

WARD . . . A High Yielding, Strong-Strawed Durum Variety

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Ward (CI 15892) is a new variety of durum wheat developed and jointly released October 24, 1972, by the North Dakota Agricultural Experiment Station and the Agricultural Research Service, U. S. Department of Agriculture.

Ward is higher yielding, has stronger straw, greater resistance to leaf rust, and a lower incidence of leaf spotting diseases than the durum varieties Rolette, Leeds, Wells and Hercules grown in North Dakota. Ward is equal to Leeds in stem rust resistance, test weight, kernel weight and maturity, and is one inch shorter. The name "Ward", was taken from the name of one of the important durum producing counties in north central North Dakota.

Breeding History

Ward was selected from the cross D6062/D6142, made in the greenhouse at Fargo in April, 1963. D6062 is Langdon/3/Ld357//CI7780/Ld362, a midearly selection slightly shorter than Leeds, having moderate resistance to stem rust, and slightly lower kernel weight, test weight, yield and color score than Leeds. D6142 is Br180/Wells, a selection derived from the same F₂ plant as Leeds. D6142 had higher yield, high test and kernel weights, excellent stem rust resistance, was slightly shorter than Leeds, and had stiff straw. D6142 was slightly below Leeds in spaghetti color and kernel weight. CI 7780 is an introduction from Abyssinia (mideast Africa) resistant to stem rust in the field during the 1952 epidemic. Ld357 and Ld362 have the varieties Heiti, Stewart, Carleton, Mindum and Nugget in their pedigrees. The cross to produce Ward was

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made to combine characteristics of both parents and resulted in transgressive yield and straw strength performance.

Early selection through the F₅ generation was done in four years, the F₄ grown in the Mexican winter nursery. It was bulked in the F₅ generation as an F₄ derived line and first entered in preliminary yield trials in North Dakota in 1967 under the designation D6674. The original cross and early generation selection were done by K. L. Lebsock, formerly Research Agronomist, ARS, USDA, at North Dakota State University, and final performance testing and increase directed by J. S. Quick.

Performance Trials

Higher yield and stiffer straw, coupled with high quality and disease resistance, have been among the major objectives in the durum improvement program for North Dakota and adjoining states. The variety, Leeds, successfully overcame the small kernel disadvantage of Wells and Lakota durums and provided additional straw strength and stem rust resistance, but did not provide increased yield. Ward has a distinct yield advantage over Leeds and provides additional straw strength and leaf rust and leaf spotting disease resistance. However, Ward does not possess the earliness of Rolette.

Ward has been tested in North Dakota in small plot trials since 1967 and in larger drill strip field plots at North Dakota Agricultural Experiment Stations from 1970 to 1972. It was evaluated in the uniform regional durum yield trials in North Dakota, Minnesota, South Dakota, Montana and Manitoba from 1969 to 1972.

Data from North Dakota stations (Table 1) show that Ward has ranked higher than Leeds, Wells, Hercules and Rolette in yield, resistance to

Table 1. Agronomic and disease performance of Ward compared with Leeds, Wells, Hercules, and Rolette grown at several locations in North Dakota in four years, 1969-1972.

Character	Station years	Ward	Rolette	Hercules	Leeds	Wells
Agronomic						
Yield, bu/a	29	50.0	46.1	45.2	43.6	47.3
Test weight, lb/bu	29	62.3	62.3	62.0	62.5	61.6
1000 kernel weight, g	16	41.8	43.7	44.5	41.3	34.4
Days to head	27	62	59	61	62	63
Height, in	27	37	36	37	38	38
Lodging %	27	5	6	10	10	17
Disease^v						
Leaf rust, seedling	—	MR	S	S	MS	MS
Leaf rust, adult	—	MR	MR	MS	MR	MR
Stem rust, seedling	—	R	R	R	R	MR
Stem rust, adult	—	R	R	R	R	R
Leaf spots*	14	2.8	3.3	3.6	3.7	3.2
Blackpoint	—	MR	MR	MR	MR	MR

*Includes foliar diseases of *Septoria* spp., *P. trichostoma*, *H. sativum*, 0-9.

^vR - resistant, MR - moderately resistant, MS - moderately susceptible and S - susceptible.

lodging, resistance to leaf rust and resistance to leaf spotting diseases. Ward had a 15 per cent higher average yield than Leeds, the variety grown on more than 60 per cent of the North Dakota acreage in each year 1969-1972. Ward ranked slightly above Leeds and below Rolette in kernel weight, and slightly below Leeds and equal to Rolette in test weight. Ward was equal to Leeds in days to head and three days later than Rolette. Ward was about one inch shorter than Leeds and had less lodging. Ward has yielded more than 10 per cent higher than Leeds at all locations in North Dakota except Williston where only one year's data is available

(Table 2). Ward has averaged 7 per cent higher yield than Wells and 9 per cent higher than Rolette in 29 tests.

