

Brevis spring triticale

J. G. McLeod¹, H. S. Randhawa², K. Ammar³, B. L. Beres², and R. B. Muri¹

¹Agriculture and Agri-Food Canada, 1 Airport Road, Swift Current, Saskatchewan, Canada S9H 3X2; ²Agriculture and Agri-Food Canada, 5403-1st Avenue South, Lethbridge, Alberta, Canada T1J 4B1; and ³CIMMYT, Apdo. Postal 6-641, Mexico, D.F., 06600, MEXICO. Received 25 May 2011, accepted 12 September 2011.

McLeod, J. G., Randhawa, H. S., Ammar, K., Beres, B. L. and Muri, R. B. 2012. **Brevis spring triticale**. Can. J. Plant Sci. **92**: 199–202. Brevis spring triticale (\times *Triticosecale* Wittmack) is well adapted to the Canadian prairies with high grain yield in each of the soil zones. Brevis has reduced height compared with the check cultivars and excellent lodging resistance. Brevis matures in a similar number of days as Pronghorn and AC Certa and about 3d later than AC Ultima. It combines large heavy seed with test weight equal to that of AC Certa, the best check cultivar. Brevis is resistant to the prevalent races of leaf rust, stem rust and common bunt. Its reaction to *Fusarium* head blight is moderately susceptible to moderately resistant.

Key words: Cultivar description, spring triticale, (\times *Triticosecale* Wittmack), disease resistance, grain yield, reduced height, test weight

McLeod, J. G., Randhawa, H. S., Ammar, K., Beres, B. L. et Muri, R. B. 2012. **La triticale de printemps Brevis**. Can. J. Plant Sci. **92**: 199–202. Brevis est une variété de triticale de printemps (\times *Triticosecale* Wittmack) bien acclimatée aux Prairies canadiennes. Elle se caractérise par un rendement grainier élevé dans chacune des zones de sols. Le plant pousse moins haut que celui des cultivars témoins et possède une excellente résistance à la verse. Brevis parvient à maturité approximativement en même temps que Pronghorn et AC Certa, et environ trois jours plus tard que AC Ultima. Ses grosses graines lourdes ont le même poids spécifique que celles de AC Certa, le meilleur cultivar témoin. Brevis résiste aux races courantes de la rouille des feuilles, de la rouille de la tige et de la carie; en revanche, la variété est de modérément sensible à modérément résistante à la brûlure de l'épi causée par *Fusarium*.

Mots clés: Description de cultivar, triticale de printemps, (\times *Triticosecale* Wittmack), résistance à la maladie, rendement grainier, taille réduite, poids spécifique

Brevis spring triticale (\times *Triticosecale* Wittmack) originated from the International Maize and Wheat Improvement Centre (CIMMYT) triticale breeding program. It was introduced by the Semiarid Prairie Agricultural Research Centre (SPARC), Research Branch, Agriculture and Agri-Food Canada (AAFC), Swift Current, SK, as part of the Triticale Breeding Project, via the 36th International Triticale Screening Nursery (ITSN) in 2004 and further selected for uniformity and removal of off types. In February, 2010, it received support for registration from the Prairie Recommending Committee for Wheat, Rye and Triticale. Brevis received a restricted registration no. 7024 from the Variety Registration Office, Canadian Food Inspection Agency, 2011 May 24.

Pedigree and Breeding Method

Brevis is a complete hexaploid triticale. It was developed through a selection from a cross made at CIMMYT's station near El Batán, 2249 m altitude and 19.5°N latitude, between the lines ARDI_1/TOPO 1419//ERIZO_9/3/LIRON and FAHAD_4/FARAS, the pollen donor, in the summer/fall of 1995. Brevis has the following selection history code CTSS95B00243S-19M-0Y-0B-0Y-0B-7B-0Y-7B-0Y. It corresponds to the

CIMMYT line designated by the Cross Identification number 254988 and Selection Identification number 207.

