LLOYD . . . A STRONG GLUTEN SEMIDWARF DURUM

R. G. Cantrell, J. S. Quick, J. D. Miller and J. W. Dick

Lloyd is superior in cooking quality to Cando and Calvin, the only semidwarf durum cultivars being grown in North Dakota. The grainyield of Lloyd is similar to Cando and it has slightly higher test weight. The maturity, plant height, and disease reactions are essentially equal to Cando.

The name Lloyd was chosen to honor Lloyd Skinner who has been active in the pasta industry since 1938. He is currently a member of the Board of Directors of the National Pasta Association, an office he has held since 1950. Through that organization, he has been a strong advocate of durum improvement research at NDSU.

Breeding History

The North Dakota cultivars Cando and Edmore were crossed in the greenhouse in 1974 to combine the high yield and short straw of Cando with the strong gluten, large kernels, and root rot resistance of Edmore. Early selection through the F_5 generation was by the pedigree method. The F_2 and F_3 generations were grown in the winter breeding nurseries at Cd. Obregon, Sonora, Mexico. Lloyd was bulked in the F_5 generation as an F_4 derived line and was first entered in preliminary yield trials in North Dakota in 1978 as selection D771. Dr. Quick coordinated the development and evaluation of D771 until April, 1981.

Performance Trials

Lloyd has been tested in North Dakota small plot trials since 1978, in regional yield trials in North Dakota, South Dakota, Montana, Minnesota, Manitoba, and Saskatchewan since 1979, and in larger drill strip field plots at the six North Dakota Agricultural Experiment Stations since 1979. Resistance to leaf rust and stem rust has been evaluated in national and international disease tests.

Cantrell is assistant professor, Department of Agronomy; Quick is professor of Agronomy, Colorado State University; Miller is research plant pathologist, Agricultural Research Service, SEA-USDA; Dick is associate professor, Department of Cereal Chemistry and Technology.

The grain yield of Lloyd is equal to Cando but less than Ward, Rugby, and Vic when averaged over all locations in North Dakota, northern South Dakota, eastern Montana, western Minnesota, and southern Manitoba and Saskatchewan (Table 1). Lloyd is equal to Cando in maturity, plant height, and lodging. The disease resistance of Lloyd is similar to Cando except for root rot resistance where it is better than Cando but similar to Vic.

Lloyd has yielded less than Ward, Rugby, Vic and Cando in the eastern areas, but it has yielded better than these cultivars in the western areas (Table 2). When grown on fallow land, Lloyd seems well adapted to western growing areas in contrast to Cando which is more adapted to eastern areas.

Stem rust resistance

Lloyd is highly resistant to most stem rust (caused by *Puccinia graminis* f. sp. *tritici*) races. It has shown resistance in seedling tests to races 11, 17, and 151, and subraces of 15 which includes 15B-2 and 15B-6. The resistant reaction of Lloyd to orange mutant race 9 is similar to that of Edmore and better than the mixed, moderately susceptible to resistant reaction of Cando and Leeds. Lloyd is highly resistant to mutant race 15WL which is virulent on Wells and Lakota. Adult plants of Lloyd were resistant to artificial epidemics of stem rust races 15-TNM, -TLM, and 151-QSH in the 1979-82 rust nurseries in Fargo, and its reactions were similar to those of cultivars Cando, Ward, Coulter, and Vic (Table 1). Its resistant reactions did not change in the rust nurseries at the two dryland locations, Minot and Langdon, or under overhead irrigation at Oakes and flood irrigation at Carrington when natural occurring stem rust was present. When grown in the 1980 International Spring Wheat Rust Nursery at 20 sites in 13 countries, Lloyd was immune or resistant at 17 locations and susceptible at one location each in Ethiopia, India, and Kenya. Its reactions at all locations were similar to those of Cando, Vic, and Ward except for Lloyd's resistant reaction in Chile and Cando's immune reation in India.

Lloyd is similar to Cando in leaf rust (caused by *Puccinia recondita* f. sp. *tritici*) resistance in the adult stage (Table 1). The reaction to leaf spotting diseases has been

Table 1. Performance of Lloyd and check cultivars grown in North Dakota, Montana, South Dakota, Minnesota, Manitoba, and Saskatchewan in 1979-82.

Trait	Station years	Ward	Rugby	Vic	Cando	Lloyd
Agronomic						
Yield, bu/A	37	46.0	47.2	46.0	44.7	44.6
Days to head[1]	25	60.0	60.0	59.9	61.3	61.8
Height, cm	29	90.8	91.5	91.6	71.1	70.3
Lodging, 0-9[2]	16	2.3	3.0	2.3	0.9	0.4
Disease						
Stem rust, seedling[3]		R	R	R	R	R
Stem rust, adult		R	R	R	R	R
Leaf rust, adult		MR	MR	MR	MR	MR
Leaf spot, 0-9[4]	14	3.3	3.6	3.5	3.6	4.3
Blackpoint		MR	MR	MR	MR	MR
Root/crown rot		S	S	MR	S	MR

[1]Number of days from date of planting.
[2]0 = no lodging, 9 = severely lodged.
[3]R = resistant, MR = moderately resistant, S = susceptible.
[4]0 = no infection, 9 = severe infections.

