Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Impact of *Fusarium* head blight resistance on wheat variety registration in Western Canada

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Canada

Canadian wheat

- 2019 Spring wheat production: 32 MMT
- Spring wheat export: 15 MMT (up to October 2019)

Total Wheat Area Planted (hectares)

Area Planted	2018/2019	2019/2020	Percent change
Durum	2,503,100	1,980,400	-21%
Spring wheat	7,005,500	7,956,900	14%
Winter wheat	501,000	376,000	-25%
All wheat	10,009,640	9,953,300	-1%

https://grainscanada.gc.ca/en/grain-research/statistics/

Wheat exporters

- Russia: US$8.4 billion (20.5% of total wheat exports)
- Canada: $5.7 billion (13.8%)
- United States: $5.5 billion (13.2%)
- France: $4.1 billion (10%)
- Australia: $3.1 billion (7.5%)
- Ukraine: $3 billion (7.3%)
- Argentina: $2.4 billion (5.9%)

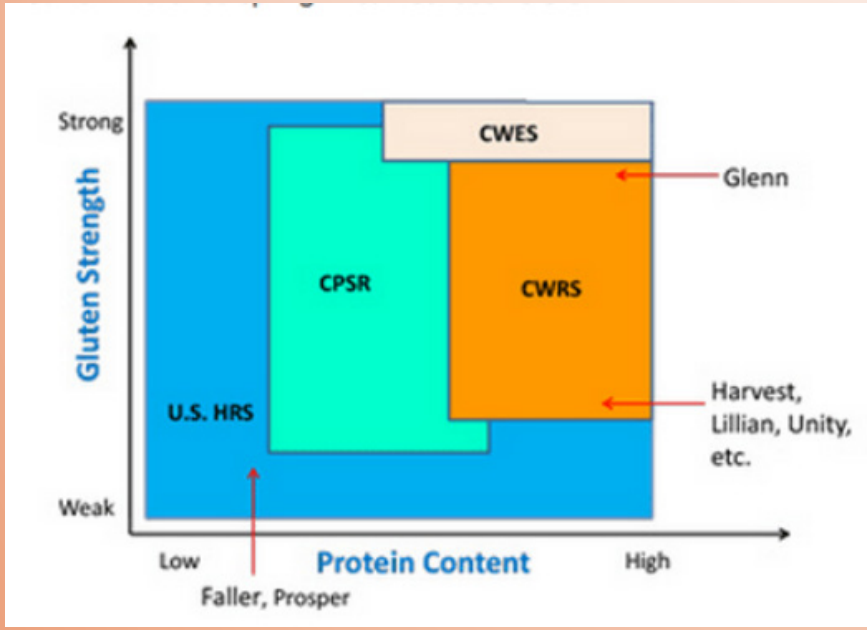
http://www.worldstopexports.com/wheat-exports-country/

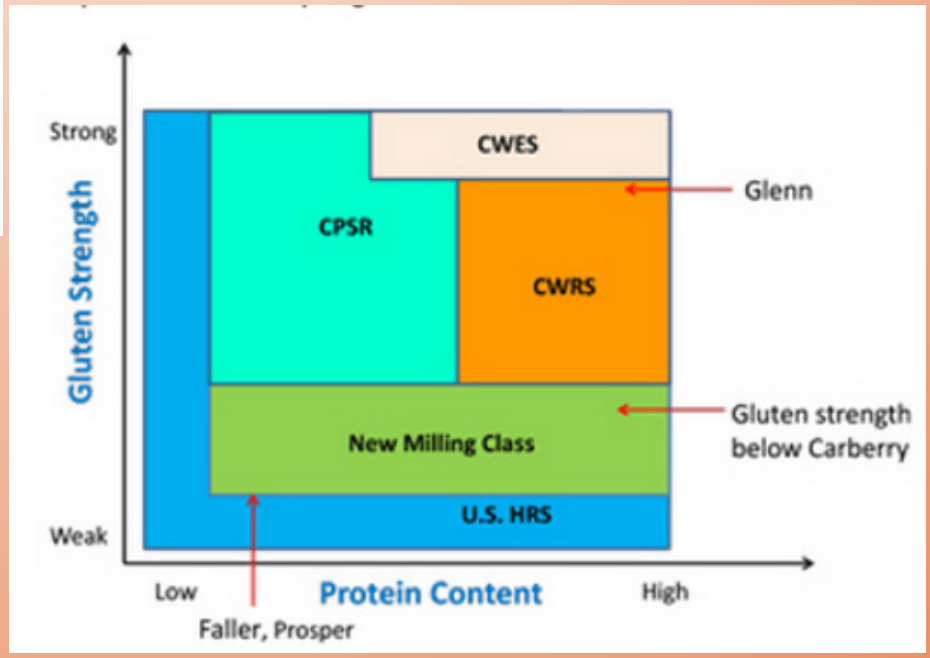
Major wheat classes in Canada

2018 Western Canada insured wheat acreage by class	
CWRS	11,550,371
CPS	646,685
CNHR	301,932
CWSWS	259,842
CWRW	129,096
CWSP	127,751
CWHWS	9,478
CWES	525

