CULTIVAR DESCRIPTION

Sunray spring triticale

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Beres, B. L., Skovmand, B., Randhawa, H. S., Eudes, F., Graf, R. J. and McLeod, J. G. 2012. **Sunray spring triticale**. Can. J. Plant Sci. **92**: 363–367. Sunray, a spring triticale (× *Triticosecale* Wittmack) cultivar, is adapted to the Canadian prairies and represents an improvement in ergot resistance for Canadian triticale. Sunray is resistant to the prevalent races of leaf rust, stem rust, common bunt and common root rot and is moderately resistant to grain sprouting. Sunray is short-statured with excellent lodging resistance and grain yield; grain volume test weight and seed mass were similar to the check cultivars. Sunray matures 2 d earlier than Pronghorn and AC Certa, and similar to AC Ultima. Sunray is eligible for the grades of Canada Triticale.

Key words: × *Triticosecale* Wittmack, disease resistance, ergot, grain yield, quality, triticale

Beres, B. L., Skovmand, B., Randhawa, H. S., Eudes, F., Graf, R. J. et McLeod, J. G. 2012. **Le triticale de printemps Sunray**. Can. J. Plant Sci. **92**: 363–367. Sunray est un cultivar de triticale de printemps (× *Triticosecale* Wittmack) acclimaté aux Prairies canadiennes. Plus résistant à l'ergot que les autres variétés de triticale, Sunray résiste aux races courantes de rouille de la feuille, de rouille de la tige, de carie et de piétin, et résiste modérément à la germination spontanée. Sunray se caractérise par sa petite taille, à laquelle s'ajoutent une excellente résistance à la verse et un excellent rendement grainier. Le poids spécifique et la masse des grains ressemblent à ceux des cultivars témoins. Sunray parvient à maturité deux jours avant Pronghorn et AC Certa, et à peu près en même temps que AC Ultima. Sunray est admissible au classement en tant que triticale canadien.

Mots clés: × *Triticosecale* Wittmack, résistance à la maladie, ergot, rendement grainier, qualité, triticale

Sunray, a spring triticale (× *Triticosecale* Wittmack) cultivar, was selected by Agriculture and Agri-Food Canada (AAFC), Lethbridge Research Centre (LRC), Lethbridge, Alberta from a number of advanced lines provided by the International Maize and Wheat Improvement Centre (CIMMYT), México, DF, México. It was introduced into Canada in 2004 as part of the research initiatives set forth by the Canadian Triticale Biorefinery Initiative. Sunray was selected from segregating head rows for improved resistance to ergot (caused by *Claviceps purpurea*) and early physiological maturity. Sunray was assigned registration number 7035 by the Variety Registration Office, Canadian Food Inspection Agency, Agriculture and Agri-Food Canada, on 2011 Jul. 07.

Pedigree and Breeding Methodology

Sunray is a hexaploid triticale that was first assigned the breeding line designation 89TT126 by the International Wheat and Maize Improvement Centre (CIMMYT) in México and introduced by the Research Branch, Agriculture and Agri-Food Canada Lethbridge Research Centre. The pedigree is unavailable as the documents that accompanied the germplasm transferred to Lethbridge in 2003–2004 were incomplete. The Head of the gene bank and contact for CIMMYT, Dr. Bent Skovmand, fell ill shortly after the transfer of germplasm and passed away in 2007.

The line 89TT126 was first evaluated in an adaptation and yield stability study that commenced in 2004; 268 introduction lines originating from CIMMYT in México were evaluated in a single row nursery in Lethbridge, Alberta, Canada (Goyal et al. 2011). Twenty hexaploid triticale lines were selected based on the following traits: (1) resistance to ergot (caused by *Claviceps purpurea* Fr.), (2) days to physiological maturity, (3) seed yield, which was based on a reproductive index of seeds planted: seeds harvested, and (4) straw strength. Ten lines, including 89TT126, were advanced to the Triticale "B" Test in 2006. 89TT126 was evaluated in the Western Spring Triticale Co-operative Test as T204 from 2007 to 2009, inclusive.

†*Deceased*

Table 1. Least square means for grain yield performance of Sunray compared with Pronghorn, AC Certa and AC Ultima triticales, based on data from the Western Spring Triticale Registration Trials, 2007–2009, inclusive

		Yield (kg ha^{-1})[z]							
Test no.	Name	Zone 1[y]	% of check mean	Zone 2	% of check mean	Zone 3	% of check mean	Overall mean	% of check mean
T124	Pronghorn	4408	102	4448	105	7850	102	4808	103
T128	AC Certa	4228	98	4169	98	7396	96	4554	98
T150	AC Ultima	4274	99	4144	97	7894	102	4618	99
T204	**Sunray**	**4290**	**100**	**4531**	**107**	**8425**	**109**	**4857**	**104**
	Check mean	4303	100	4254	100	7713	100	4660	100
	$LSD^{x}_{0.05}$	543		467		1065		373	
	No. of tests	12		12		3		27	

[z]Means are weighted for locations and years.
[y]Zone 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.
[x]$LSD_{0.05}$ calculated using all data points for the Western Spring Triticale Registration Trials for 2007–2009, inclusive.

