Stiffer and shorter straw, earliness and higher yield are major advantages of Rolette over Leeds durum.

ROLETTE

An Early, Strong-Strawed High Yielding Durum Variety

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Rolette is a new variety of durum wheat developed and jointly released December 1, 1971, by the North Dakota Agricultural Experiment Station and the Plant Science Research Division, Agricultural Research Service, U.S. Department of Agriculture.

This new variety is earlier, has shorter and stiffer straw, and is higher yielding when compared to the durum varieties Leeds, Wells and Hercules in North Dakota. It exceeds Leeds and Wells in kernel size and exceeds Wells and Hercules in test weight. Rolette has a broad range of stem resistance and has moderate field resistance to the prevalent races of leaf rust. The name "Rolette" was taken from the name of one of the important northern durum producing counties in North Dakota.

Performance Trials

Earliness, higher yield, and shorter, stiffer straw have been among the major objectives in the durum improvement program for North Dakota and adjoining states. Losses in total production and quality due to short, wet harvest seasons often result in lower income for North Dakota farmers in the durum producing area. Leeds and Wells were improvements in earliness and straw strength over Stewart 63 and Mindum, but have been consistently later than desired in the northern durum area, and often lodged under high moisture and fertility conditions. Rolette combines several desirable agronomic characters and maintains high standards of quality and stem rust resistance.

Rolette has been tested in North Dakota in small plot trials as experimental number D6517 since 1966 and in larger drill strip field plots at North Dakota Agricultural Experiment Stations from 1968 to 1971. It was evaluated in the uniform regional durum yield trials in North Dakota, Minnesota and South Dakota from 1969 to 1971. Data from the North Dakota stations (Table 1) show that Rolette has ranked higher than Leeds and Wells in earliness, yield and kernel weight. Rolette also had stiffer and shorter straw than Leeds in 31 tests over a four-year period. In comparison with Leeds, the most popular variety in North Dakota, Rolette had stronger straw, larger kernels, a 9% higher

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An increase field of Rolette durum grown in 1971 being observed by John Wright, Edmore, president of the U.S. Durum Growers Association.

grain yield, and was three days earlier and two inches shorter. Rolette has ranked higher than Wells and Hercules in grain yield and test weight. Rolette had a kernel size similar to Hercules and was slightly earlier, shorter and stiffer-strawed. It appears to be especially well adapted to the northern part of the durum growing area where earliness and lodging resistance are distinct advantages.

Table 1. Performance of Rolette, Wells, Leeds and Hercules grown at several North Dakota Stations in drill strips and rod-rows in 1968-71.

Agronomic Characteristics	No. of station years	Rolette	Hercules	Leeds	Wells
Yield, bu/a	31	48.4	47.0	44.5	47.3
Test weight, lb/bu	29	62.2	61.9	62.7	61.4
1000 kernel weight, gm	23	41.0	41.7	38.5	32.0
Days to head	16	64	65	67	67
Height, inches	16	38	39	40	40
Lodging, %	16	9	14	14	20

Agronomic data from the uniform regional trials in North Dakota, South Dakota and Minnesota (Table 2) indicate that Rolette was earlier and shorter than the standard varieties. It had less lodging, higher kernel weight and higher test weight than Wells. Rolette had a higher grain yield than Leeds and was similar to Wells and Hercules. It had a slightly larger kernel and a slightly lower test weight than Leeds. Information from seed increase fields in 1971 supported the data obtained from Rolette in drill strips and small plots.

Table 2. Agronomic data from uniform regional trials in North Dakota, South Dakota and Minnesota, 1968-70.