Canadian Grain Commission

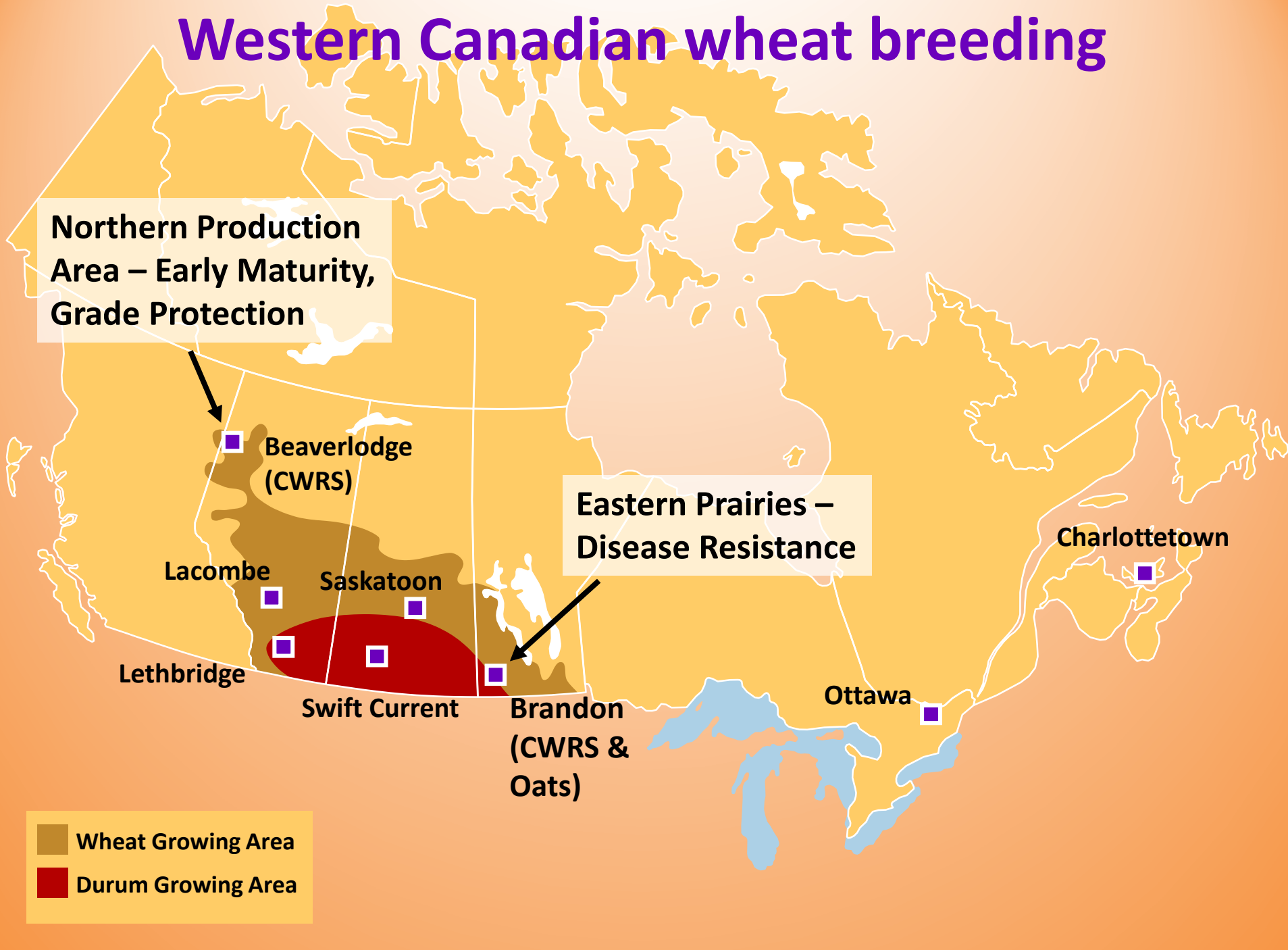
Canadian wheat class modernization

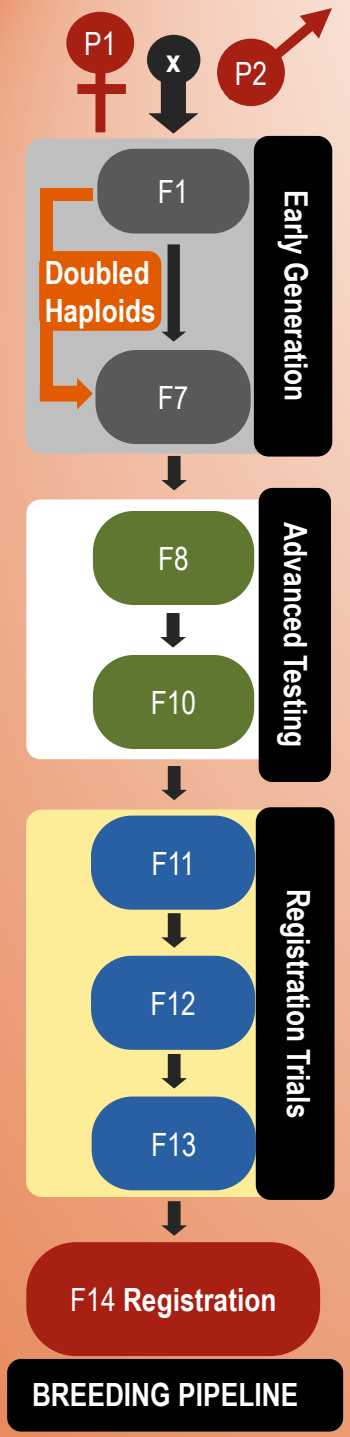




Canadian Grain Commission

Western Canadian wheat breeding





Breeding cycle
12 years

Agronomic Objectives
(yield, maturity, height, lodging)