The F₁ was grown near Ciudad Obregon, 40 m altitude and 27.5°N latitude, in the northern Mexican state of Sonora, during the 1995–1996 crop cycle and harvested in bulk to produce an F₂ population. Subsequent selection was implemented using the “shuttle breeding method” (Borlaug 1968) employed in CIMMYT cereal breeding programs (Rajaram 1995), which consists in alternating selection in segregating generations between the northern location of Ciudad Obregon and the central locations of either El Batán or Toluca, 2640 m altitude and 18°N latitude. This approach enables plant breeders to select cultivars that are adapted to a wide range of biotic and abiotic stress. The F₂ generation was sown near Toluca over the summer of 1996. In the F₂, single plant selection was conducted and Brevis originated from plant no. 19, which was harvested and threshed individually to produce an F₃ family. This family was sown near Obregon during the 1996–1997 crop cycle and was selected in bulk. Further bulk selection was performed in the F₄ in the summer of 1997 near El Batán, the F₅ during the 1997–1998 cropping cycle near Ciudad Obregon and

the F₆ during the summer of 1998 near El Batan. Reserve F₇ seed from the El Batan nursery in 1998 was sown in the summer of 1999 at El Batan, and a single plant was selected (plant no. 7), harvested and threshed individually to produce an F₈ family, which was sown near Obregon during the 1999–2000 cropping cycle and harvested in bulk. From the resulting F₉ family planted near El Batan over the summer of 2000, a single plant (plant no. 7) was selected, harvested and threshed individually and planted as F₁₀ near Obregon during the 2000–2001 cropping cycle. The final seed which produced Brevis was an F₁₁ family bulked in Obregon in 2000–2001.

As generation advancement and line purification described above was conducted, parallel yield testing using bulked seed initiated in 1998–1999 in replicated yield trials sown under full and reduced irrigation at the station near Obregon. Brevis exhibited high and stable grain yield under Mexican conditions and was selected for multiplication near Mexicali, Sonora an internationally recognized karnal bunt-free area in Northern Mexico, during the 2002–2003 crop cycle.

In 2004, it was introduced via the 36th International Triticale Screening Nursery (ITSN) as entry T0400A-010 and grown near Swift Current, SK, as a paired row plot. It was selected for further testing in Canada because it had large kernels and high grain yield and test weight and shorter straw than other Canadian cultivars. In 2005, it was entered into the Triticale 'A' Test grown at four locations near Swift Current, Stewart Valley, Regina and Indian Head, SK. It was advanced to the Triticale 'B' Test in 2006 grown at seven locations near Swift Current, Stewart Valley, Regina and Indian Head, SK, and Lacombe, Trochu and Lethbridge, AB. T0400A-010 was tested as T200 in the Western Spring Triticale Registration Trials from 2007 to 2009, inclusive. Tests were grown near Morden and Winnipeg, MB, Indian Head, Saskatoon, Swift Current, Stewart Valley and Regina, SK, and Lethbridge and Lacombe, AB, in 2007 to 2009, inclusively. T200 was assessed for resistance to the prevalent races of leaf rust (caused by *Puccinia recondita* Rob. Ex Desm. f. sp. *tritici*), stem rust (caused by *P. graminis* Pers.:Pers f. sp. *tritici* Eriks. & E. Henn.) in inoculated nurseries near Glenlea, MB; to common bunt [caused by *Tilletia foetida* (Wallr.) Liro and *T. caries* (DC) Tul.] in inoculated nurseries near Lethbridge, AB; and to Fusarium head blight {caused by *Fusarium graminearum* Schwaub, GroupII [telomorph *Gibberella zeae* (Schwein) Petch]} in inoculated nurseries near Carman and Glenlea, MB.

Performance and Adaptation

Brevis is well adapted to the soils of the Canadian Prairies. Averaged over 27 site years, the grain yield of Brevis was similar to that of Pronghorn (Salmon et al. 1997) and greater than that of AC Certa (McLeod et al. 1996) and AC Ultima (McLeod et al. 2000) (Table 1). The grain yield of Brevis was equal to that

Table 1. Mean grain yield performance of Brevis compared with that of the checks, based on data from the Western Spring Triticale Registration Trials, 2007–2009, inclusive

Cultivar	Yield (kg ha ⁻¹) ^z			
	Zone 1 ^y	Zone 2	Zone 3	Mean
Pronghorn	4409	4448	7850	4827
AC Certa	4228	4169	7396	4551
AC Ultima	4274	4144	7894	4631
Brevis	4519	4868	8137	5047
LSD _(0.05) ^x (P = 0.05)	543	467	1065	373
No. of Tests	12	12	3	27

^zMeans are weighted for locations and years within a zone.

^yZone 1, Dark Brown and Black Soils Zones of MB and SK; Zone 2, Brown and Dark Brown Soils Zones of SK and AB; Zone 3, Thin Black Soils Zone of AB.