Disease severity in artificially inoculated field nurseries was estimated for leaf rust (caused by *P. triticina* Eriks.) and stem rust (caused by *Puccinia graminis* Pers.: Pers. f. sp. *tritici* Eriks. & e. Henn.) at the AAFC Cereal Research Centre (CRC), Winnipeg, using the modified Cobb scale (Peterson et al. 1948). Seedling infection type reactions were determined in the greenhouse for leaf rust races MBDS (12-3), MGBJ (74-2), TJBJ (77-2) and MBRJ (128-1) (McCallum and Seto-Goh 2006) and stem rust races TMRTK (C10), RKQSR (C63), TPMKR (C53) RTHJT (C57), QTHST (C25) and RHTSK (C20) (Roelfs and Martens 1988; Fetch 2005). *Fusarium* head blight (caused by *Fusarium graminearum* Schwab) tolerance was evaluated in field nurseries at Carman and Glenlea, MB, which were spray-inoculated with a macroconidial suspension and rated using a visual index (% incidence × % severity/100) as described by Gilbert and Woods (2006). Evaluation of common bunt [(caused by *Tilletia laevis* Kuhn in Rabenh) and *T. tritici* (Bjerk.) (Bjerk.) R. Wolff] resistance was conducted at the Lethbridge Research Centre using a composite of races L1, L16, T1, T6, T13 and T19, and planting into cold soil (Gaudet and Puchalski 1989; Gaudet et al. 1993).

The MIXED procedure of SAS® (Littell et al. 2006) was used to perform yearly and multi-year analyses for agronomic data where years, environments and their interactions were considered random and cultivar treated as fixed effects. Mean separation tests were performed using a Fisher protected LSD procedure.

Performance and Adaptation

Sunray is adapted to the agroecological zones of the Canadian prairies. Averaged over the 27 site-years, the grain yield of Sunray was similar to the mean grain yield of the triticale check cultivars (Table 1). Sunray is 7 cm shorter than the mean height of Pronghorn, AC Certa and AC Ultima (Table 2). The number of days to maturity of Sunray is 2 d earlier than Pronghorn and AC Certa, with a similar maturity as AC Ultima (Table 2). Lodging resistance, test weight, and kernel weight of Sunray are within the ranges of the check cultivars. Similar agronomic performance of Sunray has been observed in other studies, where the yield performance of Sunray seems stable across an array of environments (Goyal et al. 2011). The Hagberg Falling Number of Sunray was less than AC Ultima but greater than Pronghorn and AC Certa (Table 2).

Table 2. Least square means for height, maturity, lodging resistance, test weight, kernel weight and Hagberg falling number of Sunray compared with Pronghorn, AC Certa and AC Ultima triticales, based on data from the Western Spring Triticale Registration Trials, 2007–2009, inclusive

		Agronomic data					
		Height (cm)	Maturity (d)	Lodging (1–9)	Test weight (kg hL^{-1})	Kernel weight (g 1000^{-1})	Hagberg falling number(s)
T124	Pronghorn	105	109	2	69.5	45.2	65
T128	AC Certa	106	109	2	73.6	43.5	70
T150	AC Ultima	98	106	3	70.2	45.5	132
T204	**Sunray**	**96**	**107**	**2**	**69.6**	**44.4**	**82**
	Check mean	103	108	2.3	71.1	44.7	89
	$LSD^{z}_{0.05}$	2	1	1	0.9	1.5	22.6
	# of tests	27	21	8	27	27	27

[z]$LSD_{0.05}$ calculated using all data points for the Western Spring Triticale Registration Trials for 2007–2009, inclusive.

