CROP DEVELOPMENT CENTRE USASK

REQUEST FOR SUPPORT OF REGISTRATION OF **T322**

CROP KIND: Triticale **TYPE:** Spring Triticale

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TEST NUMBERS: T322 **PEDIGREE**: Ultima*2/CDC EMDR9 F2#4//Ultima/X08.88

T322 was selected from the cross Ultima*2/CDC EMDR9 F2#4//Ultima/X08.88.

CDC EMDR9 is a common wheat with elevated seed dormancy levels (Hucl and Matus, CJPS 82:411-413). The cross X08.88 has the pedigree Sandro*2/Goodeve. Sandro is a spring triticale while Goodeve is a CWRS wheat cultivar. F_5 seedlings from X08.88 population were screened with a molecular marker for the $Bx7^{OE}$ HMW glutenin allele and carriers were crossed with Ultima in late 2011. The resulting F_1 was crossed to the F_1 of the cross Ultima*2/CDC EMDR9 F2#4. The backcross in the latter parent was made by selecting seed from individual F_2 spikes for increased seed dormancy at room temperature and using the resulting F_3 plants as pollen donors.

The final cross was made in a growth chamber in early 2012. The F_1 generation was grown in a growth chamber as was the F_2 generation. The F_3, F_4 and F_5 generations were grown in bulk plots at Saskatoon during the 2013, 2014 and 2015 crop seasons, respectively.

F_5-derived F_6 head rows ("hills") were grown in 2016. The F_5 hills were selected for reduced height and lodging. Individual F_6 spikes were selected and sown in F_7 hills in 2017. The hill nurseries were grown at Saskatoon. The same selection criteria applied as in 2016. Subsequently, selected lines were evaluated in an unreplicated yield plot nursery in 2018 and selected using the same criteria as in 2017, with the addition of grain yield, ergot infection, test weight, kernel weight Falling Number and SDS sedimentation volume. A line identified as 19TRIT103 was subsequently evaluated in local yield tests in 2019 and 2020 (two sites), and 2021 to 2024 (three sites) The line was an entry in the Spring Triticale Registration Test from 2022 to 2024, under the T322 identity. T322 is F_6-derived, and breeder seed was developed from spikes harvested in the F_{11} generation.

AREA OF ADAPTATION: Triticale growing areas of western Canada.

STRENGTHS: Improved baking quality. Higher forage yield than all the checks.

WEAKNESSES: Presence of awns.

DESCRIPTION: T322 is awned. Based on three years of data from the Spring Triticale Registration Test, T322 was within the range of the triticale checks for grain yield, days to heading and maturity, height and lodging score (Table 1). T322 had an intermediate test weight but lower kernel weight relative to the triticale checks (Table 1).

T322 was in the range of the triticale checks for ergot infection (Table 2). T322 was rated resistant to prevalent races of leaf, stem and stripe rust as well as bunt (Table 2). The Fusarium Head Blight rating for T322 was in the range of the checks (Table 2).

Based on two years of data, the forage yield of T322 was significantly higher than that of all the check cultivars (Table 3).

The line 19TRIT103 was assessed for grain quality in CDC Trials for three years (Supplementary Tables S1 and S2). Averaged over years and sites, 19TRIT103 had a grain protein concentration and Falling Number in the range of the three triticale checks (Table S1). The SDS Sedimentation volumes were approximately twice those of Brevis and Sandro and 39% higher than those of Ultima.

In larger scale quality tests, 19TRIT103 was similar to the three triticale checks for milling quality and Farinograph water absorption (Table S2). The dough strength characteristics of 19TRIT103 were an improvement over the three triticale checks. The Farinograph Dough Development Time was approximately 50% longer than that of the triticale checks. The Mixing Tolerance Index values of 19TRIT103 were nearly four times lower than those of Brevis and Sandro and two times lower than those of Ultima. The Farinograph Stability values of 19TRIT103 were nearly three times higher than those of the three triticale checks (Table S2). 19TRIT103 averaged a 32% larger loaf volume than Ultima (Table S2) with a more wheat-like crumb (Figure 1). Brevis and Sandro samples were not baked due to their overly weak dough properties.