Disease objectives
(rusts, FHB, bunt)

Quality objectives
(don't ask)

PGDC

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ABOUT PRAIRIE GRAIN DEVELOPMENT COMMITTEE

The Prairie Grain Development Committee (PGDC) is a forum for the exchange of information relevant to the development of improved cultivars of grain crops for the western Canadian prairies.

The four independent recommending committees are responsible for the testing, evaluation, and recommending of grain crop candidate cultivars for registration in Western Canada:

- Prairie Recommending Committee for Wheat, Rye and Triticale (PRCWRT)
- Prairie Recommending Committee for Oat and Barley (PRCOB)
- Prairie Recommending Committee for Pulse & Special Crops (PRCPSC)
- Prairie Recommending Committee for Oilseeds (PRCO)

WHEAT, RYE & TRITICALE

Click to Access Committee Page

OAT & BARLEY

Click to Access Committee Page

PULSE & SPECIAL CROPS

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OILSEEDS

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PGDC NEWS

Nov. 18, 2019

The Annual Meeting page has been updated with 2020 meeting information. The timelines and cost of early registration as well as the hotel room costs for the meeting in Winnipeg have been added.

PGDC ANNUAL MEETING DATES

2020 Feb. 25th - Feb. 27th Winnipeg, Delta Winnipeg

2021 Feb. 23rd - Feb. 25th Banff, Banff Centre

To learn more information about the CFIA_ACIA - _7730947 - v2F - VRO-2018-19-RC-OP-PRCWRT_Prairie wheat committees operating procedures_March 2019_TZ, please view the document in PDF format.

Agronomic performance

Agronomic Traits Measured in each Co-operative Registration Trial

	Central Bread Wheat	Western Bread Wheat	High Yielding Red Wheat	Parkland Wheat	Hard White Wheat	Soft White Spring Wheat	Durum Wheat	Special Purpose Wheat	Western Winter Wheat	Fall Rye	Spring Triticale
Number of Replicates	3	3	3	3	3	3	4	3	3	3	3
Grain Yield	+	+	+	+	+	+	+	+	+	+	+
Heading	-	-	-	+	-	-	-	-	+	-	-
Maturity	+	+	+	+	+	+	+	+	+	+	+
Height	+	+	+	+	+	+	+	+	+	+	+
Lodging	+	+	+	+	+	+	+	+	+	+	+
Shattering	-	-	-	-	-	+	-	-	-	-	-
Cleanout	-	-	-	-	-	-	-	-	-	-	-
Test Weight	+	+	+	+	+	+	+	+	+	+	+
Kernel Weight	+	+	+	+	+	+	+	+	+	+	+
Smudge	-	-	-	-	-	-	+	-	-	-	-
Black Point	-	-	-	-	-	+	-	-	-	-	-
Starchy Kernels	-	-	-	-	-	-	+	-	-	-	-
Sample Grade (site basis)	-	-	+	+	-	-	+	-	-	-	-
Wheat Stem Sawfly Cutting*	-	+	-	-	-	-	-	-	-	-	-
Winter Survival	-	-	-	-	-	-	-	-	+	+	-
Hagberg Falling Number	-	-	-	-	-	-	-	-	-	+	+

Agronomic performance

WHEAT CANDIDATE CULTIVAR MERIT ASSESSMENT and RECORD OF DECISION — **App Version:** WA19-2

Candidate Name:	**BW1053**	**Crop Kind:**	Spring wheat
Registration Type:	Full	**Proposed Class:**	CWRS
Proposer:	Santosh Kumar	**Evaluation**	CBWC
Institution/Company:	Agriculture and Agri-Food Canada	**Tests:**	2016-2018

MOTIONS	**Mover / Seconder**	**Sup**	**DNO**	**Obj**	**Abs**	**Total**
CANDIDATE CONSIDERATION:						0
SUPPLEMENTARY DATA:			--			0
PROCEDURAL SET-ASIDE:			--			0

