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Alice

A High Yielding Hard White Winter Wheat

Origin and breeding history

Alice, a hard white winter wheat (*Triticum aestivum* L.), was developed by the South Dakota Agricultural Experiment Station and released in 2006 to seed producers by the developing institution and the Nebraska Agricultural Experiment Station. Alice was released on the basis of its white grain color, earliness, excellent baking quality, pre-harvest sprouting resistance, and yield potential in South Dakota and the northern Great Plains. Alice has been named to honor Alice Wright, administrative assistant for the South Dakota Wheat Commission for 23 years.

Alice was derived from the cross 'Abilene' (PI 511307)/Karl (PI 527480) made in 1992 and developed by the bulk breeding method. The cross (coded X92103) was advanced to the F₃ generation as a bulk population. Seed harvested from the F₃ bulk was sorted for white kernel color in 1995. The bulk of selected white kernels was coded X92103W and was grown in the greenhouse in spring 1996. Single heads were harvested from this selected F₄ bulk and planted in the field as head-rows in fall 1996. Alice was derived as an F_{4.5} line selected by S.D. Haley in 1997 and evaluated as SD97W609 in the South Dakota Early Yield Trial nursery in 1998. Alice was advanced to the South Dakota Advanced

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Yield Trial in 1999 due to superior performance. It was tested in the South Dakota Crop Performance Testing (CPT) variety trials between 2000 and 2006, excluding 2002 because of seed purification, and in the Northern Regional Performance Nursery in 2003.

Breeder seed of Alice originated from a composite of 200 F_{10:11} head-rows selected in 2004 based on visual uniformity and white kernel color purity. Alice has been uniform for all morphological characters (such as maturity and plant height) during the last four generations of increase. Alice contains 0.05% purple-chaffed, tall hard red off-type and 0.28% tall white variant.

The South Dakota Foundation Seed Stocks Division (Plant Science Department, South Dakota State University, Brookings) had foundation seed of Alice available to seed producers for planting during Fall 2006. Seed classes will be Breeder, Foundation, Registered, and Certified. Alice will be submitted for U.S. Plant Variety Protection under P.L. 910577 with the certification option.

Characteristics

Alice is an awned, white-glumed, early maturing, semi-dwarf, hard white winter wheat. Alice has green foliage at anthesis. The spike is tapered, in-



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clined, and mid-dense. The glume is wide with a medium length, a wanting shoulder, and an acuminate tip. Kernels are white, hard textured, and elliptical in shape with a collarless short brush, rounded cheeks, and a shallow crease.

Alice is an early maturity variety similar to Wendy and 1 day earlier maturing than Expedition. It is 3 days earlier than Wesley and 6 days earlier than Harding. Alice is slightly taller than Wendy and Wesley and 15 cm shorter than Harding. Alice has fair to good winter survival similar to Culver in testing during the cold winter of 2001. Winter survival of Alice during 2003–2006 was excellent. Alice has a short coleoptile similar to that of Wesley. Alice has the best pre-harvest sprouting resistance among any hard white tested in the CPT, similar to Crimson and better than Trego and Wendy.

Agronomic performance and quality

Alice has a very good grain yield potential. In eastern South Dakota Alice has on average yielded 1 bu/A better than Trego and Wendy, and yielded the same as or better than most popular hard red winter wheat varieties from 2004 to 2006 (Table 1). At western South Dakota locations in 2006, Alice was comparable or better yielding than other hard white wheat varieties (Table 2). From 2004 to 2006, the yield of Alice at western South Dakota locations has averaged the same as that of Wendy and 1 bu/A less than that of Trego. In 2006 CPT trials Alice had a test weight of 61 lb/bu, similar to that of Crimson, Darrell, NuFrontier, and Trego and 1 lb less than that of Jagalene. Grain protein of Alice in the 2006 season was 13.5%, slightly lower than that of NuDakota and Wendy but higher than the grain protein of Trego.