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Table 1. Agronomic summary for T322 in the Spring Triticale Registration Test, 2022 to 2024.													
Code	**Name**	**Yield (kgha^{-1})**				**Prong horn**	**Brevis**	**Heading**	**Maturity**	**Height**	**Test Weight**	**1000 Kernel Weight**	**Lodging**
		2022	**2023**	**2024**	**Mean**	**(%)**	**(%)**	**(days)**	**(days)**	**(cm)**	**(kg/hl^{-1})**	**(g)**	**(1-9)**
T124	PRONGHORN	5701	6689	5444	5944	100	102	52.8	96.3	104.9	69.9	43.2	2.9
T200	BREVIS	5535	6487	5534	5852	98	100	52.6	96.6	91.1	74.0	41.9	1.3
T150	AC ULTIMA	5767	6031	5191	5663	95	97	51.8	94.6	98.0	71.3	45.6	2.2
T951	AC ANDREW	5884	6486	5868	6079	102	104	56.1	94.0	83.5	77.1	35.9	1.8
T322	19TRIT103	6021	6266	5431	5906	99	101	52.6	95.3	98.2	72.9	40.8	2.4
	Mean	**5864**	**6470**	**5611**	**5982**			**53.1**	**95.9**	**93.5**	**72.4**	**42**	**2.1**
	CV%	**6.6**	**8.4**	**8.6**	**5.8**			**0.8**	**0.5**	**2.6**	**1.9**	**3.6**	**20.4**
	$LSD_{0.05}$	**425**	**278**	**224**	**449**			**0.8**	**0.9**	**4.1**	**2.7**	**3.4**	**1.6**
	Stations	**10**	**10**	**12**	**32**			**19**	**27**	**29**	**26**	**26**	**26**

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Table 2. Disease ratings for ergot, leaf, stem and stripe rust, bunt and Fusarium Head Blight, 2022-2024 Spring Triticale Registration Test.

		Ergot (% by weight)				Leaf Rust			Stem Rust			Stripe Rust			Bunt		
Code	**Name**	**2022**	**2023**	**2024**	**Mean**	**2022**	**2023**	**2024**	**2022**	**2023**	**2024**	**2022**	**2023**	**2024**	**2022**	**2023**	**2024**
T124	PRONGHORN	0.16	0.30	0.09	0.18	R	R	R	NA	MS	MS	R	R	R	NA	R	R
T200	BREVIS	0.07	0.14	0.03	0.08	R	R	R	R	R	R	R	R	R	R	R	R
T150	AC ULTIMA	0.28	0.38	0.09	0.25	R	R	R	R	R	R	R	R	R	R	NA	R
T951	AC ANDREW	0.00	0.02	0.00	0.01	MS	MS	MS	NA	R	MR	MR	R	R	R	I	S
T322	19TRIT103	0.28	0.21	0.08	0.19	R	R	R	R	R	R	R	R	R	R	R	R

		Fusarium Head Blight											
			Visual Rating Index Rating					DON rating					
		2022		2023		2024		2022		2023		2024	
Code	**Name**	**Carman**	**Morden**	**Carman**	**Morden**	**Carman**	**Morden**	**Carman**	**Morden**	**Carman**	**Morden**	**Carman**	**Morden**
T124	PRONGHORN	R	I	R	MR	MR	I	I	MS	I	I	I	I
T200	BREVIS	MR	I	MR	I	I	MS	I	MS	MS	I	I	I
T150	AC ULTIMA	I	S	MR	I	MS	S	S	S	MS	S	S	S
T951	AC ANDREW	I	MS	I	MS	MR	S	S	MS	S	S	I	S
T322	19TRIT103	I	MS	MR	I	I	MS	MS	S	I	MS	S	MS

