

2003

**NORTH AMERICAN BARLEY SCAB
EVALUATION NURSERY (NABSEN)
INTERIM REPORT**

December 2003

Stephen Neate* and Patrick Gross
Dept Plant Pathology, North Dakota State University

*address all enquiries regarding this report to Stephen Neate, contact details enclosed

Collaborating Scientists

Richard D. Horsley
 Professor & Barley Breeder
 Department of Plant Sciences
 North Dakota State University
 P.O. Box 5051
 Fargo, ND 58105-5051, U.S.A.
 Phone: (701) 231-8142
 Fax: (701) 231-8474
 Email: Richard.Horsley@ndsu.nodak.edu

Jerome D. Franckowiak
 Professor & Barley Breeder
 Department of Plant Sciences
 North Dakota State University
 P.O. Box 5051
 Fargo, ND 58105-5051, U.S.A.
 Phone: 1-701-231-7540
 Fax: 1-701-231-8474
 Email: j.franckowiak@ndsu.nodak.edu

Stephen Neate
 Associate Professor
 Department of Plant Pathology
 North Dakota State University
 P.O. Box 5012
 Fargo ND 58105-5012
 Phone: 1 701 231-7078
 Fax: 1 701 231-7851
 Email: Stephen.Neate@ndsu.nodak.edu

Bill Legge
 Agriculture & Agri-Food Canada Research Centre
 P.O. Box 1000A, R.R. #3
 Brandon, Manitoba R7A 5Y3
 Canada
 Phone: (204)726-7650
 Fax: (204)728-3858
 Email: blegge@agr.gc.ca

James Tucker
 Agriculture & Agri-Food Canada Research Centre
 P.O. Box 1000A, R.R. #3
 Brandon, Manitoba R7A 5Y3
 Canada
 Phone: (204)726-7650
 Fax: (204)728-3858
 Email: jtucker@agr.gc.ca

Kevin P. Smith
 Assistant Professor
 Department of Agronomy and Plant Genetics
 University of Minnesota
 St. Paul, MN 55108
 phone 612-624-1211
 fax 612-625-1268
 email: smith376@tc.umn.edu

Ruth Dill-Macky
 Associate Professor
 Department of Plant Pathology
 University of Minnesota
 St Paul MN 55108
 Phone: 612-625-2227
 Fax: 612-625-9728
 Email: ruthdm@umn.edu

Blake Cooper
 Sr. Manager North American Barley Research
 Busch-Agricultural Resources Inc. (BARI)
 3515 E. County Rd. 52
 Ft. Collins, CO 80524
 Phone: (970) 472-2327
 Fax: (970) 472-2334
 email: blake.cooper @ anheuser-busch.com

Linnea G. Skoglund
 Cereal Pathology Manager
 Busch Agricultural Resources, Inc.
 3515 East County Road 52
 Fort Collins, CO 80524
 Phone: (970) 472-2332
 Fax: (970) 472-2334
 Email: Linnea.Skoglund@anheuser-busch.com

Flavio Capettini
 Head, Barley Breeding, ICARDA/CIMMYT Latin Am.
 Program
 Apartado Postal 6-641
 06600 Mexico D.F., Mexico
 Phone: 52 595 952-1900, + 52 55 5804-2004
 Fax: 52 595 952-1983/84
 Phone via USA (IVDN): + 1 650 833-6655
 Email: f.capettini@cgiar.org

Maarten van Ginkel
 Head, CIMMYT Wheat Gene Bank; Head Fusarium Res
 Unit.
 Apartado Postal 6-641
 06600 Mexico D.F., Mexico
 Phone: 52-55-5804-2004
 Email: m.van-ginkel@cgiar.org

INTRODUCTION

The 2003 North American Barley Scab Evaluation Nursery (NABSEN) was grown at Fargo, Langdon, Osnabrock and Carrington, ND; St. Paul and Crookston MN; Brandon, Manitoba and Toluca Mexico. Nurseries were either irrigated or un-irrigated (dryland). Dryland nurseries provide conditions similar to those found in commercial fields. Disease in irrigated fields are more severe than growers would observe in most years and entries with only moderate FHB resistance have high disease levels. Only entries with higher levels of resistance similar to Chevron or CIho 4196 display resistance in the irrigated nurseries. Dryland nurseries allow discrimination of entries with moderate to low levels of FHB resistance. Each nursery included a set of common checks. The checks were CIho 4196 (resistant two-row check), Chevron (resistant six-row check), Robust and Stander (susceptible six-row checks), MNBrite (moderately resistant six-row check), and Conlon (moderately resistant two-row check).

At all locations percent severity of FHB was determined at the soft dough stage by determining the ratio of infected kernels to total kernels on 10-20 spikes per entry, and then multiplying by 100. At sites with low disease, disease incidence was measured as number of infected plants / total number of plants x 100. In addition Type II resistance, spread of *Fusarium* in the head, is measured at Toluca Mexico by point inoculation of heads, bagging and measuring spread of the fungus after checks have reached a predetermined level of infection.

Brief site details are as follows;

FARGO, ND – Stephen Neate, Pat Gross and Sun Yongliang

- Irrigated
- Inoculated by grain spawn method (barley and corn with 5 *F. graminearum* isolates)
- Unreplicated due to mid season flooding damage.
- DON content (ppm) measured by GC/ECD by P Schwarz, NDSU on the surviving replicate.

LANGDON, ND - – Stephen Neate, Pat Gross and Sun Yongliang

- Irrigated
- Inoculated by grain spawn method (barley and corn with 5 *F. graminearum* isolates)
- 3 Replicates
- DON content (ppm) measured by GC/ECD by P Schwarz, NDSU on a composite sample from 3 replicates

OSNABROCK, ND – Richard Horsley and Jason Faller

- Dryland
- Inoculated by grain spawn method (barley and corn with 5 *F. graminearum* isolates)
- 3 Replicates
- DON content (ppm) measured by GC/ECD by P Schwarz, NDSU on a composite sample from 3 replicates

CASSELTON, ND - Linnea Skoglund

- Dryland
- Un-inoculated
- 3 replicates
- DON content (ppm) measured by GC/ECD by P Schwarz, NDSU

ST. PAUL, MN– Kevin Smith and Ruth Dill-Macky

- Irrigated
- 4 replicates RCB design
- Inoculated by macroconidia spray method, made up of at least 12 isolates
- DON content (ppm) measured by GC/ECD by P Schwarz, NDSU

