORGANIZATION |
|--------------|----------------|-------------|--------------------------|
| 1 | Branson | Red | AgriPro COKER |
| 2 | TW110-062 | White | AgriPro COKER |
| 3 | W1377 | Red | AgriPro COKER |
| 4 | Excel 343 | Red | Bio Plant Research |
| 5 | Excel 423 | Red | Bio Plant Research |
| 6 | Vigoro Tribute | Red | Crop Production Services |
| 7 | Vigoro V9723 | Red | Crop Production Services |
| 8 | DF101 | Red | D.F. Seeds, Inc. |
| 9 | Genesis R045 | Red | D.F. Seeds, Inc. |
| 10 | Genesis R055 | Red | D.F. Seeds, Inc. |
| 11 | Caledonia | White | Harrington Seeds, Inc. |
| 12 | Jensen | White | Harrington Seeds, Inc. |
| 13 | Ava | White | Hyland Seeds |
| 14 | Emmit | Red | Hyland Seeds |

1997 and Following – Reports Online

Agronomics -

Yield, TW, JDF,
Height, Lodging

Morphology – Grain
color, Chaff
color, awns

Diseases – FHB,
DON, Leaf/Stripe
rust, PM,
BYDV, WSSMV,

Quality:

Flour yield, LAR,
% Protein,
Softnes,
Sprouting, Black
point

Table 1 : Multi-Year Performance Summary (Note: Tables sorted by 2007 Yield, red wheats grouped be

| Name | Grain Color | Chaff Color | Awns | Yield: Bushels/Acre (Adjusted to 13% Moisture) | | | |
|---------------------|----------------|----------------|------|---|---------------|---------------|---------------|
| | | | | Multi-Year Averages | | | |
| | | | | 2007 | 2 YR 06-07 | 3 YR 05-07 | 4 YR 04-07 |
| MSU D8006W | WHITE | WHITE | YES | 94.6 | 96.3 | 91.1 | 87.0 |
| MSU Line E0028 | WHITE | WHITE | NO | 94.0 | 96.8 | 91.9 | 86.9 |
| Crystal | WHITE | WHITE | YES | 93.3 | 95.2 | 90.9 | 85.5 |
| Jewel | WHITE | WHITE | YES | 91.3 | 93.0 | 88.8 | 85.5 |
| TW110-062 | WHITE | WHITE | NO | 90.2 | ----- | ----- | ----- |
| MSU Line E2017 | WHITE | BRONZE | NO | 89.9 | 92.7 | 89.2 | ----- |
| MSU Line E1009 | WHITE | WHITE | YES | 89.6 | 90.2 | ----- | ----- |
| MCIA CRL | WHITE | WHITE | NO | 89.5 | ----- | ----- | ----- |
| MSU Line E2041 | WHITE | WHITE | YES | 88.9 | 92.6 | ----- | ----- |
| Pioneer Brand 25W41 | WHITE | WHITE | YES | 88.3 | 90.9 | 86.9 | 82.7 |
| Aubrey | WHITE | WHITE | NO | 87.9 | 87.9 | 86.3 | 83.5 |
| TW122-001 | WHITE | WHITE | NO | 87.8 | ----- | ----- | ----- |

**Single and Multiyear averages
(when available)**



Wheat Breeding Requires Many Years

Cross



Many years of



- selection



- purification (*inbreeding*)



- increase

Yield Trials



BREEDING NURSERY
80 acres – 3 year rotation.