^xLSD of means was based on the checks and Brevis and calculated using the SAS PROC MIXED procedure (SAS Institute, Inc. 2006).

of the check cultivars in the Dark Brown and Black Soils Zones of Manitoba and in the thin Black Soils Zone of Alberta, but was superior to AC Certa and AC Ultima in the Brown and Dark Brown soil zones of Saskatchewan and Alberta.

Brevis headed in a similar number of days to the check cultivars (Table 2). Brevis matured in a similar number of days to Pronghorn and AC Certa, all being significantly later than AC Ultima. Brevis was significantly shorter than all of the check cultivars. The lodging resistance of Brevis was similar to that of the check cultivars. The test weight of Brevis was equal to that of AC Certa, the best check cultivar and significantly greater than that of Pronghorn and AC Ultima. The kernel weight of Brevis was equal to that of the check cultivars. The Hagberg Falling Number of Brevis was significantly less than that of AC Ultima and equal to that of Pronghorn and AC Certa.

Disease Reaction

Brevis was resistant to the prevalent races of leaf rust, stem rust and common bunt, moderately susceptible to moderately resistant to Fusarium head blight, and susceptible to ergot like the checks (Table 3).

End Use Suitability

Brevis is eligible for the Canada grades of triticale. It is suitable for use as an ultra high yielding feed grain; as a high quality feedstock for ethanol production and for specialty baked goods.

Other Characteristics

Plant characteristics were recorded from experimental field plots grown in 2009 at Swift Current, SK.

Seedling Characteristics

Coleoptile colour: Anthocyanin colouration absent to weak.

Table 2. Means for agronomic performance for heading, height, maturity, lodging resistance, test weight, kernel weight and Hagberg falling number of Brevis compared with that of the checks based on data from the Western Spring Triticale Registration Trials, 2007–2009, inclusive

Cultivar	Heading (d)	Height (cm)	Maturity (d)	Lodging ^z (1–9)	Test weight (kg hL ⁻¹)	Kernel weight (mg)	Hagberg falling number (s)
Pronghorn	59	105	109	3	69.5	45.2	65
AC Certa	58	106	109	2	73.6	43.5	70
AC Ultima	57	98	106	3	70.2	45.5	132
Brevis	58	92	109	2	73.9	44.0	66
LSD _(0.05)	1.0	2	1	1	0.9	1.5	22.6
No. of tests	13	27	21	7	27	27	27

^z1=all plants are standing; 9=all plants are lying horizontally.

³LSD of means was based on the checks and Brevis and calculated using the SAS PROC MIXED procedure (SAS Institute, Inc. 2006). Data consists of single measurements made for each site and year.

Juvenile growth habit: Erect.
Tillering capacity (at low densities): Medium.

Adult Plant Characteristics

Growth habit: Intermediate.
Flag leaf: Dark green, absent to weak auricle colouration, and auricle margins are glabrous. Flag leaf sheath has no waxy bloom.
Flag leaf attitude: erect.
Upper culm internode: Straight at maturity. It is hollow stemmed and has a thick wall, pubescence of neck is dense.
Maturity: Late, equal to Pronghorn and AC Certa and 3 days later than AC Ultima.
Plant height: This line is semi dwarf in height, about 14 cm shorter than Pronghorn and 6 cm shorter than AC Ultima.
Lodging resistance: Strong straw strength.

Spike Characteristics

Shape: Tapering.
Length: Medium, similar to AC Ultima, slightly smaller than Pronghorn.
Density: Medium.
Attitude: Erect.
Colour: White at maturity, anthocyanin colouration of awns is absent, weak glaucosity of spikes.
Awns: Awned.

Spikelet Characteristics

Glumes: Long length of lower glume, hairiness on external surface. Glumes are white in colour at maturity.

Kernel Characteristics

Type: soft and reddish orange in colour.
Shape: Elliptical in shape with rounded to slightly angular cheeks.

Table 3. Disease reaction of Brevis compared with that of the checks based on data from the Western Spring Triticale Registration Trials, 2007–2009, inclusive