CROOKSTON, MN – Kevin Smith and Ruth Dill-Macky

- Irrigated
- 4 replicates RCB design
- Inoculated by grain spawn method, corn with multiple isolates
- DON content (ppm) measured by GC/ECD by P Schwarz, NDSU

CROOKSTON, MN – Kevin Smith and Ruth Dill-Macky

- Un-irrigated
- 4 replicates RCB design
- No inoculation
- DON content (ppm) measured by GC/ECD by P Schwarz, NDSU

BRANDON, MANITOBA - Bill Legge and James Tucker

- Irrigated
- 4 replicates RCB design
- Inoculated by grain spawn method, (corn with 3 *F. graminearum* isolates)
- DON content (ppm) measured by ELISA technique at ECORC, Ottawa on a composite sample of 4 replicates

TOLUCA, MEXICO – Flavio Capettini

- Irrigated
- 2 replicates
- Type I inoculation by sprayed spore suspension. Type II by point inoculation and head bagging.
- DON content (ppm) to be measured by RIDASCREEN FAST DON (R-Biopharm) technique at CIMMYT in Dec/Jan

Table 1. Mean FHB severity of entries grown in the 2003 NABSEN Nursery in nine trials at eight locations.

Entry	Fargo ¹	Langdon	St Paul	Brandon	Toluca	Toluca*	Crookston		Osnabrock	Casselton	Mean		
					Type I	Type II	Irrigated	Dryland			All locs*	Irrigated	Dryland
ND20369	4.5	13.8	0.8	4.9	2.6	24.1	13.4	2.0	0.24	6.2	5.4	6.7	2.8
ND20388	2.8	14.2	0.6	13.2	5.3	16.9	4.0	1.7	0.65	8.7	5.6	6.7	3.7
ND20406	3.2	13.0	0.9	8.1	3.7	18.0	8.9	2.6	0.07	6.5	5.2	6.3	3.1
ND20407	4.7	15.3	0.5	4.8	5.6	16.6	4.1	1.1	0.08	6.7	4.8	5.8	2.6
ND20452	3.5	13.9	1.2	9.4	4.4	8.6	6.8	0.9	0.23	4.0	4.9	6.5	1.7
ND20493	2.6	8.3	0.5	4.0	2.6	11.4	7.7	1.6	0.43	4.2	3.5	4.3	2.1
ND20539	4.1	17.9	1.1	13.9	9.8	27.5	18.1	2.3	0.52	2.8	7.8	10.8	1.9
ND20540	2.1	15.8	0.8	7.4	8.6	14.8	8.3	2.2	0.80	5.2	5.7	7.2	2.7
LEGACY	3.9	18.6	1.3	8.9	6.4	16.6	7.0	1.8	0.09	6.2	6.0	7.7	2.7
TRADITION	4.1	19.0	3.3	11.6	2.1	9.9	7.6	1.1	0.36	6.5	6.2	7.9	2.6
6B98-9022	4.2	20.5	0.6	14.0	3.8	20.8	11.2	1.7	0.46	12.8	7.7	9.0	5.0
6B99-6339	3.9	19.8	0.7	24.8	3.8	17.9	10.9	3.7	0.44	10.7	8.7	10.6	4.9
6B99-6774	4.7	19.7	1.5	23.6	3.8	10.9	5.9	0.7	0.30	10.3	7.8	9.9	3.8
6B00-1100	9.7	19.7	1.3	9.9	5.9	15.2	9.2	1.9	0.50	10.3	7.6	9.3	4.2
6B00-1323	11.1	19.0	1.8	16.2	7.0	17.9	7.2	2.1	0.60	4.2	7.6	10.4	2.3
6B00-1499	5.5	23.3	1.8	25.9	4.0	21.4	16.3	1.2	1.10	7.2	9.6	12.8	3.2
AC Bountiful	3.8	11.1	1.1	6.7	9.3	14.1	0.7	na	0.11	1.7	4.3	5.4	0.9
Calder	2.1	10.3	1.3	9.7	13.1	12.4	1.3	na	0.37	3.8	5.2	6.3	2.1
EX645-3-6	2.6	7.5	1.5	3.8	5.4	7.7	0.7	na	0.34	7.5	3.7	3.6	3.9
EX702-4-6	2.4	16.1	3.9	12.1	5.4	6.5	5.9	na	0.58	3.7	6.3	7.6	2.1
SH01265	1.8	5.0	0.8	4.0	11.1	8.2	0.7	na	0.20	4.0	3.4	3.9	2.1
SB00106	2.6	9.3	1.3	9.8	7.0	8.2	3.4	1.1	0.30	2.8	4.2	5.6	1.4
CDC Select	2.9	20.2	2.1	18.0	15.4	10.7	3.9	na	0.43	2.8	8.2	10.4	1.6
CDC Battleford	2.6	14.3	5.0	22.6	7.1	9.3	9.5	na	0.20	10.3	8.9	10.2	5.3
FEG43-46	2.1	15.0	0.6	17.0	4.1	15.2	9.9	1.0	0.70	7.0	6.4	8.1	2.9
FEG43-47	1.8	14.6	0.7	8.6	4.5	14.4	10.8	0.8	0.35	5.7	5.3	6.8	2.3
FEG44-12	3.0	23.6	1.3	21.5	5.0	9.6	10.9	1.9	0.40	7.7	8.3	10.9	3.3
FEG55-04	2.1	16.8	1.5	7.3	3.7	11.6	8.3	2.0	0.12	4.0	5.1	6.6	2.0
FEG57-28	2.8	17.8	1.9	2.8	6.5	28.5	18.5	2.8	0.60	7.2	6.8	8.4	3.5

Table 1 cont. Mean FHB severity of entries grown in the 2003 NABSEN Nursery at nine trials at eight locations.