Composite milling and bread baking properties of Alice were determined during 2003–2005 cooper-

ative baking tests conducted by the USDA-ARS Hard Winter Wheat Quality Laboratory in Manhattan, Kan. Both milling and baking scores were very good. Alice had improved flour yield over Wesley and Wendy. In bread baking tests, flour water absorption and loaf volume of Alice were intermediate between Wendy and Wesley. Alice had higher mixograph tolerance than Wendy but slightly lower than Wesley. Alice was evaluated in the Wheat Quality Council tests in 2004. Its bread baking quality was found to be better than all hard winter experimental lines and checks including Tandem.

Alice has moderate grain polyphenol oxidase (PPO) levels similar to Trego, higher than Wendy, but lower than NuFrontier. Alice was entered into the Asian Products Collaborative (APC) Project, coordinated by the U.S. Wheat Associates and the Wheat Marketing Center (WMC) in 2004. Alice was found to be acceptable for Chinese raw noodles and Thailand bamee noodles. The noodle sheet color of Alice met the APC minimum target level.

Disease resistance

Alice is moderately resistant to stem rust and stripe rust. It is moderately susceptible to leaf rust and wheat soil-borne mosaic virus. Alice was tested in a wheat streak mosaic virus nursery in South Dakota between 2000 and 2005 and exhibited mild symptoms to the virus. Alice is susceptible to the Great Plains biotype of Hessian fly, based on seedling tests.

Table 1. A comparison of Alice hard white winter wheat yield (bu/A) with yield of other popular hard red and hard white winter wheat varieties at six eastern South Dakota locations, 2004-2006.

	Brookings		Watertown		Platte		Highmore		Dakota Lakes		Winner	
	'06	3-yr	'06	3-yr	'06	3-yr	'06	3-yr	'06	3-yr	'06	3-yr
	bu/A											
Hard red varieties:												
Alliance	81	65	51	43	48	48	67	23	47	41	47	
Arapahoe	82	69	50	46	46	45	67	28	46	35	44	
Crimson	73	62	42	54	51	46	62	23	46	37	41	
Darrell	84	68	48	53	57	42	66	32	50	37	49	
Expedition	85	70	51	56	49	40	59	27	45	37	40	
Harding	71	69	45	46	52	49	67	24	44	37	48	
Hatcher	78	-	59	55	-	46	-	24	-	38	-	
Jagalene	65	59	42	51	49	44	63	24	52	41	52	
Millennium	79	78	44	57	55	42	66	33	49	31	46	
Overland	85	-	52	53	-	32	-	31	-	38	-	
Wahoo	78	74	44	49	51	44	69	27	48	35	46	
Wesley	81	71	53	49	49	52	64	30	47	34	39	
Hard white varieties:												
Alice	72	63	47	62	51	46	63	29	47	39	47	
NuDakota	89	-	52	72	-	49	-	27	-	37	-	
NuFrontier	66	-	40	54	-	50	-	25	-	38	-	
Trego	72	58	47	48	46	51	62	27	47	38	50	
Wendy	80	68	49	49	41	34	60	32	51	38	47	
Average:	78	67	47	53	50	45	64	27	48	37	46	

Table 2. A comparison of Alice hard white winter wheat yield (bu/A) with yield of other popular hard red and hard white winter wheat varieties at five western South Dakota locations and statewide averages for yield (bu/A), bushel weight (BuWt) and percent grain protein (Prot), 2004-2006.