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Table 3. Two Year Averages 2023-2024, Dry Matter Yield and Forage Quality Data											
Name/Code	**DMY (kg/ha^{-1})**			**Prong horn**	**ADF**	**NDF**	**TDN**	**PROT**	**STRC**	**LIGN**	**RFV**
	2023	**2024**	**Mean**	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**	**(%)**
PRONGHORN	14587	8690	11639	100	28	45	67	12.4	10.3	4.0	140
BUNKER	12939	9333	11136	96	28	46	67	11.9	9.1	4.1	137
AAC DELIGHT	12698	8778	10738	92	26	43	69	11.8	11.3	3.3	152
CDC HAYMAKER (Oat)	15863	7519	11691	100	31	50	64	11.8	9.7	4.5	122
AC ANDREW (Wheat)	12988	7848	10418	90	28	46	68	12.0	12.9	3.5	136
T322	15963	10263	13113	113	25	41	70	11.2	13.9	3.2	160
Mean	**14743**	**9251**	**11694**		**27**	**44**	**69**	**12**	**12**	**4**	**147**
CV%	**9.8**	**12.0**	**8.8**								
$LSD_{0.05}$	**2430**	**1724**	**1006.2**								
Stations/yrs	**2**	**1**	**3**		**3**	**3**	**3**	**3**	**3**	**3**	**3**

ADF= Acid Detergent Fiber (%)
NDF= Neutral Detergent Fiber (%)
TDN=Total Digestible Nutrients
PROT= Crude Protein content (%)
STRC= Starch Content (%)
LIGN= Lignin content (%)
RFV= Relative Feed Value (%)

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Table S1. Grain Protein, SDS Sedimentation and Falling Number data for 19TRIT103 grown at three sites in each of three years. CDC replicated trials (r=2); samples

		Grain Protein (%)			SDS Sedimentation volume (cc)			Falling Number (sec)		
Year	**Name**	**Kernen**	**Goodale**	**Codette**	**Kernen**	**Goodale**	**Codette**	**Kernen**	**Goodale**	**Codette**
2022	Ultima	10.7	11.9	12.1	29	33	26	188	207	162
2022	Brevis	10.8	11.4	11.6	20	23	17	126	153	97
2022	Sandro	11.7	11.8	13.1	23	27	19	116	216	101
2022	Pasteur	11.9	12.0	12.8	62	57	61	398	319	284
2022	AC Barrie	14.1	15.6	16.5	69	66	73	411	461	417
2022	19TRIT103	11.3	11.4	13.4	37	37	45	123	241	136
2023	Ultima	12.0	13.5	12.9	31	42	33	94	117	67
2023	Brevis	11.2	12.5	11.4	21	22	17	64	65	62
2023	Sandro	12.8	14.3	13.0	25	32	21	70	87	62
2023	Pasteur	13.0	15.2	14.6	72	76	72	325	395	203
2023	AC Barrie	14.7	16.4	16.5	85	79	84	408	418	372
2023	19TRIT103	12.6	13.9	13.1	44	55	48	100	100	69
2024	Ultima	11.1	14.5	12.2	17	37	27	215	230	74
2024	Brevis	11.2	14.0	11.7	12	25	18	134	118	62
2024	Sandro	11.8	15.4	12.7	14	28	21	98	216	64
2024	Pasteur	11.4	14.8	14.0	55	68	63	373	393	196
2024	AC Barrie	13.9	18.5	16.9	65	77	85	395	443	358
2024	19TRIT103	11.0	15.3	12.7	24	53	41	189	212	73