Entry	Fargo	Langdon	St Paul	Brandon	Toluca	Toluca*	Crookston				Mean		
					Type I	Type II	Irrigated	Dryland	Osnabrock	Casselton	All locs*	Irrigated	Dryland
FEG59-36	2.2	10.7	1.3	3.5	1.5	11.8	10.3	1.2	0.05	2.5	3.7	4.9	1.2
FEG61-27	2.3	14.8	1.2	5.1	8.9	13.7	3.7	0.9	0.07	0.3	4.1	6.0	0.4
FEG66-08	0.5	9.0	1.4	8.6	6.4	14.1	4.3	1.6	0.23	4.3	4.0	5.0	2.0
03iC-1	3.0	12.9	2.9	17.4	8.4	16.2	7.8	1.9	1.10	7.2	7.0	8.7	3.4
03iC-2	2.6	13.0	6.4	28.0	1.0	9.8	5.8	1.4	0.03	0.0	6.5	9.5	0.5
03iC-3	3.1	16.4	1.6	18.0	2.8	8.3	6.9	1.6	2.70	6.8	6.7	8.1	3.7
03iC-4	6.5	17.5	3.4	6.4	6.7	12.5	15.3	1.5	3.70	5.3	7.4	9.3	3.5
03iC-5	1.0	12.0	0.7	4.8	5.7	16.5	0.5	0.3	0.00	0.0	2.8	4.1	0.1
03iC-6	6.8	17.6	3.1	13.8	14.5	5.3	9.8	1.4	1.50	7.2	8.3	11.0	3.4
03iC-7	2.6	17.3	1.2	12.8	4.7	5.7	6.6	0.8	1.30	9.7	6.3	7.5	3.9
03iC-8	3.3	17.7	1.7	18.8	2.0	7.7	6.7	1.3	1.70	7.0	6.7	8.4	3.3
2ND 19836	1.9	14.7	0.6	3.4	3.5	18.0	6.2	1.1	0.36	3.2	3.9	5.1	1.6
2ND 19854	3.9	13.9	1.6	7.4	na	na	7.7	1.8	1.80	12.2	6.3	6.9	5.3
2ND19119	2.3	20.9	0.6	14.1	5.1	12.5	4.8	1.0	0.63	7.2	6.3	8.0	3.0
2ND 19929	1.2	8.8	0.3	11.3	na	na	6.2	1.3	1.00	8.7	4.9	5.6	3.7
2ND 20833	2.1	14.6	1.1	25.3	7.0	5.8	4.8	0.8	0.42	2.7	6.5	9.2	1.3
MnBrite	4.0	16.1	0.7	16.8	3.7	16.2	11.2	2.5	0.22	3.3	6.5	8.7	2.0
Conlon	4.5	18.0	0.5	7.6	5.8	20.9	12.8	2.8	4.30	8.2	7.2	8.2	5.1
Robust	3.1	24.0	1.7	14.4	7.0	20.6	6.2	2.9	0.38	10.2	7.7	9.4	4.5
CIHO 4196	1.6	13.6	0.3	4.7	3.9	20.4	0.6	0.5	0.00	0.0	2.8	4.1	0.2
Chevron	0.0	4.5	2.3	2.8	11.4	28.0	1.4	0.2	0.00	1.5	2.7	3.7	0.6
Stander	2.4	19.8	1.8	29.8	4.8	9.1	11.2	2.5	0.38	9.3	9.1	11.6	4.1

¹ No replicates at Fargo

* Toluca data for Type II resistance screening not included in means
na treatments not planted or not assessed

Table 2. Mean disease incidence of entries grown in the 2003 NABSEN Nursery at six locations.

Entry	Fargo*	Langdon	Osnabrock	Toluca	Casselton	Brandon	Mean
ND20369	85	50.0	13.0	80.0	60.0	77.5	56.1
ND20388	60.0	60.0	10.0	90.0	67.0	95.0	63.7
ND20406	15.0	15.0	3.0	80.0	67.0	97.5	46.3
ND20407	15.0	15.0	6.7	60.0	60.0	87.5	40.7
ND20452	75.0	75.0	10.0	56.0	43.0	82.5	56.9
ND20493	55.0	55.0	16.0	70.0	57.0	80.0	55.5
ND20539	80.0	80.0	23.0	100.0	33.0	85.0	66.8
ND20540	55.0	55.0	16.7	95.0	67.0	97.5	64.4
LEGACY	90.0	90.0	3.3	83.0	70.0	75.0	68.6
TRADITION	85.0	85.0	13.3	54.0	70.0	62.5	61.6
6B98-9022	75.0	75.0	18.3	70.0	83.0	87.5	68.1
6B99-6339	75.0	75.0	16.7	70.0	87.0	100.0	70.6
6B99-6774	80.0	80.0	13.3	75.0	80.0	95.0	70.6
6B00-1100	100.0	100.0	20.0	75.0	83.0	97.5	79.3
6B00-1323	95.0	95.0	23.3	88.0	53.0	95.0	74.9
6B00-1499	85.0	85.0	35.0	65.0	83.0	100.0	75.5
AC Bountiful	80.0	80.0	3.3	95.0	20.0	80.0	59.7
Calder	50.0	50.0	8.3	95.0	30.0	90.0	53.9
EX645-3-6	50.0	50.0	10.0	55.0	67.0	65.0	49.5
EX702-4-6	60.0	60.0	20.0	70.0	57.0	87.5	59.1
SH01265	45.0	45.0	7.0	100.0	57.0	87.5	56.9
SB00106	50.0	50.0	7.0	83.0	33.0	65.0	48.0
CDC Select	55.0	55.0	8.3	100.0	30.0	100.0	58.1
CDC Battleford	80.0	80.0	8.3	75.0	73.0	100.0	69.4
FEG43-46	45.0	45.0	23.3	82.0	73.0	97.5	61.0
FEG43-47	60.0	60.0	11.7	60.0	50.0	87.5	54.9
FEG44-12	75.0	75.0	20.0	70.0	73.0	92.5	67.6
FEG55-04	70.0	70.0	8.3	70.0	50.0	82.5	58.5
FEG57-28	60.0	60.0	21.7	80.0	73.0	75.0	61.6
FEG59-36	45.0	45.0	3.3	55.0	30.0	60.0	39.7
FEG61-27	60.0	60.0	5.0	70.0	7.0	90.0	48.7
FEG66-08	80.0	80.0	8.3	75.0	43.0	90.0	62.7
03iC-1	45.0	45.0	20.0	85.0	77.0	90.0	60.3
03iC-2	55.0	55.0	1.7	35.0	0.0	97.5	40.7
03iC-3	60.0	60.0	31.7	51.0	73.0	90.0	61.0
03iC-4	85.0	85.0	48.3	90.0	60.0	80.0	74.7
03iC-5	35.0	35.0	0.0	95.0	0.0	90.0	42.5
03iC-6	70.0	70.0	25.0	70.0	70.0	97.5	67.1
03iC-7	75.0	75.0	30.0	84.0	87.0	87.5	73.1
03iC-8	55.0	55.0	26.7	35.0	63.0	90.0	54.1

Table 2 cont. Mean incidence of entries grown in the 2003 NABSEN Nursery at six locations.