Variety	Days to head	Ht. (in)	Lodging %	Kernel wt. (g/1000)	Test wt. lb/bu	Yield bu/a
No. of tests:	19	24	13	19	29	29
Wells	62	38	34	31.2	61.1	39.3
Leeds	61	38	26	37.7	61.7	37.7
Hercules	59	37	24	40.5	61.3	39.0
Rolette	58	37	23	39.3	61.9	39.6

Resistance to Stem and Leaf Rust

Rolette has been highly resistant to the prevalent and non-prevalent virulent North American stem rust races in greenhouse seedling tests (Table 3). Its reactions were similar to Leeds. In the field, adult plants of Rolette were resistant to 15B-2, the prevalent race in North Dakota, and to non-prevalent virulent races 15B-6, 32 and 151 in the Puerto Rico rust nurseries. In greenhouse tests, adult plant resistance to races 17, 29, 38 and 87 was confirmed. Rolette has been grown in the International Spring Wheat Rust Nursery in 20 countries where it has been exposed to diverse races of the stem rust organism. It was immune or resistant in all countries except in Peru, Colombia, United Arab Republic, Ethiopia and Republic of South Africa in 1968 and Kenya in 1969. Leeds was susceptible in two of these countries in 1968; however, it was susceptible or moderately susceptible in seven countries in 1969. The parental sources of stem rust resistance in Rolette and Leeds are similar.

Observations in leaf rust nurseries at Fargo, North Dakota, and St. Paul, Minnesota, indicate that Rolette has a moderately susceptible reaction to leaf rust. However, Rolette showed only traces of leaf rust in large increase plots, even though some leaf rust susceptibility in greenhouse tests

Table 3. Seedling reactions of five durum wheat varieties to 11 races and subraces of the stem rust fungus, Puccinia graminis F. sp. tritici.

Variety	Race and Varietal Reaction[1]										
	11	15[2]	15B-2	15B-6	17	29	32	38	56	87	151
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	S	SMR	S	S	R	-	S

[1]R - resistant, MR - moderately resistant, MS - moderately susceptible and S - susceptible.
[2]This culture of race 15, virulent on Wells, has not been found in the physiologic race survey in the United States.

and in leaf rust nurseries were found where the inoculum density was high. Rolette had a lower level of severity of leaf rust incidence than Hercules, but higher than Leeds or Wells in North Dakota.

Milling and Spaghetti Quality

Table 4 shows the average quality data for Rolette as well as the check varieties Leeds, Wells and Hercules, which were comparably grown in a total of 15 field trials over the past three crop years. The data show that the overall quality of Rolette is better than Hercules, but not quite as good as Leeds.

Table 4. Average milling and spaghetti processing data for Rolette and three check varieties in 15 tests during 1969-71.

Quality Characteristics	Rolette	Hercules	Leeds	Wells
Test weight, lb/bu	62.8	62.4	63.1	62.4
Grade	1HHAD	1HHAD	1HHAD	1HHAD
Vitreous kernels, %	85	92	92	89
Kernel distribution:				
Large, %	52	56	42	25
Medium, %	44	40	53	70
Small, %	4	4	5	5
1000 kernel weight, g	42.9	43.5	39.7	34.8
Wheat protein, %[1]	14.1	13.5	14.5	13.4
Semolina protein, %[1]	13.0	12.6	13.3	12.5
Semolina yield, %	56.2	56.0	55.8	54.8
Semolina specks/10 in[2]	27	25	25	24
Spaghetti firmness, g cm	3.68	4.23	3.94	4.01
Spaghetti color[2]	9.3	9.1	9.5	9.3

[1]Expressed on a 14% moisture basis.
[2]Higher score indicates more yellowness.

In test weight and market grade, Rolette was similar to the check varieties. All varieties had average test weights above 62 pounds per bushel and graded No. 1 Heavy Hard Amber Durum. The vitreous kernel content average for Rolette was slightly lower than the check varieties. This was due in large measure to the lack of vitreousness for Rolette in the 1971 samples. In 1969 and 1970, the samples of Rolette were equal in vitreousness to Leeds.

Data on kernel distribution and weight per 1,000 kernels show that Rolette had larger kernels than either Leeds or Wells, and slightly smaller kernels than Hercules. Compared with Leeds and Wells, Rolette had a greater percentage of large kernels (10 per cent more than Leeds and 25 per cent more than Wells).

The protein content of Rolette was similar to Leeds and slightly higher than Wells and Hercules. High durum protein content is not considered essential for the production of good quality macaroni products; however, adequate protein is necessary from a nutritional viewpoint.