When discussion is required

Record rationale

WHEAT AGRONOMIC MERIT ASSESSMENT

Candidate: BW1053		**Check Range**			**Endorse Limit**		**Calculated**		**Discussion**		
Trait Summary	**Range relative to checks**	**Min**	**Max**	**Line**	**Value**	**Calc**	**Endorse**	**Discuss**	**Allow**	**Flag**	**Clear**
Grain Yield (kg/ha):	*Higher than all checks*	4598	4936	**5358**	0%	4598	☑	☐	○	○	○
Maturity (d):	*Within range of checks*	93.0	95.0	**95.0**	0.0	95.0	☑	☐	○	○	○
Lodging (1-9):	*Within range of checks*	1.3	2.7	**1.4**	0.0	2.7	☑	☐	○	○	○
Test Weight (kg/hL):	*Within range of checks*	80.3	83.0	**81.4**	0.0	80.3	☑	☐	○	○	○
Winter Survival (%):	*Not applicable*				0	--	☑	☐	○	○	○
Height (cm):	*Within range of checks*	78	96	87	*Reported for information purposes only*						
1000 Kernel Weight (g):	*Higher than all checks*	33.8	36.0	37.3	*Reported for information purposes only*						
Grain Protein (%):	---	14.1	14.6	14.4	*Reported for information purposes only*						
Additional Traits:	*n/a*	***Discussion*** *must occur if supplementary data are used for additional*							☐		
Additional Traits:	*n/a*	*trait claims (vote required to consider data).*							☐		
Additional Traits:	*n/a*	***Allow*** *indicates AET approval of the claim.*							☐		
Additional Traits:	*n/a*	***Without AET Support****, any additional claims must be withdrawn.*							☐		

ACTION: NO DISCUSSION REQUIRED → NO CONCERNS

RECOMMENDATION: The Agronomic Evaluation Team ENDORSES the registration of this candidate cultivar

Recommendation Guidelines

The "Do-not-object" guidelines for Priority 1 diseases wheat and triticale in Western Canada. Priority 2: Loose smut, leaf spots.

Disease	CWRS, CPS, GP, CWHW	CWAD	SWS	CWRW	Triticale	Spelt
Leaf Rust	I	I	I (MS prior to 2017)	I	I	I
Stem Rust	I	I	I (MS prior to 2017)	I	I	NA
Common Bunt	I	I	I (MS prior to 2017)	I	I	I
FHB	I	MS	MS	MS	MS	MS
Stripe Rust	I	I	I (MS prior to 2017)	I (MS prior to 2017)	I (MS prior to 2017)	I (MS prior to 2017)

Disease resistance

Prairie Registration Committee for Wheat, Rye & Triticale — ***Disease Evaluation Team***

WHEAT CANDIDATE CULTIVAR MERIT ASSESSMENT and RECORD OF DECISION — **App Version:** WRTD19-1

Candidate Name:	**BW1053**	**Crop Kind:**	Spring wheat
Registration Type:	Full	**Proposed Class:**	CWRS
Proposer:	Santosh Kumar	**Evaluation Tests:**	CBWC
Institution/Company:	Agriculture and Agri-Food Canada		

WHEAT DISEASE MERIT ASSESSMENT

Candidate: BW1053		**Ratings**				**DNO Limit**	**Calculated**		**Discussion**		
Trait Summary	**Synopsis**	***Year 1***	***Year 2***	***Year 3***	**Final**	**for Endorse**	**Endorse**	**Discuss**	**Allow**	**Flag**	**Clear**
Stem Rust	*DNO Level +2 (Support)*	R	R	R	R	I	☑	☐	○	○	○
Leaf Rust	*DNO Level +2 (Support)*	R	R	R	R	I	☑	☐	○	○	○
Stripe Rust	*DNO Level +2 (Support)*	I	R	R	R	I	☑	☐	○	○	○
Common Bunt	*DNO Level -1 (Object)*	I	S	MS	MS	I	☐	☑	○	○	○
Fusarium Head Blight	*DNO Level +1 (Support)*	*FHB rating based on data below*			MR	I	☑	☐	○	○	○

FHB Environments (Year & Location)	MOR	MOR	MOR	CAR	CAR	CAR	7	8	9	10	11	12	13	14
Visual Rating Index (VRI)	8.9	15.1	4.8	5.7	7.7	4.8								
DON Concentration (ppm)	17	13	2	17	11.3	1								
Incidence/Severity/DON Index (ISD)	12	9.6	2.1	11	8.2	1.7								
Fusarium Damaged Kernels (FDK)														

The following are reported for information purposes only:

Other Traits:						***Discussion*** *must occur for these*	☐
Other Traits:						*trait claims and requires*	☐
Other Traits:						*acceptable supporting data.*	☐
Other Traits:						***Allow*** *indicates DET approval*	☐
Other Traits:						*of the claim.*	☐

ACTION: DISCUSSION REQUIRED → FLAG - UNRESOLVED CONCERNS

RECOMMENDATION: The Disease Evaluation Team — **DECISION is PENDING the outcome of discussion**