Entry	Fargo	Langdon	Osnabrock	Toluca	Casselton	Brandon	Mean
2ND 19836	50.0	50.0	7.0	75.0	40.0	50.0	45.3
2ND 19854	70.0	70.0	28.3	na	83.0	80.0	66.3
2ND19119	45.0	45.0	11.7	80.0	67.0	85.0	55.6
2ND 19929	25.0	25.0	8.3	na	63.0	90.0	42.3
2ND 20833	30.0	30.0	25.0	95.0	30.0	90.0	50.0
MnBrite	55.0	55.0	10.0	75.0	47.0	97.5	56.6
Conlon	65.0	65.0	43.3	78.0	90.0	85.0	71.1
Robust	75.0	75.0	18.3	85.0	83.0	95.0	71.9
CIHO 4196	40.0	40.0	0.0	47.0	0.0	92.5	36.6
Chevron	0.0	0.0	0.0	80.0	17.0	60.0	26.2
Stander	90.0	90.0	11.7	80.0	90.0	100.0	77.0

* No replicates at Fargo

na treatments not planted or not assessed

Table 3. Mean days to heading after May 31 of entries grown in 2003 NABSEN Nursery at five locations.

LABEL	Fargo	Langdon	Crookston Irrig.	St. Paul	Brandon	Mean
ND20369	26.0	32.3	23.0	13.7	46.5	28.3
ND20388	27.0	33.0	23.7	13.7	48.5	29.2
ND20406	29.3	34.0	23.3	15.0	47.0	29.7
ND20407	29.7	33.7	24.0	15.7	46.5	29.9
ND20452	30.3	35.0	26.7	16.3	49.5	31.6
ND20493	28.3	33.0	23.0	14.7	45.5	28.9
ND20539	31.7	35.0	24.7	15.7	48.5	31.1
ND20540	33.0	33.7	26.7	15.7	46.5	31.1
LEGACY	32.0	35.7	25.0	16.3	49.3	31.7
TRADITION	31.7	34.7	24.7	17.0	49.0	31.4
6B98-9022	32.0	36.0	24.7	16.3	48.0	31.4
6B99-6339	29.0	34.0	23.7	15.0	50.3	30.4
6B99-6774	33.0	36.3	27.3	18.0	50.8	33.1
6B00-1100	28.7	34.7	24.7	15.3	47.5	30.2
6B00-1323	32.3	34.7	25.3	16.3	50.5	31.8
6B00-1499	33.0	35.3	24.0	16.3	49.3	31.6
AC Bountiful	35.0	38.0	28.3	19.7	54.5	35.1
Calder	33.3	37.7	27.3	18.0	52.0	33.7
EX645-3-6	35.0	38.7	27.3	20.0	53.5	34.9
EX702-4-6	33.0	36.0	26.7	18.3	50.3	32.9
SH01265	37.3	38.3	29.7	20.7	55.0	36.2
SB00106	33.3	37.0	26.7	17.3	49.8	32.8
CDC Select	36.3	37.7	27.0	18.3	53.0	34.5
CDC Battleford	35.0	37.7	27.0	17.7	52.0	33.9
FEG43-46	33.0	36.3	26.0	16.3	50.3	32.4
FEG43-47	32.7	34.3	24.7	15.0	50.5	31.4
FEG44-12	31.7	35.7	26.0	16.0	50.0	31.9
FEG55-04	32.3	35.0	25.7	15.3	50.0	31.7
FEG57-28	31.3	37.7	23.0	12.7	47.3	30.4
FEG59-36	32.3	33.3	23.3	13.7	48.5	30.2
FEG61-27	31.0	34.7	26.7	16.7	50.8	32.0
FEG66-08	35.0	36.3	23.7	14.3	51.5	32.2
03iC-1	33.0	37.0	25.3	17.0	50.8	32.6
03iC-2	36.5	38.0	29.3	18.7	52.0	34.9
03iC-3	32.0	36.0	24.7	15.7	49.8	31.6
03iC-4	28.7	34.0	24.0	15.0	47.8	29.9
03iC-5	36.3	39.3	29.0	21.3	58.0	36.8
03iC-6	32.3	37.0	26.7	18.7	45.5	32.0
03iC-7	30.7	36.0	25.0	16.0	48.0	31.1
03iC-8	34.3	36.7	24.3	15.7	50.0	32.2

Table 3 cont. Mean days to heading after May 31 of entries grown in 2003 NABSEN Nursery at five locations.

LABEL	Fargo	Langdon	Crookston Irrig.	St. Paul	Brandon	Mean
2ND 19836	32.7	34.0	23.7	14.3	47.5	30.4
2ND 19854	31.0	34.3	23.0	13.0	46.5	29.6
2ND19119	30.3	35.7	23.3	14.3	48.0	30.3
2ND 19929	31.3	36.7	23.3	13.3	49.8	30.9
2ND 20833	32.7	37.0	24.7	17.3	51.3	32.6
MnBrite	33.0	36.3	25.0	14.3	51.5	32.0
Conlon	28.7	34.7	23.0	11.7	45.0	28.6
Robust	31.7	35.3	25.3	14.7	50.3	31.5
CIHO 4196	38.7	40.0	30.3	20.0	56.3	37.1
Chevron	39.0	39.3	28.3	18.3	53.5	35.7
Stander	31.3	37.0	24.3	15.0	50.3	31.6

Table 4. Mean DON content (ppm) of entries grown in the 2003 NABSEN Nursery at seven locations.