Agronomic data from the uniform regional trials in North Dakota, South Dakota and Minnesota (Table 3) indicate that Ward had a higher yield than that of all other varieties. Its kernel weight was higher than Leeds and lower than Rolette. Ward had a test weight lower than Leeds and higher than Wells or Hercules. Ward had less lodging than other varieties, and was one inch shorter and one day earlier than Leeds. It was two days later than Rolette.

Table 2. Grain yields (bu/a) of five durum wheats grown in North Dakota in four years, 1969-1972.

Variety	Langdon	Minot	Williston	Carrington		Fargo	Dickinson	Mean	% of Leeds
				Irrig	Dry				
No. of tests:	7	6	1	4	2	4	5	29	
Wells	55.1	47.2	34.6	59.4	38.3	50.0	30.8	47.3	108
Leeds	51.7	40.8	32.2	55.8	35.6	48.2	27.7	43.6	100
Hercules	52.2	42.3	32.1	60.2	36.2	52.7	27.1	45.2	104
Rolette	54.4	44.1	30.2	57.4	39.0	53.2	28.0	46.1	106
Ward	59.5	49.2	31.5	61.8	39.8	55.6	31.6	50.0	115
% of Leeds:									
Ward	115	121	98	111	112	115	114	115	

Table 3. Agronomic data from uniform regional trials in North Dakota, South Dakota, Minnesota, Montana and Manitoba in 1969-1972.

Variety	Days to head	Height in	Lodging %	K. Wt. g/1000	Test Wt. lb/bu	Yield bu/a
No. of tests:	29	32	28	11	39	39
Wells	62	39	24	32.7	62.5	39.3
Leeds	61	39	16	39.2	61.5	42.6
Hercules	61	37	17	43.7	61.4	41.0
Rolette	59	36	15	42.7	62.2	42.1
Ward	61	38	10	40.9	61.4	44.7

March-April, 1973

Table 4. Seedling reactions of six durum wheat varieties to 11 races of the stem rust fungus, *Puccinia graminis* f. sp. tritici.

Variety	Race and varietal reaction*										
	11	15**	15B	17	29	32	38	56	87	113	151
Ward	R	R	R	R	R	R	R	R	R	R	R
Rolette	R	R	R	R	R	R	R	R	R	R	R
Leeds	R	R	R	R	R	R	R	R	R	R	R
Wells	R	S	R	R	R	R	R	R	R	R	R
Hercules	R	MSR	R	R	R	R	R	R	R	R	R
Mindum	S	S	S	S	SMR	SMR	S	R	S	S	SR

*R - resistant, MR - moderately resistant, MS - moderately susceptible, S - susceptible.

**This culture of race 15, virulent on Wells, has not been found in the physiologic race survey in the United States but is a potential future threat.

Resistance to Stem and Leaf Rust

Ward has shown a high level of resistance to nonprevalent and prevalent North American stem rust races in seedling tests (Table 4). It was resistant to the prevalent North Dakota race 15B, which included subraces 15B-2, 15B-6, and the Texas-Mexico cultures of races 32, 113 and 151. In the field, adult plants of Ward showed resistance to 15B, and to races 17, 29, 38 and 87 in greenhouse adult plant tests. Its resistance to 32 and 151 was confirmed in the Puerto Rico field nurseries.

Ward's stem rust reactions were similar to those of Leeds in most tests, but showed some additional resistance when exposed to different environments and races of the stem rust organism in the field. Its level of resistance was higher than Leeds in one of the nine 1971 Uniform Rust Nurseries grown in the United States. Furthermore, when grown in the 1969 International Spring Wheat Rust Nursery in 19 countries, Ward was immune or resistant in all countries except India. Leeds showed resistance or immunity in only 12 countries. Ward may have acquired additional resistance from its

parent CI 7780, which is not in the parentage of Leeds. This introduction from Abyssinia (mideast Africa) was resistant in the field to stem rust during the epidemic of 1952 in North Dakota.

Milling and Spaghetti Quality

Table 5 shows the average milling and spaghetti data for Ward and four check durum varieties from a total of 12 field trials. Test weight, grade and vitreous kernel content of Ward were similar to the check varieties. Ward had an average test weight of 62.1 pounds per bushel, and graded U.S. No. 1 Heavy Hard Amber Durum with an average vitreous kernel content of 88 per cent.

In kernel weight and distribution, Ward was considered superior to Leeds and Wells, but not quite as large as Hercules and Rolette. Fifty-five per cent of Ward kernels were classified as large, while Leeds and Wells contained 47 and 33 per cent large kernels, respectively.