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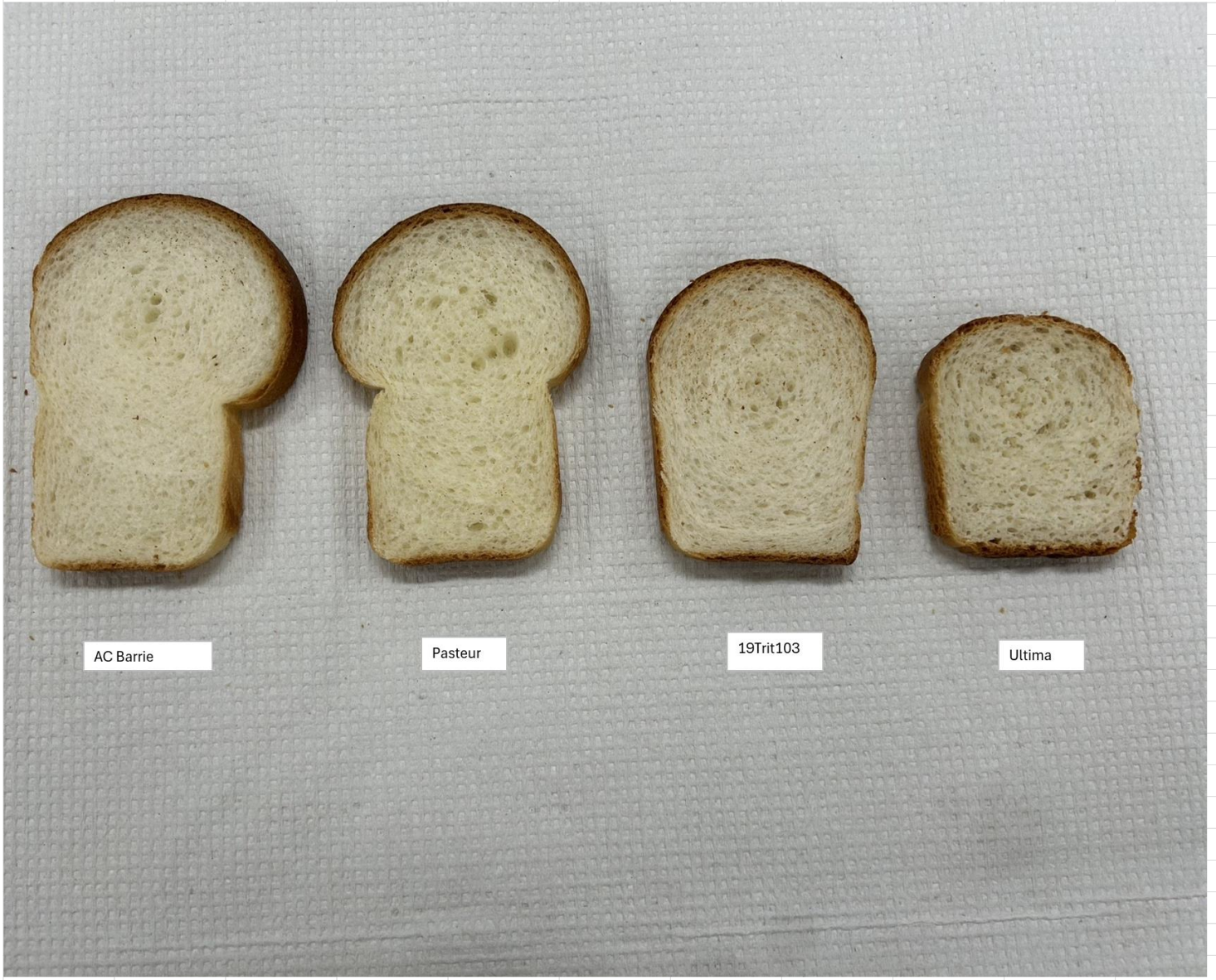
Table S2. Quality evaluation of 19TRIT103, triticale checks and bread wheat checks in each of three years. Composite samples from three sites of CDC yield trials.