LABEL	Fargo*	Langdon	Casselton	Osnabrock	Crookston		St.Paul	Brandon	Mean		
					dryland	irrigated			All locs.	irrigated	dryland
ND20369	2.4	34.2	14.2	0.3	2.1	19	4.8	7.6	10.6	13.6	5.5
ND20388	4.2	29.1	11.2	0.3	1.3	21.3	5	10.1	10.3	13.9	4.3
ND20406	5.2	20.3	14.8	0.2	1.8	20.5	3.4	10.8	9.6	12.0	5.6
ND20407	4.8	26.4	11.5	0.3	1.3	13.1	6.5	11.2	9.4	12.4	4.4
ND20452	4	26.9	8	0.2	1.3	21.5	4.7	15.4	10.3	14.5	3.2
ND20493	3.7	12.3	8.8	0.2	0.9	10.1	3.7	5.0	5.6	7.0	3.3
ND20539	6.2	15.2	9.4	0.3	1.9	26.7	3.7	11.5	9.4	12.7	3.9
ND20540	7.7	9.6	13.3	0.3	2	29.4	3.3	10.2	9.5	12.0	5.2
LEGACY	6.8	30.0	12.4	0.4	2	25.5	6.2	10.4	11.7	15.8	4.9
TRADITION	21.1	27.2	17.7	0.3	1.3	26.1	7.5	13.5	14.3	19.1	6.4
6B98-9022	18	22.6	14.9	0.4	1.9	25.8	5.4	13.7	12.8	17.1	5.7
6B99-6339	17.1	44.0	22.4	0.6	4.2	28.5	8.4	18.2	17.9	23.2	9.1
6B99-6774	23.2	34.9	25.7	0.6	2.1	38.4	10.9	24.3	20.0	26.3	9.5
6B00-1100	17.8	28.4	14.4	0.4	2.1	26.9	8.9	17.1	14.5	19.8	5.6
6B00-1323	13.8	26.5	8.2	0.3	3.5	28.3	6.1	16.4	12.9	18.2	4.0
6B00-1499	13.5	20.5	9.2	0.6	2.1	24.2	5.3	20.1	11.9	16.7	4.0
AC Bountiful	2.9	36.3	2.3	0.1	na	13.3	5.2	8.9	9.9	13.3	1.2
Calder	4.2	22.0	4.1	0.1	na	9.3	3.1	8.4	7.3	9.4	2.1
EX645-3-6	1.3	9.4	4	0.1	na	2.8	1.3	3.3	3.2	3.6	2.1
EX702-4-6	1.3	15.5	5.1	0	na	10.3	4.1	4.6	5.8	7.2	2.6
SH01265	0.7	5.2	5.1	0	na	3.4	0.9	2.4	2.5	2.5	2.6
SB00106	1.8	18.0	1	0.2	0.4	9.3	2.8	9.2	5.3	8.2	0.5
CDC Select	3.2	41.4	5.8	0.1	na	10.7	4.6	15.2	11.6	15.0	3.0
CDC Battleford	8.4	35.8	10	0.3	na	18.5	4.8	15.7	13.4	16.6	5.2
FEG43-46	8.6	29.6	12.1	0.4	1.3	18.1	6.3	21.1	12.2	16.7	4.6
FEG43-47	11.5	26.5	10.6	0.3	1.3	19.3	3.3	11.7	10.6	14.5	4.1
FEG44-12	6.6	35.6	11.4	0.3	1.3	30.9	5.8	16.0	13.5	19.0	4.3
FEG55-04	6.5	31.3	3.6	0.1	0.7	17	3.2	6.4	8.6	12.9	1.5
FEG57-28	4.7	21.9	11.9	0.4	2	19.6	3.6	5.5	8.7	11.1	4.8

Table 4 cont. Mean DON content (ppm) of entries grown in the 2003 NABSEN Nursery at seven locations.

LABEL	Fargo*	Langdon	Casselton	Osnabrock	Crookston		St.Paul	Brandon	Mean		
					dryland	irrigated			All locs.	irrigated	dryland
FEG59-36	5.6	17.2	9.1	0	1	15.8	3.1	6.2	7.3	9.6	3.4
FEG61-27	5.6	23.4	8.6	0.2	0.8	16.2	4.9	9.2	8.6	11.9	3.2
FEG66-08	4.1	42.3	6.1	0.2	1	12.9	3.6	6.3	9.6	13.8	2.4
03iC-1	0.3	15.5	7.8	0.2	1.5	7.3	4.9	9.1	5.8	7.4	3.2
03iC-2	2	13.1	3.2	0.2	0.6	11.8	2.8	12.0	5.7	8.3	1.3
03iC-3	0.8	13.6	7.2	0.4	0.9	16.1	4.4	12.0	6.9	9.4	2.8
03iC-4	4.6	25.7	14.1	0.2	1	34	5.2	14.1	12.4	16.7	5.1
03iC-5	1.1	54.8	0.9	0.1	0.9	10.3	1.7	9.0	9.9	15.4	0.6
03iC-6	1.8	28.4	12.3	0.4	1.6	30.1	9.7	7.4	11.5	15.5	4.8
03iC-7	0	26.2	8.4	0.3	1.4	11.5	3.1	11.5	7.8	10.5	3.4
03iC-8	1.3	29.9	7.2	0.1	1.3	14.5	3.9	17.9	9.5	13.5	2.9
2ND 19836	0.1	28.8	4.6	0.2	0.6	6.4	3.2	13.7	7.2	10.4	1.8
2ND 19854	3.9	18.1	9.2	0.2	1	12.5	7.1	17.3	8.7	11.8	3.5
2ND19119	1.9	45.2	10.8	0.1	1.1	9.7	5.5	21.0	11.9	16.7	4.0
2ND 19929	0.8	35.3	6.6	0.1	0.9	9.9	4	14.6	9.0	12.9	2.5
2ND 20833	0.4	38.0	4.1	0	1.1	7.6	4.9	11.4	8.4	12.5	1.7
MnBrite	3.9	41.2	3.7	0.3	1.3	19.9	4.5	8.8	10.5	15.7	1.8
Conlon	0.3	14.5	5.1	0.1	0.6	14.8	4.6	8.7	6.1	8.6	1.9
Robust	5.1	41.9	16.8	0.4	1.2	26.3	6	13.7	13.9	18.6	6.1
CIHO 4196	0.2	47.4	0.4	0.1	0.7	16.2	1.6	5.8	9.1	14.2	0.4
Chevron	0.1	22.0	2.9	0.1	0.5	9.6	2.3	7.4	5.6	8.3	1.2
Stander	3.2	67.7	22.3	0.4	3.5	29.8	7.4	20.2	19.3	25.7	8.7

* No replicates at Fargo
na treatments not planted

Table 5. Correlation among locations for FHB severity in 2003.