Wheat and semolina protein contents of Ward were considered adequate for good quality pasta products. Ward was higher in protein than Wells

Table 5. Average grade, milling, and spaghetti quality data for Ward and four check durum varieties in 12 tests during 1970-1972.

Quality factor	Ward	Rolette	Hercules	Leeds	Wells
Test weight, lb/bu	62.1	62.6	62.2	62.7	62.2
Grade, U.S.	1 HyHAD	1 HyHAD	1 HyHAD	1 HyHAD	1 HyHAD
Vitreous kernels, %	88	85	91	92	87
Kernel distribution					
Large %	55	58	63	47	33
Medium %	42	39	33	50	63
Small %	3	3	4	3	4
1000 kernel weight, g	43.3	45.0	45.8	41.0	36.2
Wheat protein, %*	13.6	13.7	13.5	14.2	13.2
Semolina protein, %*	12.5	12.7	12.2	12.9	12.1
Semolina yield, %	56.5	55.8	56.0	55.2	54.6
Semolina specks /10 in ²	20	26	22	22	22
Spaghetti color**	9.3	8.9	8.8	9.2	9.0
Spaghetti firmness, g cm.***	4.0	3.9	4.4	4.3	4.2

*Expressed on a 14% moisture basis.

**Higher score indicates more yellowness.

***Higher value indicates firmer cooked spaghetti.

and Hercules, but lower than Leeds.

Semolina milling tests showed that Ward had excellent milling properties. On the average, Ward had the highest semolina yield and lowest speck count of the series. In addition, when Ward semolina was extruded to spaghetti and dried, no unusual processing characteristics were noted for the sample. Spaghetti made from Ward had a bright yellow color and no cracks or checking were found in the dry product. Spaghetti cooking tests also showed that Ward had good quality. In firmness tests of cooked spaghetti, Ward was similar in cooking quality to the four check varieties.

In overall quality, Ward was considered excellent. The variety exhibited a high wheat grade, high milling yield, and excellent spaghetti quality in 12 trials over the past three years. Ward is superior in kernel size to Leeds and Wells and slightly smaller than Rolette. Furthermore, Ward has good milling properties, excellent spaghetti color and good cooking qualities.

Botanical Description

Ward is an awned, spring durum wheat variety, *Triticum durum* Desf., with the following botanical characters:

Stem: midtall, 0 to 1 inch shorter than Leeds, strong to very strong, usually white but may show purplish coloration under some conditions.

Spike: awned (dehisce at maturity), oblong, dense, erect.

Glumes: glabrous, yellow, midlong to long, midwide; shoulders narrow, elevated; beaks wide, acuminate, 3 to 4 mm long.

Awns: yellow and 6 to 16 cm long. Black awned plants may occur in the population at a frequency of less than 0.05 per cent.

Kernels: amber, hard, midlong and elliptical; germ midsized; crease midwide, shallow; cheeks angular to rounded; and the brush very short (essentially none).

Seed Production

In 1969, 54 pounds of Ward breeder seed were produced from a carefully rogued block of F_3 plants increased for three generations as a bulk from a single F_4 plant. Thirty pounds of this seed were increased at the Langdon Branch Station in 1970. Seven acres were grown from the 1970 seed at Minot and Langdon Branch Stations in 1971. Two hundred bushels were produced and 11 acres were planted near Yuma, Arizona, in 1971-72. Five hundred sixty-one bushels were returned and planted in North Dakota in 1972 along with 190 bushels from the 1971 North Dakota production. Seed available

from these increases will be grown in 1973 by approved seed producers under contract to the North Dakota Agricultural Experiment Station. Other states also had access to limited supplies of the new variety, if they wished to increase it, in compliance with the policy of mutually sharing new variety seed stocks.

The Agricultural Experiment Station will maintain purified seed stocks of Ward durum wheat for foundation seed growers so long as the variety is in commercial demand.

Summary

Ward, a new durum variety, has been jointly released by the North Dakota Agricultural Experiment Station and the Agricultural Research Service, U. S. Department of Agriculture. It is higher yielding, has stronger straw, greater resistance to leaf rust, and a lower incidence of leaf spotting diseases than the durum varieties Rolette, Leeds, Wells and Hercules grown in North Dakota. It is equal to Leeds in stem rust resistance, test weight, kernel weight, and maturity, and is about an inch shorter.

Milling and spaghetti processing characteristics of Ward are excellent. The overall quality of Ward is equal to Leeds and slightly superior to Rolette, Hercules and Wells. The higher yield, stiffer straw, and excellent quality characteristics should allow this variety to benefit the grower and produce an attractive product for the processor.

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