Rolette was slightly higher than Leeds and Wells in semolina milling yield, and approximately equal to Hercules. No serious speckiness was noted in the semolina milled from Rolette.

To test for processing quality, samples of semolina were processed into spaghetti on a semi-commercial scale extruder. The extruding procedure was controlled to closely simulate commercial processing conditions. Rolette compared favorably with the commercial varieties. No problems in extruding or drying were noted for Rolette or the check varieties. Furthermore, data on cooked spaghetti firmness showed that Rolette was well within the range for good eating quality.

The color of spaghetti made from Rolette semolina was variable for the three crop years tested. In 1969, Rolette showed higher color scores than Leeds, Wells and Hercules. The 1970 trials showed that Rolette was below Leeds and Wells, but above Hercules in color. The 1971 data showed that Rolette was slightly lower than Leeds, equal to Wells and higher than Hercules.

In summary, Rolette compared favorably in over-all quality with the current named varieties. The kernel size and distribution of Rolette were superior to Leeds and Wells, and nearly equal to Hercules. However, the vitreous kernel content of Rolette was somewhat lower than the check var-

ieties in one year. The protein quality, milling performance and spaghetti firmness of Rolette appeared good. Spaghetti color of Rolette appeared variable; however, on the average the color of Rolette was slightly below Leeds, equal to Wells and higher than Hercules.

Breeding History

Rolette was selected from the cross D5988/D5962 made in the greenhouse in 1962. D5988 is Ld393/2*Yuma, an early, short selection with stiff straw, good yield and large kernels, but moderately susceptible to stem rust and susceptible to leaf and head diseases. D5962 is Ld398//Ld357*2/St464, an early, short selection with weaker straw, lower yield and large kernels, but with excellent seedling stem rust resistance and resistance to leaf and head diseases. The cross was made to combine the stiff straw and high yield of D5988 with the excellent stem rust resistance and resistance to leaf and head diseases of D5962.

Early selection through the F_5 generation was done in four years, the F_4 being grown in the Mexican winter nursery. It was bulked in the F_5 generation as an F_4 derived line and first entered in preliminary yield trials in North Dakota in 1966. The original cross and early generation selection was done by Dr. K. L. Lebsock and final large scale field evaluation and increase directed by Dr. J. S. Quick.

Botanical Description

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

Stem: midtall, 0 to 2 inches shorter than Leeds, strong, usually white, but culms may show purplish coloration under some conditions.

Spike: awned, oblong, dense, erect.

Glumes: glabrous, yellow, midlong to long, midwide; shoulders narrow, elevated; beaks wide acuminate, 2 to 3 mm long.

Awns: white to yellow, 4 to 16 cm long.

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

Seed Production

In 1969, breeder seed of Rolette was produced from a carefully rogued block of F_9 plants increased for four years as a bulk from a single F_4 plant. Two pounds of this seed were increased near Yuma, Arizona, in 1969-70, and one-half acre was planted at the Langdon Branch Station in 1970. Nineteen bushels were obtained and 12 acres were planted near Yuma, Arizona, in 1970-71. Five hundred twenty-four bushels were returned and planted in North Dakota in 1971. Seed available from these increases will be grown in 1972 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 mutual sharing of new variety seed stocks.

The Agricultural Experiment Station will maintain purified seed stocks of Rolette durum wheat for foundation seed growers so long as the variety is commercially in demand. Reprints and further information regarding this variety can be obtained by writing to J. S. Quick, Department of Agronomy, NDSU, Fargo, N.D. 58102.

Summary

Rolette, a new durum variety, has been jointly released by the North Dakota Agricultural Experiment Station and the Plant Science Research Division, U.S. Department of Agriculture. It is earlier, has shorter and stiffer straw, and is higher yielding than the durum varieties Leeds, Wells and Hercules in North Dakota. Rolette exceeds Leeds and Wells in kernel weight and exceeds Wells and Hercules in test weight. It is similar to Leeds in stem rust resistance and is slightly more susceptible to leaf rust than Leeds.

Milling and spaghetti processing characteristics of Rolette are satisfactory. Good processing quality, larger kernels, and earliness should allow this variety to perform well for the grower and to produce an attractive product for the processor.

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