50 foot single plant plots
(Photo in June, 2007)



YIELD TRIALS –
6 locations, PYT, AYT,
Quality, State Performance,
Regional Nurseries

SAGINAW, 2007 (Right)



FHB NURSERY

~1400 entries this year
(USWBSI Regional Nurseries,
F3, F4, Yield Trials, Mapping)

Pre Harvest Sprouting



QUALITY DRILL STRIP TRIAL 2007

**Aubrey, Caledonia, MSU Line E0028, MSU Line E1008,
MSU Line E1009, MSU Line E3003, & MSU Line E3012**



Variety Development

Non - Negotiable Traits: _

Yield

Testweight

Quality

Traits that affect yield, testweight and/or quality

FHB resistance (affects yield, testweight and quality) – ***especially lower toxin***

Pre-Harvest Sprouting resistance

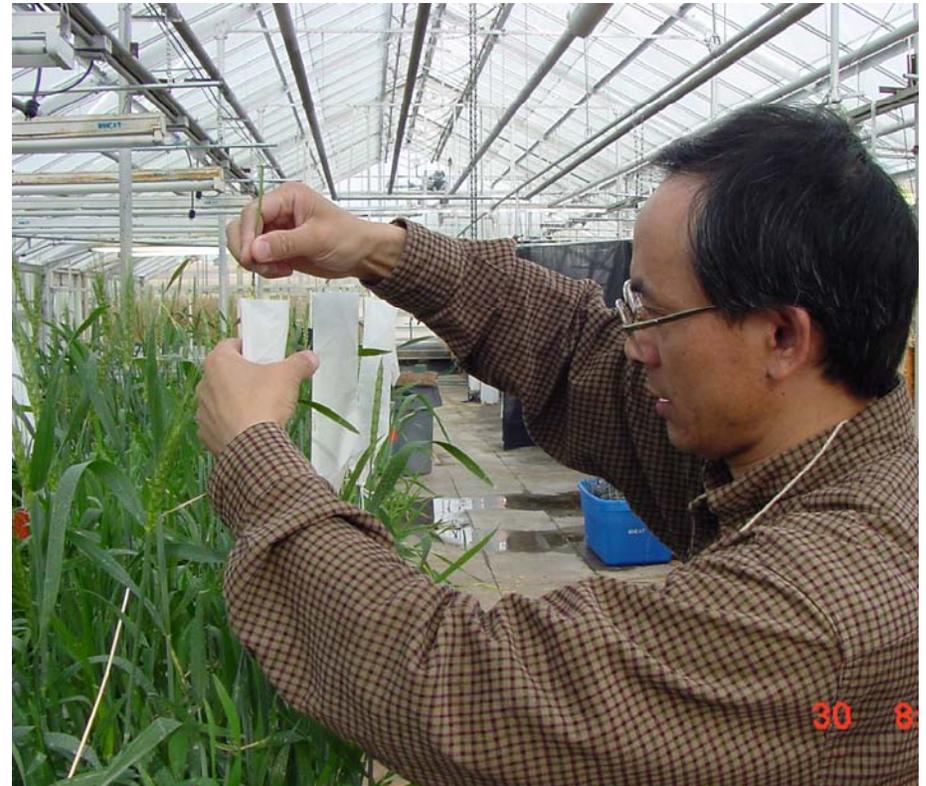
Climate change?