Quality criteria

Part 2: Quality Criteria and tests for each registration trial category

CRITERIA	TESTS/PARAMETERS	Hard Red Spring	Hard White Spring	High Yield (Prairie Spring)	Hard Red Winter	Soft White Spring	Durum	Interim Wheat
WHEAT CHARACTER-ISTICS	Grade	✔	✔	✔	✔	✔	✔	✔
	Hard vitreous kernels, %						✔	
	Cadmium, ppb						✔	
	Protein, % (13.5 moisture basis)	✔	✔	✔	✔	✔	✔	✔
	Falling number, seconds	✔	✔	✔	✔	✔	✔	✔
MILLING PERFOR-MANCE	Milling yield, clean wheat basis, %	✔	✔	✔	✔	✔	✔	✔
	Milling yield, 0.50% ash basis, %	✔	✔	✔	✔			✔
	Semolina yield, %						✔	
FLOUR / SEMOLINA ANALYSIS	Protein, % (14.0% moisture basis)	✔	✔	✔	✔	✔	✔	✔
	Protein loss (wheat to flour), %	✔	✔	✔	✔	✔		✔
	Ash, %	✔	✔	✔	✔	✔	✔	✔
	Amylograph peak viscosity, BU	✔	✔	✔	✔	✔		✔
	Starch damage (Megazyme), %	✔	✔	✔	✔	✔		✔
	Solvent retention capacity, %					✔		
	Semolina colour						✔	
	Gluten index, %						✔	
	Yellow pigment, ppm						✔	
DOUGH PROPERTIES	Farinograph • Water absorption, % • Dough development time, min • Stability, min	✔	✔	✔	✔	✔		✔
	Alveograph • P (height x 1.1), mm • L (length), mm • P/L • W, x 10^{-4} joules					✔	✔ *	
	Extensograph (90 or 135 minute rest) • Area, cm^2 • Rmax, BU • Length, cm	✔	✔	✔	✔			✔
QUALITY	Bread quality (Canadian Short Process or Remix-to-peak) • Baking absorption (%), • Mixing time (min) • Mixing energy (Whr /kg) • Loaf volume (cm^3/100g flour)	✔	✔	✔	✔			✔

Quality traits

Cultivar	Flour Characteristics					Milling Performance			
	Grain protein (%)	Flour protein (%)	Protein loss (%)	Falling number (s)	Amylo-graph (BU)	Clean flour yield (%)[b]	Flour yield (.50 ash) (%)	Flour ash (%)	Starch damage (%)
2016									
Unity	13.2	12.4	0.8	405	755	76.5	77.0	0.44	8.3
Glenn	13.8	13.0	0.8	325	525	74.4	76.5	0.45	8.7
Carberry	14.3	13.3	1.0	370	350	75.4	76.5	0.45	7.4
AAC Viewfield	13.8	13.0	0.8	370	455	75.3	77.5	0.43	7.2
BW1053	13.7	12.9	0.9	385	430	75.9	76.5	0.45	7.4
2017									
Unity	14.3	13.6	0.7	435	900	77.2	79.0	0.40	8.1
Glenn	14.6	13.9	0.7	380	830	75.3	79.5	0.39	8.2
Carberry	14.8	13.9	0.9	375	510	75.7	79.0	0.40	7.9
AAC Viewfield	14.9	14.2	0.7	430	685	75.4	79.5	0.39	7.5
BW1053	14.4	13.8	0.7	390	515	76.8	79.0	0.40	7.7
2018									
Unity	14	13.4	0.6	400	885	76.5	78.5	0.41	8.2
Glenn	14.2	13.5	0.6	345	745	75.4	79.0	0.40	8.6
Carberry	14.5	13.8	0.7	385	530	76.1	79.0	0.40	7.6
AAC Viewfield	13.8	13.4	0.5	385	615	76.4	78.5	0.41	7.6
BW1053	14.2	13.7	0.5	395	575	76.4	78.5	0.41	7.6