Table 2. Grain yields of Lloyd and check cultivars grown at locations in North Dakota, Montana, South Dakota, Minnesota, Manitoba, and Saskatchewan in 1979-82.

Location	Station years	Ward	Rugby	Vic	Cando	Lloyd
Eastern area						
Fargo	2	57.3	54.9	59.7	52.4	46.3
Carrington irrig.	2	67.1	70.7	63.2	66.0	63.8
Langdon	5	58.5	61.2	57.2	58.7	51.2
Winnipeg	2	57.6	60.4	59.6	60.7	64.4
Crookston	2	50.5	55.2	49.3	45.8	43.3
Morris	2	54.3	52.1	51.7	48.6	41.6
All eastern	15	57.8	59.5	56.8	56.0	51.7
Western area						
Minot	3	47.8	48.1	48.1	47.9	48.2
Carrington dry	3	50.1	46.9	48.5	43.4	44.7
Williston	5	31.5	31.8	33.1	32.4	37.9
Dickinson	2	14.7	18.2	19.8	19.2	17.8
Swift Current	3	30.9	32.6	32.2	33.7	36.0
Watertown	2	42.4	44.6	43.2	34.0	37.9
Selby	1	48.2	52.9	50.7	55.6	57.9
Sidney	1	42.7	39.6	40.0	39.9	43.0
Havre	1	30.5	31.4	30.3	22.9	31.6
Conrad	1	54.5	61.9	51.0	51.8	54.9
All western	22	37.9	38.8	38.6	37.0	39.7
All locations	37	46.0	47.2	46.0	44.7	44.6

low but slightly higher than Cando and the other check cultivars. The root/crown rot (primarily caused by *Helminthosporium sativum*) resistance of Lloyd is superior to Cando and similar to Vic.

Wheat, Milling and Spaghetti Quality

Quality data for Lloyd and three check cultivars, Vic, Cando, and Rugby, in 15 field trials grown during the crop years 1979, 1980, and 1981 are shown in Table 4. Vic is included as a strong gluten check. The test weight of Lloyd was 1.0 pound per bushel greater than Cando and similar to Vic. A vitreous kernel content of 89 percent and an unofficial U.S. grade of 1 Hard Amber Durum for Lloyd was equal to Vic and Cando.

Lloyd has a larger kernel size than Cando but smaller than Vic and Rugby. This is also reflected in the higher percentage of large kernels, 27 percent for Lloyd and 20 percent for Cando.

Wheat protein of 14.3 percent was similar to Cando and approximately 0.8 percentage points less tham Vic and Rugby. The milling performance of Lloyd compared favorably with all checks. The semolina extraction of 51.6 percent on the experimental durum mill was higher than Cando but less than Vic and Rugby. The speck count averaged 25 per 10 square inches which is slightly higher than Cando but less than Vic.

Pasta processing performance of Lloyd was evaluated by extruding spaghetti made from the semolina obtain-

ed from the 16 tests during 1979-81. No unusual problems were encountered in processing Lloyd during the three-year testing period. Spaghetti color score for Lloyd averaged 9.4 indicating brighter yellow spaghetti than Cando and Rugby. Spaghetti cooking quality was excellent with cooked weight similar to Vic and cooking loss slightly greater than Vic. The high cooked firmness value of 7.4 is very comparable to that for Vic and is due, in part, to the strong gluten characteristics of Lloyd.

Table 3. Adult stem rust rections of six durum spring wheats in the 1979-1982 Fargo Rust Nurseries.

	Reaction[1]			
Cultivar	1979	1980	1981	1982
Lloyd	R	R	R	R
Cando	R	R	R	R
Ward	R	R	R	R
Coulter	R	R	R	R
Vic	R	R	R	R
Mindum	S	M	S	S

[1]Reactions—resistant (R); intermediate (M); and susceptible (S).

Nurseries inoculated with common North Dakota stemrust races 15-TLM, -TNM and 151-QSH.

Table 4. Average wheat, milling, and spaghetti quality data for Lloyd, Vic, Cando, and Rugby in 16 tests during 1979-81.

Quality factor	Lloyd	Vic	Cando	Rugby
Test weight, lb/bu	60.6	60.5	59.6	60.2
Vitreousness, %	89	89	89	93
Grade, U.S.	1HAD	1HAD	1HAD	1HAD
Kernel weight, mg	38.3	44.1	36.6	39.3
Wheat protein, %*	14.3	15.1	14.2	15.1
Kernel distribution, %				
Large	27	38	20	32
Medium	70	60	75	64
Small	3	2	5	4
Semolina yield, %	51.6	52.0	51.1	52.2
Semolina ash, %	0.59	0.57	0.60	0.59
Semolina specks/10 in²	25	27	21	24
Semolina protein, %	13.1	14.1	13.3	14.1
Spaghetti color**	9.4	9.6	9.2	9.3
Cooked weight, g	30.8	30.8	32.0	31.9
Cooking loss, %	6.6	6.3	6.7	6.3
Cooked firmness, g cm***	7.4	7.8	6.5	6.2

*Expressed on a 14% moisture basis.
**Higher score indicates more yellowness.
***Higher vlaue indicates firmer cooked spaghetti.