Crosses Spring 2007

Emphasis on FHB
Resistance

Emphasis on Pre-Harvest
Sprouting Resistance



Crossing Block Winter

'07/Spring '08

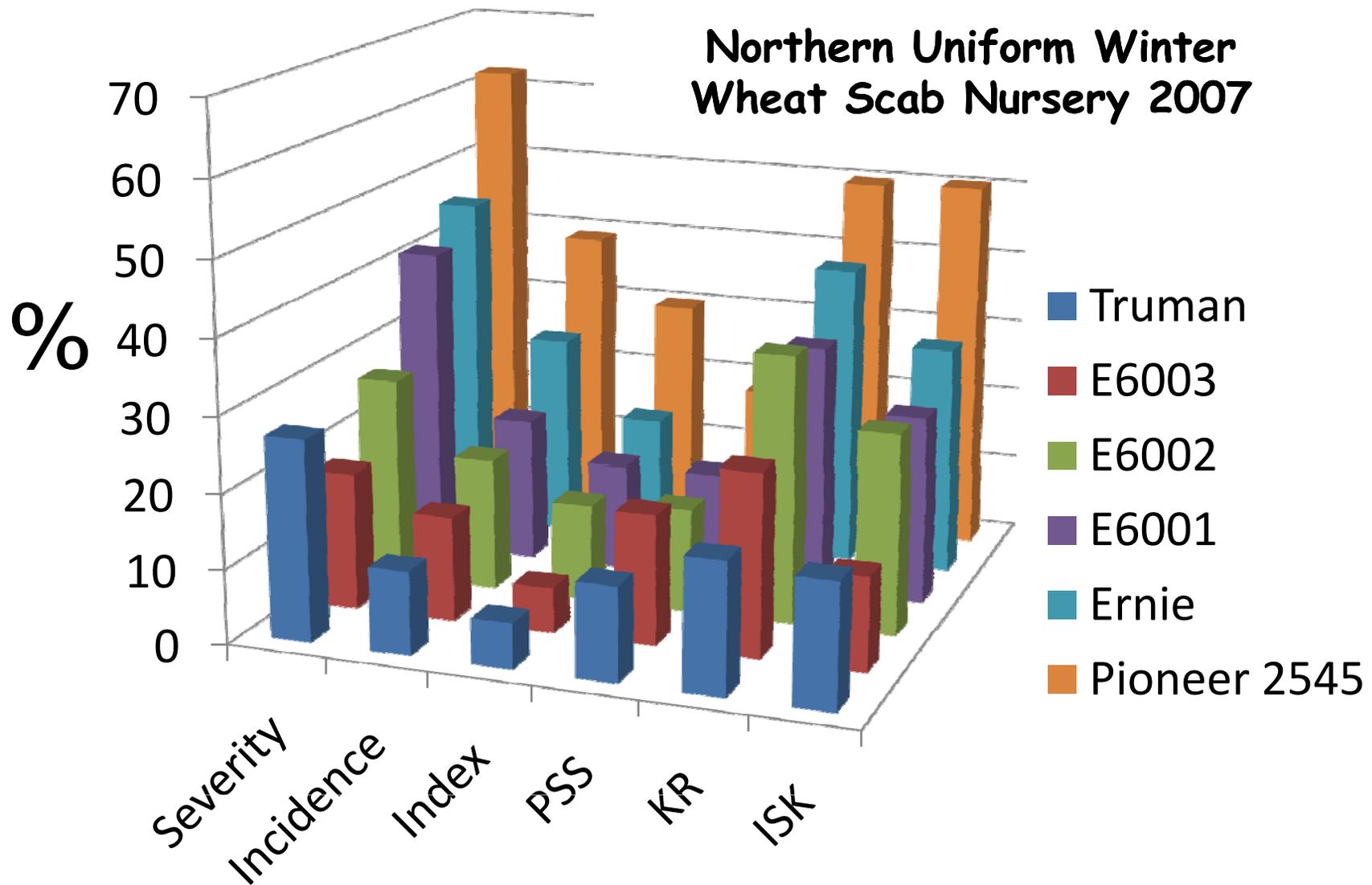
13 planting dates over 8 weeks
(Nov '07 – Jan '08)

- Elite true-breeding parents
- FHB resistant parents
- Selected F1 lines for 3-way crosses



FHB Resistant Materials

MSU Lines E6001, E6002, E6003



Molecular Marker Data

| Line | <i>PEDIGREE</i> | FHB1 3BS QTL | FHB 5A QTL | FHB 2DL QTL |
|-------------------|--------------------------|-------------------------|-----------------------|------------------------|
| MSU Line E6001 | PIONEER_25W60 /CJ9306 | yes | no | hetero |
| MSU Line E6002 | VA96W-403WS /CJ9403 | no | no | yes |
| MSU Line E6003 | VA96W-403WS /W14 | yes | no | yes |

Summary of Materials in Field

Breeding Nursery

- 1799 Single Plant Progeny Plots

Yield Trials

- Preliminary Yield Trial
- Advanced Yield Trials
- State Performance Trial
- Regional Trials

FHB Nursery

- Early generation materials (165 F3 and 451 F4)
- Advanced Generation Materials (Preliminary and
Advanced Yield trials, State Performance Trial)
- Regional nurseries