	Martin		Oelrichs		Bison		Sturgis		Wall		Statewide Averages 2006		
	'06	3-yr	'06	3-yr	'06	3-yr	'06	3-yr	'06	3-yr	Yield (bu/A)	BuWt (lb)	Prot (pct)
	bu/A												
Hard red varieties:													
Alliance	42	-	54	-	17	-	33	30	46	48	49	60	11.9
Arapahoe	45	-	52	-	17	-	30	26	42	42	46	60	14.3
Crimson	42	-	51	-	14	-	33	27	34	43	44	61	14.5
Darrell	52	-	55	-	19	-	39	32	43	49	50	61	13.9
Expedition	44	-	56	-	17	-	33	28	46	45	48	60	13.9
Harding	40	-	52	-	18	-	33	28	42	48	45	60	14.5
Hatcher	55	-	62	-	12	-	38	-	41	-	50	60	13.8
Jagalene	42	-	57	-	16	-	38	31	42	47	46	62	13.6
Millennium	43	-	56	-	19	-	32	32	41	48	46	60	13.9
Overland	44	-	52	-	13	-	28	-	46	-	47	60	13.0
Wahoo	45	-	61	-	16	-	36	30	48	53	48	59	13.6
Wesley	48	-	52	-	17	-	34	29	42	44	48	59	14.5
Hard white varieties:													
Alice	47	-	52	-	17	-	37	27	45	45	48	61	13.5
NuDakota	50	-	58	-	16	-	31	-	47	-	50	59	13.6
NuFrontier	46	-	57	-	11	-	35	-	44	-	47	61	13.4
Trego	53	-	54	-	17	-	36	32	40	42	48	61	13.0
Wendy	48	-	49	-	19	-	33	27	46	46	48	60	13.8
Average:	46	-	55	-	16	-	34	29	43	46	47	60	13.7

Table 3. Agronomic traits and disease reactions for Alice hard white winter wheat and other winter wheat varieties.

Rel Hdg*	Origin	Lodg Res	End- Use Qty	Traits ^d			Disease Reaction ^e					PVP** ⁺
				Wntr hardy Ttg	Cole- optile Pct ^{##}	Wht Strk Msc	Tan Spot	Stripe Rust	Leaf Rust	Stem Rust		
Hard red varieties:												
Alliance	2	NE-93	G	AB	G	76	MS	VS	MR	S	MS	Yes
Arapahoe	3	NE-88	F	GB	G-E	83	S	S	MS	MR	MR	Yes
Crimson	5	SD-97	G	GB	G-E	110	MR	R	MR	S	MS	Yes
Darrell	5	NE/SD-06	G	AB	G	92	MS	MR	MR	MS	R	***
Expedition	0	SD-02	F	EB	G-E	88	S	MS	MS	MS	R	Yes
Harding	5	SD-99	F-G	AB	E	100	MR	MR	MS	MR	MR	Yes
Hatcher	2	CO-04	E	EB	F-G	92	S	-	MR	MR	MR	Yes
Jagalene	3	AW-02	E	AB	G	92	MS	MR	MR	MS	MR	Yes
Millennium	4	NE-99	G	AB	F-G	78	S	MS	MR	MS	MR	Yes
Overland	4	NE-06	E	AB	G	92	MS	MR	S	MR	MR	**
Wahoo	3	NE/WY-01	G	AB	G	91	-	MR	MR	S	R	Yes
Wesley	2	NE-98	E	AB	G-E	79	S	MR	MR	MS	R	No
Hard white varieties:												
Alice	-1	NE/SD-06	G	EB	G	67	MR	-	MR	-	MR	***
NuDakota	1	AW-06	E	-	G	-	MS	MR	MR	R	MR	Yes
NuFrontier	4	AW-05	G	-	G	87	MS	MS	MR	MS	MR	Yes
Trego	3	KS-99	F-G	EB	F-G	80	S	MS	S	MR	R	Yes
Wendy	-1	SD-04	E	GN	E	67	MS	R	MR	MS	MR	Yes

* Heading, relative difference in days to heading, compared to Expedition.

E = excellent, A = Acceptable, F = Fair, G = Good, P = Poor, B = Baking, N = Noodles.

Percent of Harding (3 1/4 inch long).

+ R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible, VS = very susceptible.

** Plant variety protection (PVP), title V, certification option, to be sold by variety name only as a class of certified seed.

*** PVP application pending or anticipated.



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