Cultivar	2007										
	Leaf rust		Stem rust		FHB-Glenlea			FHB-Carman		Common bunt	Ergot
	Severity	Reaction ^z	Severity	Reaction	% VRI ^y	Class ^x	DON ^w	VRI %	Class	Severity	% by weight
Pronghorn	0	R			16.7	MR	0.7/5.1	16.7	I	VR	
AC Certa	0	R			11.6	MR	1.3/7.7	17.8	I	VR	
AC Ultima	0	R			29.8	I	6.1/14.9	34.2	MS	VR	
Brevis	0	R			9.2	R	3.5/9.5	29.6	I	VR	
	2008										
Pronghorn	0	R	15	MS	0.5	R	12.3	8.8	MR	VR	0.20
AC Certa	0	R	0	R	4	MR	13.6	42.8	MS	VR	0.30
AC Ultima	0	R	0	R	17.5	MS	27	56.7	S	VR	0.23
Brevis	0	R	0	R	2	R	19.7	44.7	MS	–	0.10
	2009										
Pronghorn	0	R	20	I	3	R	27.0	8.6	R	R	0.61
AC Certa	0	R	3	R	12.3	MR	23.1	16.9	MR	R	0.55
AC Ultima	0	R	1	R	27.5	I	41.4	33.3	I	R	1.07
Brevis	0	R	1	R	16.8	MR	16.0	24.8	MR	–	1.01

^zRust reaction: R=resistant; VR=very resistant; number indicates percent infection.

^yPercent VRI=severity estimate by visual rating index=(% infected spikelets × % infected spikes)/100.

^xResistance class, R=resistant; MR=moderately resistant; MS=moderately susceptible; S=susceptible; I=intermediate.

^wDON, data from Glenlea/Carman in 2007, Glenlea in 2008.

Size: large sized with long length and mid-wide width.
 Brush: Large-sized with mid-long to long brush length.
 Embryo: Rounded to angular Cheeks, crease is mid-wide and mid-deep.
 Germ: Large and oval in shape.
 Phenol reaction: Faun to light brown.

Seed Maintenance and distribution

Final seed purification of Brevis was started in 2007 with the selection of 200 single plants from an F₁₀ derived F₁₆ bulk, grown in plots near Swift Current, SK. These were sown as 3-m rows in 2008 near Swift Current, SK. Rows with off types were discarded and 150 rows were harvested and sown in 15 m rows in 2009 near Indian Head, SK. Again, rows with off types were discarded and 136 rows were harvested in bulk to form a Breeder seed lot of 457 kg of conditioned seed of which 420 kg is available for distribution. Western Ag labs and Wagon Wheel Seed Corp have been awarded the multiplication, marketing and distribution right for Brevis. Breeder seed will be maintained by the Seed Increase Unit of the Experimental Farm, Research Branch, Agriculture and Agri-Food Canada, Indian Head, Saskatchewan, Canada S0G 2K0.

Appreciation is expressed to Dr. J. Gilbert for assessing FHB reaction; to Drs. T. G. Fetch and B. D. McCallum for providing leaf and stem rust reaction, all of Cereal Research Centre,

AAFC, Winnipeg, MB; to Dr. D. A. Gaudet, and Ms. T. Despins, Research Centre, AAFC, Lethbridge, AB, for assessing reaction to common bunt; to Mr. G. McClare Semiarid Prairie Agricultural Research Centre, AAFC, Swift Current, SK, Mr. O. Thompson, Research Farm, AAFC, Indian Head, SK and R. Ferguson, AAFC, Regina, SK for their technical assistance in conducting field trials, and to Mr. D. T. Gehl, Seed Increase Unit, Research Farm, AAFC, Indian Head, SK, for his assistance in the multiplication of Breeder seed of Brevis.

Borlaug, N. E. 1968. Wheat breeding and its impact on world food supply. Pages 1–36 in K. W. Finley and K. W. Sheppard, eds. Proceedings 3rd Int. Wheat Genetics Symposium, Canberra, Australia.

McLeod, J. G., Pfeiffer, W. H., DePauw, R. M. and Clarke J. M. 1996. AC Certa spring triticale. *Can. J. Plant Sci.* **76**: 333–335.

McLeod, J. G., Pfeiffer, W. H., DePauw, R. M. and Clarke, J. M. 2000. AC Ultima spring triticale. *Can. J. Plant Sci.* **80**: 831–833.

Rajaram, S. 1995. Wheat germplasm improvement: Historical perspectives, philosophy, objectives and missions. Pages 1–9 in S. Rajaram and G. P. Hettel, eds. Wheat breeding at CIMMYT: Commemorating 50 years of research in Mexico for global wheat improvement. Wheat special report No. 29. CIMMYT, Mexico, D. F.

Salmon, D. F., Cortez, M. J., Helm, J. H., Jedel, P. E. and Duggan, T. R. 1997. Registration of 'Pronghorn' Triticale. *Crop Sci.* **37**: 1392–1393.

SAS Institute, Inc. 2006. SAS software. Version 9.13. SAS Institute, Inc., Cary, NC.