MSU Recent Release in Commercial Production

Estimates of acreage 2007/08 according to certified seed sales

D8006 (white) ~ 12,000 acres

- “Best in Show” – Quality council meeting, Kansas City, 2008

Jewel (white) ~ 5,000 acres

Crystal (white) ~ 2,000 acres

Red Ruby (red) ~ 4,000 acres

Other Recent Release and lines Being Reviewed for Review

MSU Line E0028 - white (released)

MSU Line E2017 - white

MSU Line E1009 - white

MSU Line D8006R - red

MSU Line E0028
2007 release
MSU WHEAT BREEDING PROGRAM



MSU Line E0028 Characteristics

Cross Made in 1994:

Pioneer 2737W/MSU D1148,

Soft White Winter Wheat. White Chaff. Awnletted.

Flowers ~2 Days Earlier than Caledonia.

1 inch Taller than Caledonia.

Yield and Lodging Resistance Similar to Caledonia.

Good Winter Hardiness in comparison to Caledonia.

MSU Line E0028 Characteristics

Soft White Winter Wheat. White Chaff. Awnletted.

Strengths:

- Higher yield
- Higher flour yield
- Early maturity (2 days)



Weaknesses:

- Lower than Average Test Weight.
- Susceptible to FHB (including DON).

MSU Line E2017

Being reviewed for release 2008



MSU Line E2017 Characteristics

- Cross made in 1995:
D3913/D0331
- It is currently an F_{6:13} Soft White Winter Wheat, awnless with bronze chaff.
- 95 Acres were planted for increase production in Michigan for the 2007-08 growing season.