	Fargo	Langdon	St. Paul	Brandon	Toluca	Crookston		Osnabrock	Casselton
						irrigated	dryland		
Fargo	1.00	0.50**	0.17	0.21	0.06	0.35*	0.29	0.28	-0.12
Langdon	0.50**	1.00	0.12	0.58**	-0.09	0.55**	0.52**	0.22	-0.23
St. Paul	0.17	0.12	1.00	0.35*	0.04	0.09	-0.03	0.10	-0.13
Brandon	0.21	0.58**	0.35*	1.00	-0.18	0.26	0.29	0.06	-0.02
Toluca	0.06	-0.87	0.04	-0.18	1.00	-0.20	-0.26	0.04	0.28
Crookston- irrigated	0.35*	0.55**	0.09	0.26	-0.20	1.00	0.68**	0.30	-0.36*
Crookston-dryland	0.29	0.52**	-0.26	0.29	-0.26	0.68**	1.00	0.14	-0.35*
Osnabrock	0.28	0.22	0.10	0.06	0.04	0.30	0.14	1.00	0.12
Casselton	-0.12	-0.23	-0.13	-0.02	0.28	-0.36*	-0.35*	0.12	1.00

*,** r-values significantly different from 0.0 at P<0.05 and P<0.01, respectively

Table 6. Correlation among locations for DON accumulation in 2003.

	Fargo	Langdon	St. Paul	Brandon	Crookston		Osnabrock	Casselton
					irrigated	dryland		
Fargo	1.00	-0.48*	0.33	-0.15	0.02	-0.26	-0.23	-0.14
Langdon	-0.48*	1.00	0.05	0.60**	0.50*	0.67**	0.53**	-0.05
St. Paul	0.33	0.05	1.00	0.30*	0.39*	0.23	0.30*	-0.08
Brandon	-0.15	0.60**	0.30*	1.00	0.63**	0.67**	0.56**	-0.16
Crookston- irrigated	0.02	0.50*	0.39*	0.63**	1.00	0.48	0.48*	-0.12
Crookston-dryland	-0.26	0.67**	0.23	0.67**	0.48*	1.00	0.68**	-0.25
Osnabrock	-0.23	0.53**	0.30*	0.56**	0.47*	0.68**	1.00	-0.43*
Casselton	-0.14	-0.05	-0.08	-0.16	-0.12	-0.25	-0.43*	1.00

*,** r-values significantly different from 0.0 at P<0.05 and P<0.01, respectively

Table 7. Pedigree and source of breeding lines tested for FHB resistance in 2003.

LABEL	PEDIGREE	SOURCE
ND20369	ND16918/C98-62-3	North Dakota State Univ.
ND20388	ND16918/C98-62-3	North Dakota State Univ.
ND20406	ND16918/C98-62-3	North Dakota State Univ.
ND20407	ND16918/C98-62-3	North Dakota State Univ.
ND20452	ND16918*2/CIho 15258	North Dakota State Univ.
ND20493	ND16918*2/CIho 6611	North Dakota State Univ.
ND20539	ND16918*2/CIho 5809	North Dakota State Univ.
ND20540	ND16918*2/CIho 5809	North Dakota State Univ.
Legacy	Bumper / Karl // Bumper / Manker /3/ Bumper / Karl /4/ Excel	Bush Agri Resource Inc.
Tradition	6B89-2126 / ND10981	Bush Agri Resource Inc.
6B98-9022	6B92-7098 / 6B92-7166	Bush Agri Resource Inc.
6B99-6339	6B92-8177 / 6B94-7862	Bush Agri Resource Inc.
6B99-6774	LEGACY / 6B94-7862	Bush Agri Resource Inc.
6B00-1100	6B94-7378 // Legacy / 6B94-7544	Bush Agri Resource Inc.
6B00-1323	6B94-8126 // Legacy / 6B95-6311	Bush Agri Resource Inc.
6B00-1499	6B94-7378 // Legacy / 6B94-7416	Bush Agri Resource Inc.
AC Bountiful	Wpg843-234/Manley//AC Oxbow/Manley	AAFC-Brandon/ Legge
Calder	TR229/TR238	AAFC-Brandon/ Legge
EX645-3-6	Br. CC 053//B1602/Bt213/806F7/Conquest/Minn. M82/BT946/Gainer	AAFC-Brandon/ Therrien
EX702-4-6	(BR. CC 53xMsg2)//(Stein/Ellice/Norbert/Bonanza/Harrington/ BT946//Bacon)	AAFC-Brandon/ Therrien
SH01265	CDC Freedom/ C2-83-6-12	U of SK/ CDC / Rossnagel & Zatorski
SB00106	TR339/TR251	U of SK/ CDC / Rossnagel & Zatorski
CDC Select	AC Metcalfe/ TR118	U of SK/ CDC / Harvey & Lefol
CDC Battleford	M67/BT411	U of SK/ CDC / Harvey & Lefol
FEG43-46	MAS2-54/Lacey	University of Minnesota
FEG43-47	MAS2-54/Lacey	University of Minnesota
FEG44-12	FEG2-26/Lacey	University of Minnesota
FEG55-04	FEG2-26/MNBrite	University of Minnesota
FEG57-28	FEG10-16/FEG4-98	University of Minnesota
FEG59-36	FEG14-119/FEG10-16	University of Minnesota

Table 7 cont. Pedigree and source of breeding lines tested for FHB resistance in 2003.