Quality traits

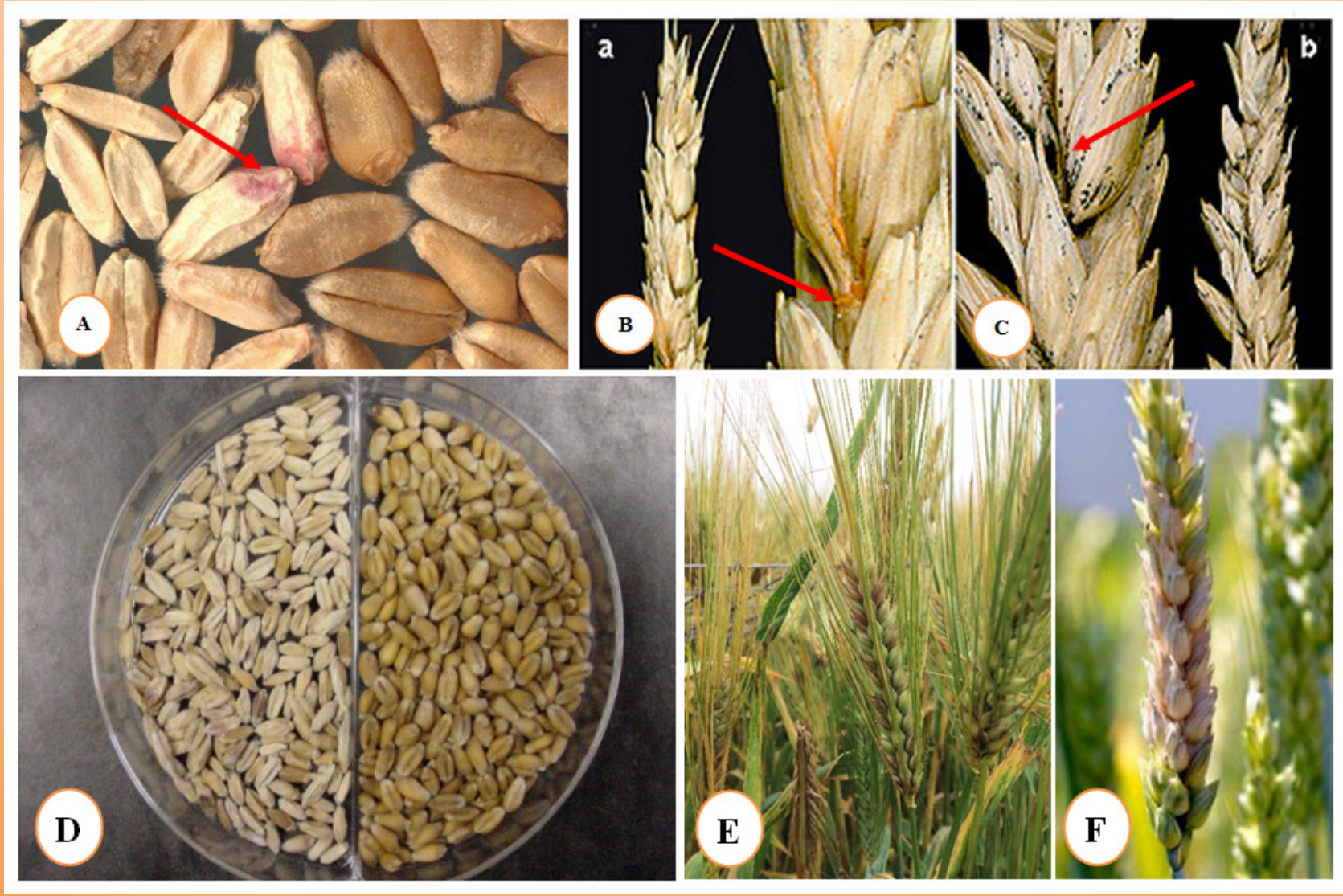
Cultivar	Dough Properties						Baking Quality				
	Farinograph			Extensograph			Canadian short process (150 ppm ascorbic acid)[d]				
	Abs (%)[a]	DDT (min)[b]	Stability (min)	EXT Area	EXT Rmax	EXT Length	Abs (%)	Mixing time (min)	Mixing energy (whr/kg)	Loaf volume (cm3)	Loaf top ratio
2016											
Unity	63.6	4.75	6.0	73	300	19.0	70	2.9	8.3	795	0.55
Glenn	65.6	5.50	9.5	122	624	16.4	73	3.8	10.5	910	0.67
Carberry	63.7	5.50	5.5	90	353	20.5	71	3.0	8.3	790	0.55
AAC Viewfield	63.6	5.75	7.5	91	358	20.3	71	3.1	7.8	825	0.51
BW1053	62.4	6.75	8.5	103	462	17.8	69	3.5	10.0	775	0.56
2017											
Unity	63.8	5.75	7.0	89	332	21.4	71	2.9	7.5	740	0.40
Glenn	64.6	9.75	11.5	153	680	18.8	72	4.0	10.4	840	0.59
Carberry	64.0	7.25	7.5	97	352	22.1	71	3.2	8.6	780	0.48
AAC Viewfield	63.8	7.75	11.0	119	470	20.6	71	3.4	9.4	805	0.48
BW1053	62.2	8.25	11.5	120	488	20.4	70	3.7	10.0	735	0.47
2018											
Unity	65.1	5.25	7.0	87	366	18.8	72	2.9	7.8	765	0.50
Glenn	65.9	9.00	13.0	139	689	16.7	73	4.1	10.3	845	0.58
Carberry	64.8	7.25	8.0	101	443	18.4	73	3.5	8.8	790	0.52
AAC Viewfield	64.9	7.25	10.0	114	480	19.3	72	3.5	9.0	795	0.51
BW1053	62.9	8.75	10.5	121	495	19.6	70	3.8	9.6	720	0.50



Summary

- Defined marker classes for Canadian wheat
- CFIA mandated PGDC recommends varieties for registration
- Lines registered only if licensed
- My line BW1053 did not make it

FHB: Implications for Wheat



http://medcraveonline.com/APAR/APAR-02-00039.pdf

FHB: Implications for Wheat

Reduction in grain quality

- Wrinkled and contracted and/or discolored kernels. Fusarium-damaged kernels (FDK).

- Contamination of grain with the trichothecene mycotoxin deoxynivalenol (DON) and other mycotoxins.

