

Description of CDC Aixe and CDC Marval spring einkorn wheat cultivars.

Breeding history:

CDC Aixe (10EINK8) and CDC Marval (10EINK9) were selected from the cross 2000EINK1/Prime made at the University of Saskatchewan in mid-2003. The F₁ generation was grown in a greenhouse during the winter of 2003-2004. The F₂- F₄ generations were grown in bulk plots at Saskatoon (2004-2006). The F₅ and F₆ generations were grown in hill field nurseries in 2007 (702 lines) and 2008 (566 lines). Lines (n=104) selected from the 2008 hill nursery were grown in an unreplicated yield trial nursery in 2009. From 2010 to 2017 the two einkorn selections were grown in replicated (r=2 per trial) yield trials in the Saskatoon region. Breeder seed was developed starting in the F₁₁ generation in 2013.

The parental line 2000EINK1 is an experimental line developed at the CDC and was selected from the cross 98EINK9/TM23. The line 98EINK9 was developed from a single plant selection made from the spring einkorn germplasm bulk population PI 584654 developed by Vallega and released in 1996 (Crop Sci. 36:1717). TM23 (PI355523) is a high-yielding einkorn line that has been used as an agronomic check at the CDC since the mid-1990's.

Cultivar attributes:

Data averaged over trials is presented in Table 1. The data was obtained from trials that were statistically sound (CV < 15%). The einkorn grain yields presented in Table 1 are with the hull attached to the grain. On average, the hull content of einkorn is in the 25 to 30% range. Thus, the naked grain yield of einkorn is approximately 25% lower than that of the CWRS wheat cultivar AC Barrie.

CDC Aixe (pronounced 'X') is lower-yielding than CDC Marval and TM23 (Table 1). CDC Aixe, however, was selected primarily based on its dough handling and baking properties (Tables 3 and 4). The vast majority of einkorn wheats lack the ability to produce doughs that rise.

CDC Aixe is similar in days to heading, days to maturing and plant height relative to CDC Marval and TM23. CDC Aixe has a lower seed mass than CDC Marval and TM23.

The einkorn lines, including CDC Aixe and CDC Marval, are resistant (generally immune reactions) to leaf, stem and stripe rust and resistant to common bunt (Table 2).

CDC Aixe produces Falling Number values higher than those of the other einkorn test entries as well as the CWRS check (AC Barrie). The einkorn lines produce very soft kernels, as measured by the SKCS Hardness Index. The kernels of einkorn wheat are softer than those of soft white common wheat (data not presented).

CDC Aixe produces spikes with purple/black glumes and awns, the expression varying with growing conditions.

CDC Marval was selected on the basis of a higher grain yield (+8%) relative to TM23 (Table 1) combined with high yellow pigment content (mainly lutein) (Table 3). The yellow pigment

content of CDC Marval is nearly twice that of TM23 and higher than that of PI418547, the high yellow pigment content check. CDC Marval flours produce cookies that are superior to those of the other einkorn entries and the CWRS check (AC Barrie).

CDC Marval differs in appearance from CDC Aixe in that it produces a spike that is white in colour.

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Table 1. Agronomic data for einkorn wheat lines grown in field trials conducted between 2010 and 2017 in the Saskatoon region.							
NAME	Grain Yield (kg/ha)	Heading (days)	Maturity (days)	Height (cm)	Lodging (1 to 9)	Hulled Test Wt (kg/hl)	1000 kwt (g)
TM23	3862	57.7	97.0	88.2	4.1	47.3	31.7
PI418587	2513	56.7	96.5	89.1	3.1	59.4	32.7
AC Barrie	3780	54.1	92.6	85.7	1.5	76.9	36.2
CDC Aixe	3500	57.4	97.0	91.0	3.0	47.6	24.5
CDC Marval	4164	58.0	98.0	94.0	3.1	47.8	28.6
# of trials	22	20	22	17	16	19	19

Table 2. Disease reaction of einkorn wheat lines.