LABEL	PEDIGREE	SOURCE
FEG61-27	Ciho 6613/Lacey	University of Minnesota
FEG66-08	FEG18-20/M96-64	University of Minnesota
03iC-1	TOCTE//GOB/HUMAI10/3/ATAH92/ALELI	ICARDA/CIMMYT
03iC-2	PENCO/CHEVRON-BAR	ICARDA/CIMMYT
03iC-3	ATAH92/GOB	ICARDA/CIMMYT
03iC-4	SVANHALS-BAR/MSEL//AZAF/GOB24DH	ICARDA/CIMMYT
03iC-5	SVANHALS-BAR	ICARDA/CIMMYT
03iC-6	ARUPO/K8755//MORA	ICARDA/CIMMYT
03iC-7	GOB24DH	ICARDA/CIMMYT
03iC-8	ATAH92/GOB	ICARDA/CIMMYT
2ND 19836	Logan//ND16436/ND15409	North Dakota State Univ.
2ND 19854	ND 15403-3/ND16462	North Dakota State Univ.
2ND19119	ND15403-3/ND15368//ND16453	North Dakota State Univ.
2ND 19929	TR258/ND17437	North Dakota State Univ.
2ND 20833	TR258/ND1609-1//ND16461-1	North Dakota State Univ.
MnBrite	M90-89/M69	check
Conlon	Bowman*2/DWS1008/ND10232	check
Robust	Morex/Manker	check
CIHO 4196	UNKNOWN	check
Chevron	UNKNOWN	check
Stander	Robust*2/3/Cree/Bonanza//Manker/4/Robust/Bumber	check

Table 8. Climatic conditions 7 days either side of heading period at Crookston (Eldred the closest NDAWN site)

Date	Days after 31-May	Max Air Temp (°C)	Min Air Temp (°C)	Avg Temp (°C)	Avg Wind Spd (m/s)	Total Rainfall (mm)	Avg Dew Point (°C)
6/17/2003	17	28	16	22	2.4	0	17
6/18/2003	18	26	10	18	3.4	0	10
6/19/2003	19	27	9	18	3.9	0	9
6/20/2003	20	29	15	22	7.2	0	10
6/21/2003	21	29	17	23	8.3	6	13
6/22/2003	22	27	14	20	2.3	15	18
6/23/2003	23	25	15	20	2.5	5	18
6/24/2003	24	23	13	18	5	18	15
6/25/2003	25	14	11	12	5.4	5	11
6/26/2003	26	20	10	15	4.8	1	11
6/27/2003	27	20	10	15	2.4	0	13
6/28/2003	28	23	11	17	3	4	13
6/29/2003	29	25	11	18	2.4	0	14
6/30/2003	30	28	12	20	2.5	0	15
7/1/2003	31	30	16	23	4.9	0	19
7/2/2003	32	29	17	23	3.2	11	20
7/3/2003	33	27	15	21	2.7	0	17
7/4/2003	34	27	14	20	3	0	14
7/5/2003	35	28	16	22	2.7	0	16
7/6/2003	36	28	14	21	3.8	2	17
7/7/2003	37	22	12	17	3.2	0	12
Averages:		26	13	19	3.7		14
Totals:						71	
Max:		30	17	23	8.3	18	20
Min:		14	9	12	2.3	0	9
Std. Dev.:		4	3	3	1.6		3

Table 9. Climatic conditions 7 days either side of heading period at St. Paul, Minnesota (UM Dept Soil, Water&Climate data).

Date	Days after 31-May	Max Air Temp (°C)	Min Air Temp (°C)	Avg Temp (°C)	Avg Wind Spd (m/s)	Total Rainfall (mm)	Avg Dew Point (°C)
6/6/2003	6	17.78	14.44	16.1	2.1	18.8	
6/7/2003	7	18.89	13.89	16.7	2.73	0.51	
6/8/2003	8	22.22	13.33	17.8	4.43	0	
6/9/2003	9	23.33	11.11	17.2	3.04	0.25	
6/10/2003	10	22.22	13.33	17.8	4.47	0	
6/11/2003	11	20	11.67	16.1	4.25	0	
6/12/2003	12	22.78	13.33	18.3	3.35	0	
6/13/2003	13	27.78	17.78	22.8	3.08	0	
6/14/2003	14	27.78	15	21.7	2.77	0	
6/15/2003	15	28.89	15	22.2	1.39	0	
6/16/2003	16	31.67	18.33	25	3.49	0	
6/17/2003	17	30.56	20.56	25.6	2.24	0	
6/18/2003	18	28.89	18.33	23.9	3.93	0	
6/19/2003	19	26.11	14.44	20.6	3.13	0	
6/20/2003	20	28.33	15	21.7	4.69	0	
6/21/2003	21	31.11	14.44	22.8	5.81	0	
6/22/2003	22	28.33	21.11	25	5.45	0.25	
6/23/2003	23	31.11	21.11	26.1	4.78	0.51	
6/24/2003	24	31.11	18.89	25	5.77	34.8	
6/25/2003	25	26.11	13.89	20	5.36	53.09	
6/26/2003	26	21.11	12.22	16.7	6.03	0	
6/27/2003	27	23.89	13.89	18.9	2.1	0	
6/28/2003	28	23.89	15.56	20	2.59	3.05	
6/29/2003	29	27.22	13.33	20.6	3.22	0	
6/30/2003	30	28.33	16.11	22.2	1.21	0	
Averages:		26.0	15.4	20.8	3.66	8.9	
Totals:						222.52	
Max:		31.67	21.11	25.6	6.03	53.09	
Min:		17.78	11.11	16.1	1.21	0	

Table 10. Climatic conditions 7 days either side of heading period at Casselton (Prosper the closest NDAWN site)

Date	Days after 31-May	Max Air Temp (°C)	Min Air Temp (°C)	Avg Temp (°C)	Avg Wind Spd (m/s)	Total Rainfall (mm)	Avg Dew Point (°C)
6/19/2003	19	28	10	19	3.7	0	8
6/20/2003	20	30	14	22	7.3	0	10
6/21/2003	21	30	17	23	8	10	13
6/22/2003	22	27	16	21	3.1	3	18
6/23/2003	23	27	17	22	3	7	19
6/24/2003	24	22	13	18	5.8	17	17
6/25/2003	25	14	11	13	5.4	5	11
6/26/2003	26	21	10	15	5	5	11
6/27/2003	27	20	11	16	2.1	7	14
6/28/2003	28	23	10	17	2.8	0	13
6/29/2003	29	25	12	19	3.2	0	13
6/30/2003	30	28	12	20	3	0	15
7/1/2003	31	31	15	23	4.7	0	19
7/2/2003	32	30	19	24	3.6	0	20
7/3/2003	33	30	16	23	3.2	3	17
7/4/2003	34	29	15	22	3.8	0	14
7/5/2003	35	31	13	22	2.8	0	16
7/6/2003	36	29	13	21	3.5	0	16
7/7/2003	37	24	11	18	3.3	0	12
7/8/2003	38	23	11	17	3	0	11
7/9/2003	39	16	14	15	4.1	26	14
7/10/2003	40	23	13	18	3	5	15
7/11/2003	41	23	14	18	3.7	2	15
7/12/2003	42	27	12	20	1.5	0	15
7/13/2003	43	30	13	22	4.4	0	18
7/14/2003	44	30	15	22	3.8	0	18
7/15/2003	45	27	15	21	2.4	0	15
7/16/2003	46	30	14	22	3.6	0	17
Averages:		26	13	20	3.8		15
Totals:						90	
Max:		31	19	24	8	26	20
Min:		14	10	13	1.5	0	8
Std. Dev.:		5	2	3	1.4		3