															Farinograph-63rpm				CSP Bake Test	Mixing	Mixing
		SKCS	FN	FlYld	Fl Ash	FlYld	FlPro	Agtron Slurry				RVA Pk		starch	FAB	DDT	MTI	STA	LV	Energy	Time
Year	Name	(HI)	(sec)	(%)		(0.50ash)	(%)	Agtron	L*	a*	b*	PkVisc	PPO	damage	(%)	(min)	(BU)	(min)	(cc)	Whr/Kg	(min)
2021	Ultima	32	76	61.3	0.42	65.1	10.6	55.0	85.8	1.07	14.7	19	0.708	3.4	55.9	1.3	117	1.9	560	5.4	2.9
2021	Brevis	44	62	60.5	0.41	64.8	10.8	44.0	84.7	1.09	14.3	9	0.870	4.9	56.6	1.2	209	1.3	nd	nd	nd
2021	Sandro	40	63	60.0	0.38	65.8	10.8	52.0	85.5	1.10	14.7	15	0.826	3.4	56.5	1.5	238	1.4	nd	nd	nd
2021	Pasteur	80	242	64.2	0.43	67.9	11.2	72.2	87.2	1.09	16.7	110	0.701	5.2	59.1	5.7	23	15.3	1000	7.3	3.1
2021	AC Barrie	65	369	71.2	0.37	77.7	14.6	64.3	86.8	1.41	14.8	124	1.356	4.9	60.2	6.7	36	12.2	1025	7.1	2.6
2021	19TRIT103	36	69	61.3	0.40	66.3	11.0	55.5	85.7	1.12	14.9	17	0.606	4.0	54.9	2.5	55	5.4	785	8.3	3.5
2023	Ultima	38	74	63.3	0.45	65.9	10.2	36.2	85.2	0.83	13.4	19	0.574	nd	55.5	1.0	109	1.6	588	5.4	2.5
2023	Brevis	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
2023	Sandro	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
2023	Pasteur	95	248	66.5	0.47	67.9	11.8	47.1	86.1	0.91	16.0	94	0.416	nd	62.1	6.4	23	9.8	1036	7.8	2.9
2023	AC Barrie	68	366	72.9	0.38	79.1	14.2	50.8	86.5	1.11	14.5	142	0.732	nd	61.8	7.0	22	13.8	1092	7.6	2.7
2023	19TRIT103	35	70	63.5	0.41	67.8	10.6	42.3	85.7	0.72	13.4	17	0.432	nd	54.5	1.0	59	4.0	732	9.3	3.3
2024	Ultima	25	109	61.2	0.39	66.7	9.6	42.7	85.7	0.8	12.9	31	nd	4.0	55.4	1.5	118	1.7	584	5.7	2.9
2024	Brevis	45	65	60.9	0.42	64.9	9.1	33.2	85.1	1.1	14.2	20	nd	5.0	55.6	1.5	175	1.3	nd	nd	nd
2024	Sandro	36	77	59.5	0.38	65.5	9.9	47.7	86.1	0.8	13.3	21	nd	3.9	55.2	1.0	193	1.4	nd	nd	nd
2024	Pasteur	83	332	63.4	0.43	66.9	10.9	48.7	86	0.9	17	103	nd	5.3	63.2	6.5	39	6.7	971	9.5	3.8
2024	AC Barrie	64	419	70.8	0.37	77.3	14.0	55.9	86.6	1.2	15.1	166	nd	4.9	61.7	6.9	24	12.6	1086	8.5	3.0
2024	19TRIT103	26	140	60.4	0.4	65.4	9.7	53.1	86.3	0.8	12.6	29	nd	4.0	53.0	2.4	43	5.7	764	7.0	3.6

Figure 1. Loaf slices from AC Barrie (CWRS wheat), Pasteur (CWSP wheat), 19TRIT103 and Ultima triticale. 2024 CDC yield trial grain composite.



Note: All quality evaluations conducted at the CDC Baking Lab (Tables S1 and S2).