F. graminearum
F. culmorum
F. avenaceum
F. poae
F. sporotrichioides

F. spp: Inoculum

Isolate ID	Chemotypes	Origin
HSW-15-27	15ADON	Eastern MB
HSW-15-57	15ADON	Central MB
HSW-15-39	3ADON	Southwest MB
HSW-15-87	3ADON	Southwest MB

Wheat FHB Nursery: Breeding

- **Location:** Brandon
- **Area:** 30 acres/3 y rotation (irrigated)
- **Nursery capacity:** 75K 1m rows, and 250K single plants
- **Generations:** F2, F4, F6, F8-F13
- **Participants:** BRDC, ScRDC, LRDC, UoA, international observation nurseries (ICARDA, CIMMYT)

Wheat FHB Nursery: Registration Testing

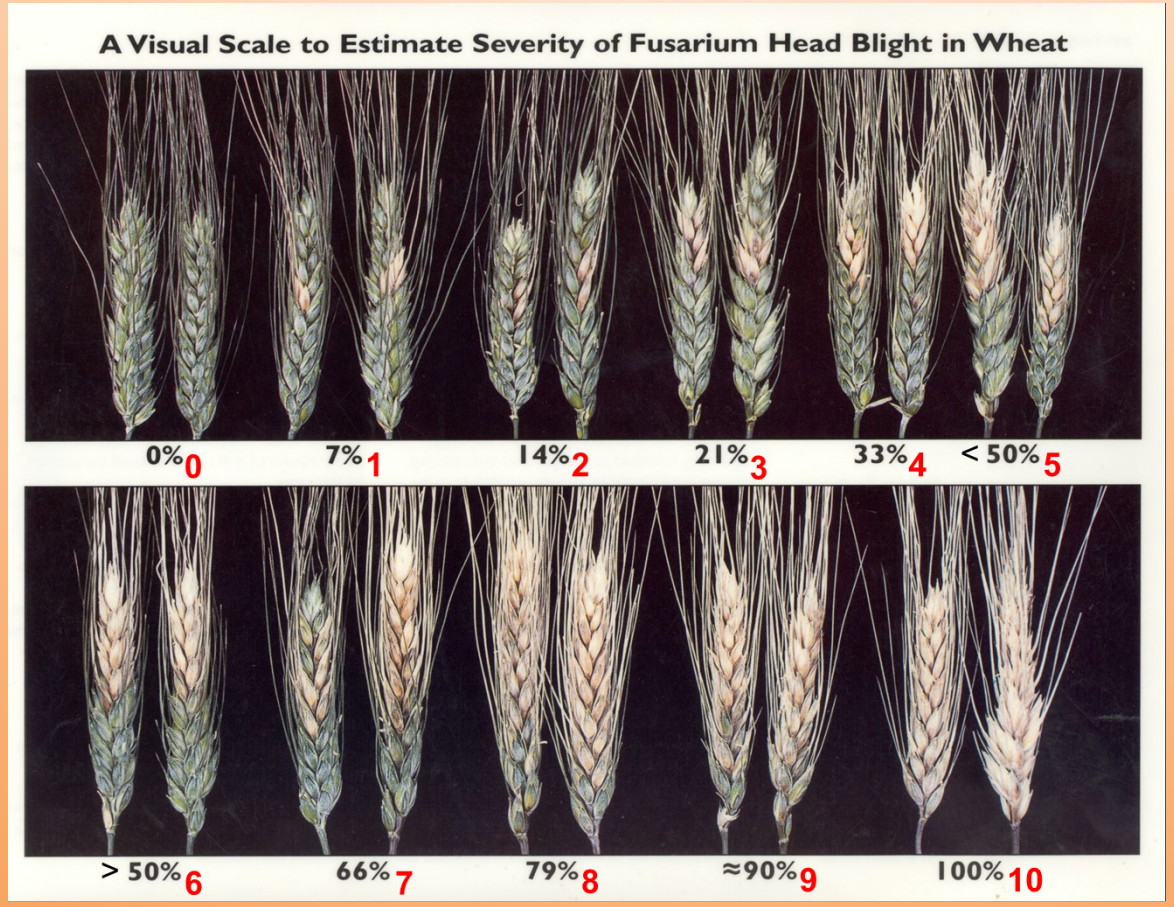
AAC Tenacious	R
FHB37	MR
5602HR	MR
AC Cora	I
AC Barrie	I
Brigade	MS
AC Morse	MS
AC Splendor	S
CDC Teal	S

2019: 40,000 rows

FHB Index (VRI: visual rating index)

[Average % incidence X Average % severity] / 100

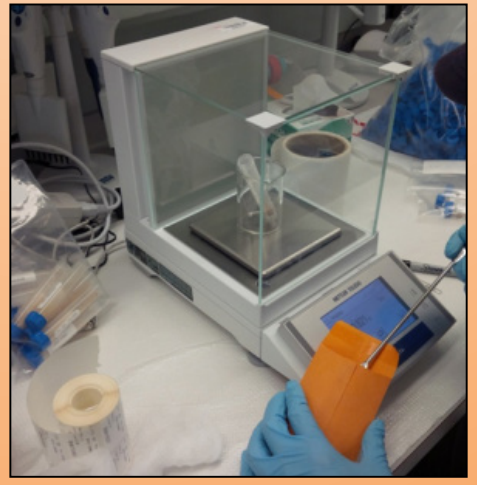
Incidence: The proportion of infected spikes per plot
Severity: The proportion of infected spikelets in each spike