Table 3. Disease reaction of Sunray compared with Pronghorn, AC Certa and AC Ultima triticales, based on data from the Western Spring Triticale Registration Trials, 2007–2009, inclusive

		2007													
		Leaf rust		Stem rust		FHB-Glenlea			FHB-Carman		Common bunt				
Test #	Name	Severity	Rating	Severity	Rating	VRI %	Class	DON[z]	VRI %	Class	Reaction	Class	% Ergot by weight[y]		
T124	Pronghorn	0	R	–	–	17	MR	0.7/5.1	17	I	0	VR	–	–	–
T128	AC Certa	0	R	–	–	12	MR	1.3/7.7	18	I	0	VR	–	–	–
T150	AC Ultima	0	R	–	–	30	I	6.1/14.9	34	MS	0	VR	–	–	–
													–	–	–
													–	–	–
T204	**Sunray**	**0**	**R**	**–**	**vr**	**7**	**R**	**6.7/8.8**	**22**	**I**	**0**	**VR**	**–**	**–**	**–**
								2008							
													U of S	Lacombe	Test mean
T124	Pronghorn	0	R	15	MS	1	R	12.3	9	MR	0	VR	0.22	0.31	0.20
T128	AC Certa	0	R	0	R	4	MR	13.6	43	MS	0	VR	0.46	0.55	0.30
T150	AC Ultima	0	R	0	R	18	MS	27.0	57	S	0	VR	0.52	0.27	0.23
T204	**Sunray**	**0**	**R**	**0**	**R**	**1**	**R**	**22.5**	**41**	**MS**	**–**	**–**	**0.13**	**0.12**	**0.09**
								2009							
														Lacombe	Test mean
T124	Pronghorn	0	R	20	1	3	R	27.0	9	MR	0	R		2.44	0.61
T128	AC Certa	0	R	3	R	12	MR	23.1	17	I	0	R		2.18	0.55
T150	AC Ultima	0	R	1	R	28	I	41.4	33	MS	0	R		4.30	1.07
T204	**Sunray**	**0**	**R**	**1**	**R**	**12**	**MR**	**37.7**	**19**	**I**	**–**	**–**		**0.77**	**0.20**

[z]DON, data from Glenlea/Carman in 2007, Glenlea in 2008 and 2009.
[y]In addition to the test mean, those sites with the greatest ergot severity in each year are reported.

Disease Reaction

Sunray represents an improvement in resistance to ergot among Canadian triticale germplasm. Sunray exhibited lower ergot infection (percent ergot by weight) than the checks (Table 3). Sunray is also highly resistant to the prevalent races of leaf rust, stem rust, common bunt and common root rot. In 5 of 6 site-years for *Fusarium* head blight reaction, Sunray exhibited responses in the range of "R" to "I"; at Carmen, MB in 2008 and it was rated "41 MS" (Table 3). However, based on elevated deoxynivalenol (DON) levels in 2009 (Table 3), the overall response of Sunray to *Fusarium* head blight was rated "S". Relative to the check cultivars for *Fusarium* head blight infection and DON accumulation, Sunray displayed a similar response as AC Certa, improved resistance over AC Ultima, and higher infection rates and DON accumulation than Pronghorn.

End Use Suitability

Sunray is suitable for use as an ultra high yielding feed grain and could also be considered for niche triticale milling or ethanol feedstock markets.

Other Characteristics

Plant characteristics were recorded from greenhouse increases and experimental field plots grown in 2010 at Lethbridge and Edmonton, AB.

Seedling Characteristics

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

Adult Plant Characteristics

Growth habit: Intermediate.
Flag leaf: Blue green, strong auricle colouration, and auricle margins are slightly pubescent. Flag leaf sheath is glabrous.
Flag leaf attitude: drooping.
Upper culm internode: Moderately curved at maturity. It is hollow-stemmed with a thin wall, and strongly pubescent neck.
Maturity: Medium, 2 days earlier than Pronghorn.
Plant height: This line is semi-dwarf, about 10 to 15 cm shorter than Pronghorn and 5 to 10 cm shorter than AC Ultima.
Lodging resistance: stronger straw strength.

Spike Characteristics

Shape: Tapering.
Length: Medium, similar to AC Ultima, slightly smaller than Pronghorn.
Density: Dense.
Attitude: Nodding.
Colour: White at maturity.
Awns: Awned.

Spikelet Characteristics

Glumes: medium length of lower glume, which is strongly pubescent. Glumes are white in colour at maturity.

Kernel Characteristics

Type: soft and reddish orange in colour.
Shape: Elliptical in shape with angular cheeks.
Size: large sized with long length and mid-wide width.
Brush: Large-sized with long brush length.
Embryo: Angular cheeks; crease is mid-wide and mid-deep.
Germ is large and oval in shape;
Phenol reaction is light brown.

Maintenance and Distribution of Pedigreed Seed

SeedNet Inc has been granted the marketing rights in Canada for Sunray. 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. Distribution and seed multiplication of all other generations of Sunray will be performed by SeedNet Inc. P.O. Box 1150 Vulcan, Alberta, Canada T0L 2B0.

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