NAME	Leaf rust severity (%)					Stem rust (reaction)				
	2013	2014	2015	2016	2017	2013	2014	2016	2017	
TM23	5	0	0	0	0	R	R	MR	R	
PI418587	10	0	0	0	0	R	R	R	R	
AC Barrie	80	70	40	60	85	MR	MR	MR	MR	
CDC Aixe	5	1	0	0	0	R	R	MR	R	
CDC Marval	1	0	0	1	0	R	MR	R	R	
Year:	2013	2014	2015	2016	2017	2013	2014	2016	2017	
	Stripe rust									
NAME	% Incidence			% Severity			Infection Type			Bunt (%)
TM23	0	0	1	0	0	1	0	0	r	40
PI418587	0	nd	1	0	nd	1	0	nd	r	30
AC Barrie	100	100	100	40	20	5	S	S	MS	28
CDC Aixe	0	0	0	0	0	0	0	0	r	20
CDC Marval	0	0	0	0	0	0	0	0	r	10
Year:	2014	2016	2017	2014	2016	2017	2014	2016	2017	n=4

Table 3. Predictive quality analyses of einkorn wheat lines in trials conducted between 2010 and 2016.

Mixograph											
	Protein (as is basis)			Yellow pigment	Peak Time	Peak Height	Total Energy	Band Width	Slope after peak	Energy to peak	Band width at 6.0
NAME	%	SDS sed cc	FN sec	ppm							
TM23	16.2	8	393	4.55	1.0	35.0	177	19.5	-2.2	26	12.3
PI418587	17.7	8	374	7.93	1.0	37.1	211	17.5	-2.2	29	8.1
AC Barrie	16.1	63	396	2.78	2.1	64.3	387	38.6	-2.5	105	21.8
CDC Aixe	17.3	34	462	5.37	1.1	46.6	280	23.1	-2.5	39	9.8
CDC Marval	15.3	8	393	8.78	0.9	32.1	184	16.5	-1.8	26	6.3
# of trials	19	19	19	19	16	16	16	16	16	16	16

Table 4. Detailed milling and bake quality analyses, average of seven years (2010-2016).

Name	Flour				Farinograph									CSP Bake Test			
	yield (%)	Ash	protein	SKCS	Agtron Slurry				FABS	DDT	MTI	STA	LV	Energy	Time	RVA Pk	
	14%mb	(%)	14%mb	H.I.	Agtron	L*	a*	b*	PPO	(%)	(min)	(BU)	(min)	(cc)	Whr/Kg	(min)	(RVU)
TM23	61.0	0.53	13.8	-1	25	81.7	1.49	25.40	1.603	54.4	1.30	213	0.9	510	0.50	1.05	204
PI418587	55.3	0.66	15.7	-6	2	79.1	2.08	29.05	1.382	55.4	1.27	216	1.0	676	0.72	1.04	171
AC Barrie	71.7	0.51	14.0	63	55	85.5	1.12	14.33	0.682	61.1	5.70	31	9.4	1011	6.65	4.90	169
CDC Aixe	59.9	0.54	15.4	1	47	83.4	1.52	29.01	1.339	57.0	2.38	81	2.5	775	1.90	2.12	177
CDC Marval	65.5	0.54	13.3	1	28	81.7	1.78	30.62	1.330	52.3	1.13	260	0.5	*	*	*	163

Table 4 continued. Cookie quality of einkorn lines (2014 and 2015).

Name	2014 Cookie Data				2015 Cookie Data			
	T	W	Cookie Spread	Cookie Ratio	T	W	Cookie Spread	Cookie Ratio
TM23	*	*	*	*	1.0	8.3	82.5	8.7
PI418587	1.0	8.00	80.0	8.0	1.0	7.7	76.8	7.7
AC Barrie	1.0	7.16	71.6	7.2	1.0	8.0	79.5	8.2
CDC Aixe	1.1	8.05	80.5	7.7	1.0	8.4	84.0	9.0
CDC Marval	0.9	8.59	85.9	10.1	0.9	8.6	86.0	9.6

T = Thickness
W - width
Cookie Spread = W x 10
Cookie Ratio = W/T

Einkorn



Einkorn: 10Eink8 2016

Einkorn: 10Eink9 2016

Einkorn: AC Barrie 2016