21 days post anthesis

Modified https://www.ag.ndsu.edu/ndipm/publications/wheat/documents/pp1095.pdf

DON Testing



FHB rating

		2018		
Checks	FHB rating	AVG VRI	AVG DON	AVG ISD
CDC Teal	S	37.6	10.9	15.4
AC Morse	MS	41.9	18.2	22.3
AC Cora	I	27.2	5.5	7.0
5602 HR	MR (I)	19.9	5.9	9.4
FHB 37	R (MR)	1.4	2.0	4.0
AAC Tenacious	R	0.0	0.4	0.8

2018

Rating Scales (Based on AAC Tenacious as R)

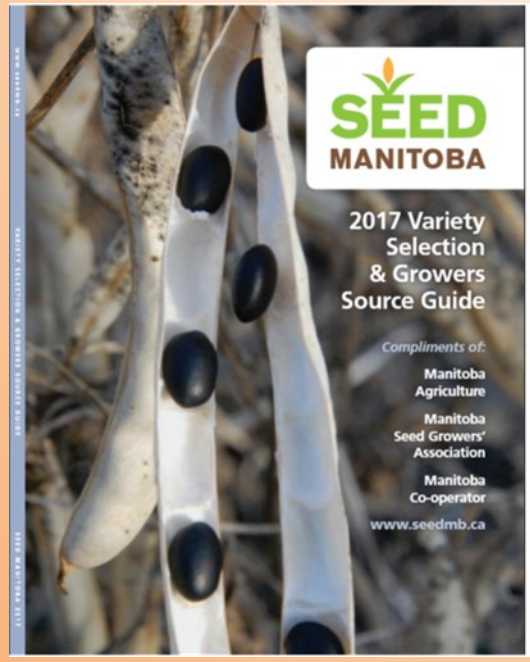
RATING	R	MR	I	MS	S
VRI	< 3.8	3.9 -19.9	20 - 30.34	30.35 - 37.5	> 37.6
DON	< 2	2.1 - 5.5	5.6 - 10.8	10.9 - 18.1	> 18.2
ISD	< 2	2.1 - 5.4	5.5 - 8.9	9.0 - 13.5	> 13.6

(ISD: 0.2 x mean incidence+0.2 x mean severity+0.6 x mean DON)

Progress: DET Supported Varieties

Reg. Trials	2014	2015	2016	2017	2018
CBWC	**MR(1)**; I(1)	**MR(2)**; I(2)	**MR(2)**	**MR(3)**; I(1)	**MR(1)**; I(3)
WBWC	I(4); MS(1)	**MR(1)**; I(1); MS(1)	**MR(1)**; I(1); MS(1)	**MR(2);** I(2)	I(2); MS(1)
ParkC	I(3); MS(1); S(1)	**MR(1)**	-	I(1); MS(1)	**MR(3);** I(3)
HYWC	I(4); MS(1)	**MR(1)**; I(1)	I(1)	-	I (1); S(1)
WWC	**MR(1)**; I(1)	I(4)	-	**MR(1)**	**MR(3);** I(1)

Provincial Seed Guides



WHEAT RED SPRING - 2019 MANITOBA VARIETY ACREAGE REPORT

AAC BRANDON	66.2%
AAC VIEWFIELD	8.1%
AAC ELIE	7.4%
CARDALE	3.8%
CDC LANDMARK	2.3%
AAC REDBERRY	1.9%
CDC PLENTIFUL	1.2%
CARBERRY	1.1%
AAC CAMERON VB	1.0%
AAC TISDALE	1.0%
AC DOMAIN	0.9%
AAC REDWATER	0.8%
GLENN	0.8%

Based on 2,691,388 Acres Reported

New Varieties

NRC Research Press

CULTIVAR DESCRIPTION

AAC Cameron Canada western red spring wheat

S.L. Fox, S. Kumar, J.B. Thomas, D.G. Humphreys, J. Mitchell Fetch, D. Green, I. Wise, M. Smith, T. Fetch, J. Gilbert, B. McCallum, and J. Menzies

NRC Research Press

CULTIVAR DESCRIPTION

AAC Jatharia Canada Western Red Spring wheat

S. Kumar, S.L. Fox, D.G. Humphreys, J. Mitchell Fetch, D. Green, T. Fetch, B. McCallum, and J. Menzies

NRC Research Press

CULTIVAR DESCRIPTION

AAC Warman Canada Western Red Spring wheat

S. Kumar, S.L. Fox, J. Mitchell Fetch, D. Green, T. Fetch, B. McCallum, R. Aboukhaddour, and M.-A. Henriquez

CULTIVAR DESCRIPTION

AAC Magnet Canada Western Red Spring wheat

S. Kumar, S. L. Fox, J. Mitchell Fetch, D. Green, T. Fetch, B. McCallum, R. Aboukhaddour and M.A. Henriquez

CULTIVAR DESCRIPTION

AAC LeRoy Canada Western Red Spring wheat

S. Kumar, S. L. Fox, J. Mitchell Fetch, D. Green, T. Fetch, B. McCallum, R. Aboukhaddour and M.A. Henriquez

NRC Research Press

REVIEW

Marker-assisted breeding of hexaploid spring wheat in the Canadian prairies

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Thanks

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Sask Wheat Development Commission

Alberta Wheat Commission

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