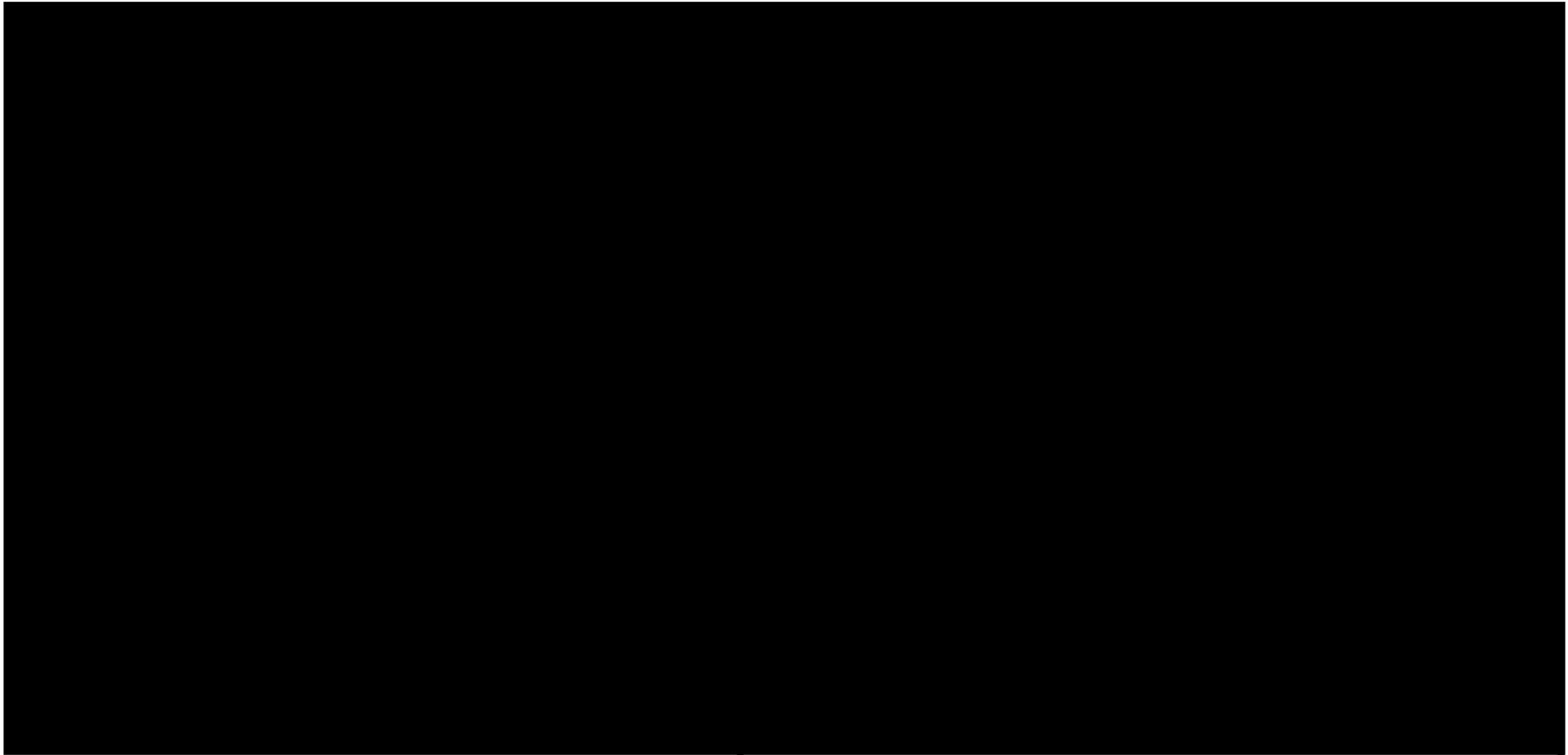
MSU Line E2017 Characteristics

- Soft White, bronze chaff, awnless
- Strengths
 - Improved FHB resistance (visual)
 - Improved DON toxin levels compared with many high yielding white wheats.
 - Good test weight
 - Awnless
- Weaknesses
 - Powdery Mildew
 - Stripe Rust



| DON (ppm): 2 Year MSU average 2005-06 2 YEAR AVG. | DON in grain (ppm): 3 year average: MN ('07, 2005-07 3 YEAR AVG. |
|--|---|
| 3.7 | 3.1 |
| 4.9 | 5.1 |
| 4.5 | 3.8 |
| 6.9 S+ | 6.4 S+ |
| 8.7 S+ | 6.8 S+ |
| 7.1 S+ | 9.0 S+ |
| 6.5 S+ | 7.1 S+ |
| 8.1 S+ | 8.4 S+ |
| 3.3 | 3.8 |
| 2.8 | 2.5 |
| 40.7 | 39.5 |

S+ = significantly more than E2017 (LSD 0.05)
S- = significantly less than E2017(LSD 0.05)



S+ = significantly more than E2017 (LSD 0.05)

S- = significantly less than E2017(LSD 0.05)

MSU Line E1009

Being reviewed for release 2008



MSU Line E1009

Being reviewed for release 2008

Cross: 1995 DC076 / PIONEER 2552

(DC076,87F_INTCB_ENT#182/AUG//AUG)/3/(PIONEER_2555,PNR_W3
017/PNR_W521)

F4:13

Soft White Winter Wheat.

white chaff, awns

MSU Line E1009

Characteristics

Soft White, White Chaff, has awns

Strengths:

Higher Testweight
Lower DON (toxin) levels
than many high yielding
white wheats.
Shorter

Weaknesses
BYDV



MSU Line D8006R

Being reviewed for release 2008



MSU Line D8006R Characteristics

Being reviewed for release 2008

- Cross made in : 1991
PIONEER 2555/LOWELL
(P2555,PIO_2555_COKER_68-
16/MOW7140//PIO_W521)/3/(LOWELL,X0467/B2141//B5250)
- It is currently an F10:17 Soft Red Winter Wheat,
awned with white chaff.
- 17 Acres were planted for increase production in
Michigan for the 2007-08 growing season.

MSU Line D8006R Characteristics

- Soft Red
- Strengths
 - High flour yield
 - Powdery Mildew resistance
 - Good yield
- Weaknesses
 - Leaf Blotch



Thank you!

- Michigan State University
- U.S. Wheat and Barley Scab Initiative
- Michigan Crop Improvement Association
- Soft White Wheat Endowment Group

Questions?