Table 11. Climatic conditions 7 days either side of heading period at Brandon, Manitoba (Environment Canada climate data)

Date	Days after 31-May	Max Air Temp (°C)	Min Air Temp (°C)	Avg Temp (°C)	Avg Wind Spd (m/s)	Total Rainfall (mm)	Avg Dew Point (°C)
6/11/2003	41	25.7	13	19.4		0	
6/12/2003	42	29.7	8.5	19.1		0	
6/13/2003	43	34.9	15.5	25.2		0	
6/14/2003	44	26.8	12.8	19.8		1	
6/15/2003	45	29.6	9.1	19.4		0	
6/16/2003	46	25.6	11.4	18.5		0	
6/17/2003	47	27.2	9.4	18.3		0	
6/18/2003	48	32.4	17.1	24.8		0	
6/19/2003	49	32.8	15.3	24.1		0	
6/20/2003	50	25	12.6	18.8		0	
6/21/2003	51	23.6	11.7	17.7		0	
6/22/2003	52	27.5	7.0	17.3		0	
6/23/2003	53	32	12.5	22.3		0	
6/24/2003	54	34	17.1	25.6		0	
6/25/2003	55	29.6	15.7	22.7		0	
6/26/2003	56	27.2	15.2	21.2		0	
6/27/2003	57	30.3	10.1	20.2		0	
6/28/2003	58	33	11.6	22.3		0	
6/29/2003	59	29.1	15.6	22.4		0	
6/30/2003	60	24.2	12.5	18.4		3	
6/31/2003	61	24.2	13.8	19		0	
7/1/2003	62	27.6	11.9	19.8		0	
7/2/2003	63	28.4	9.9	19.2		0	
Averages:		28.7	12.6	20.7			
Totals:						4.0	
Max:		34.9	17.1	25.6		3	
Min:		23.6	7.0	17.3		1	

Table 12. Climatic conditions 7 days either side of heading period at Fargo, ND (NDAWN data)

Date	Days after 31-May	Max Air Temp (°C)	Min Air Temp (°C)	Avg Temp (°C)	Avg Wind Spd (m/s)	Total Rainfall (mm)	Avg Dew Point (°C)
6/19/2003	19	28	11	20	3.8	0	9
6/20/2003	20	29	16	23	7	0	9
6/21/2003	21	30	17	23	7.7	10	13
6/22/2003	22	27	17	22	3.1	24	19
6/23/2003	23	27	18	22	2.3	4	19
6/24/2003	24	24	13	19	4.8	20	18
6/25/2003	25	14	11	13	4.8	6	12
6/26/2003	26	21	10	16	4.6	8	11
6/27/2003	27	20	12	16	2.1	7	14
6/28/2003	28	23	13	18	2.6	1	14
6/29/2003	29	25	13	19	2.9	0	13
6/30/2003	30	28	15	22	3.1	0	15
7/1/2003	31	31	18	24	5.2	0	19
7/2/2003	32	30	19	25	3.9	0	20
7/3/2003	33	31	16	24	2.9	1	17
7/4/2003	34	29	17	23	3.8	0	13
7/5/2003	35	31	18	24	3.2	0	16
7/6/2003	36	30	17	23	3.6	0	16
7/7/2003	37	24	13	18	3.3	0	12
7/8/2003	38	23	13	18	3.1	0	11
7/9/2003	39	17	13	15	3.9	25	14
7/10/2003	40	22	13	18	2.9	5	15
7/11/2003	41	23	15	19	3.5	1	16
7/12/2003	42	27	13	20	1.4	0	15
7/13/2003	43	30	16	23	4.9	0	18
7/14/2003	44	31	16	23	4.2	2	18
7/15/2003	45	26	16	21	2.6	0	15
7/16/2003	46	31	17	24	4.2	0	18
Averages:		26	15	21	3.8		15
Totals:						114	
Max:		31	19	25	7.7	25	20
Min:		14	10	13	1.4	0	9
Std. Dev.:		5	2	3	1.4		3

Table 13. Climatic conditions 7 days either side of heading period at Langdon, ND (NDAWN data)

Date	Days after 31-May	Max Air Temp (°C)	Min Air Temp (°C)	Avg Temp (°C)	Avg Wind Spd (m/s)	Total Rainfall (mm)	Avg Dew Point (°C)
6/25/2003	25	14	10	12	4.3	2	9
6/26/2003	26	18	8	13	3.7	3	10
6/27/2003	27	19	8	14	3.4	0	12
6/28/2003	28	22	10	16	3.9	0	11
6/29/2003	29	24	10	17	2.7	0	11
6/30/2003	30	28	9	19	3	0	11
7/1/2003	31	30	18	24	5.2	0	18
7/2/2003	32	26	16	21	2.9	12	19
7/3/2003	33	24	14	19	3.3	0	13
7/4/2003	34	25	12	19	3.8	0	11
7/5/2003	35	26	14	20	3	0	13
7/6/2003	36	23	14	19	5.1	0	12
7/7/2003	37	20	10	15	4	0	10
7/8/2003	38	19	7	13	2.6	0	9
7/9/2003	39	16	11	13	2.7	6	11
7/10/2003	40	22	9	16	2.2	2	13
7/11/2003	41	21	13	17	3.2	4	14
7/12/2003	42	26	10	18	2.5	0	13
7/13/2003	43	29	15	22	5.2	0	16
7/14/2003	44	26	15	20	3.4	2	16
7/15/2003	45	26	12	19	3.1	0	15
7/16/2003	46	25	12	19	4.1	0	15
7/17/2003	47	23	11	17	3.6	0	11
Averages:		23	12	17	3.5		13
Totals:						31	
Max:		30	18	24	5.2	12	19
Min:		14	7	12	2.2	0	9
Std Dev:		4	3	3	0.8		3