Botanical Description

Lloyd is an awned, daylength sensitive, spring durum wheat cultivar, *Triticum turgidum* L. var. *durum* with the following botanical characteristics:

Stem: semidwarf, about 70 cm tall; strong straw, usually white, with slightly recurved peduncles.

Spike: awned, oblong, dense, and erect.

Glumes: glabrous, white, midlong to long, midwide, shoulders narrow and elevated; beaks wide, acccuminate and 3 to 4 mm long.

Awns: white, 6 to 16 cm long.

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

Seed Production

About 10 bushels of Lloyd breeder seed were harvested at the Yuma Experiment Station, Yuma, AZ, in April, 1980. This seed was produced from a bulk seed lot from carefully rogued F_7 plants grown at CIANO, Ciudad Obregon, Sonora, Mexico, in 1978-79. The F_4 derived F_7 plants were increased as a bulk for two generations. The 10 bushels of breeder seed were further increased at North Dakota Branch Stations in 1980, 1981, and 1982. About 3500 bushels of clean seed has been distributed to approved seed producers for growing in 1983 under contract to the North Dakota Crop Improvement Association as the agent of the North Dakota Agricultural Experiment Station. All increases have been carefully rogued but tall off-types may occur in this cultivar at a frequency of less than one-half of one percent. Limited Foundation seed will be made available to neighboring states in compliance with the policy of sharing new cultivar seedstocks. Lloyd durum will be available to North Dakota producers for commercial production in 1984. The North Dakota Agricultural Experiment Sation will maintain Breeders seedstocks of Lloyd durum wheat for foundation seed growers as long as the cultivar is in commercial demand.

Summary

Lloyd, a new durum wheat cultivar, was developed and released by the Agricultural Experiment Station, North Dakota State University, in cooperation with the United States Department of Agriculture. Lloyd is the first semidwarf strong gluten durum released by the Agricultural Experiment Station. Lloyd has demonstrated a yield advantage over Cando when grown in central and western North Dakota. The yield of Lloyd in eastern regions was less than Cando. Lloyd has white awns and glumes and a test weight and kernel weight superior to Cando. Disease resistance has been very good and resistance to root rot is superior to Cando and similar to Vic. The quality characteristics of Lloyd are very similar to the strong gluten, high quality cultivar Vic. Increased cooked spaghetti firmness is the most significant improvement in cooking quality when compared to Cando.

Acknowledgements

The authors are grateful to all cooperators who have contributed to the development of this cultivar. J. S. Quick coordinated the development and evaluation of

Lloyd durum unti April, 1981. Several scientists, technicians, and secretaries in the Departments of Agronomy, Cereal Chemistry and Technology, and Plant Pathology at NDSU,the Cooperative Rust Laboratory at St. Paul, Minnesota, the Agricultural Research Center, Beltsville, Maryland, the USDA Hard Red Spring and Durum Wheat Quality Laboratory at NDSU and the NDSU Branch Experiment Stations cooperated in the development of Lloyd. The winter increases of Lloyd at CIANO (Experiment Station), Ciudad Obregon, Sonora, Mexico, and near Yuma, AZ, were accelerated through cooperation of the Crop Quality Council, Minenapolis, MN, the Mexican Ministry of Agriculture, and CIMMYT.

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NEW RESOURCE HANDBOOK WILL BE BOON TO FARM BUILDING TRADE

"Anyone involved in the farm building trade who wants to keep up with the latest innovations in the designing, planning, layout and construction of farm structures."

That's the audience Dexter Johnson, head of the Extension Agricultural Engineering section of North Dakota State University, says will "get its money's worth" by purchasing the newest edition of the "Structures and Environment Handbook."

The 658-page resource book is the work of the Midwest Plan Service, an organizaton of extension and research engineers from each of the 12 midwestern land grant universities, said Johnson. This revised eleventh edition includes basic and updated information useful to anyone involved in the planning or construction of farm structures.

Updated material in the handbook includes information on snow, wind and dead loads for buildings, grain storage design, wood post and truss rafter design and swine and sheep barn planning, he said.

Additional new information is available on farm machinery buildings, solar heated farm buildings, ventilation heat exchangers, domestic waste disposal and farm building electricity use planning.

While Johnson calls "building planners" the publication's primary audience, he points out the term is broad enough to include a wide variety of occupations.

Consulting engineers, farm building concerns, lumber yards, county agents, bankers, savings and loan officers, researchers working with farm buildings or applications of farm buildings — just about anyone with a concern in farm structures — use this publication, he explained.

Johnson says the one-of-its-kind handbook is mainly used as a source of information. The information gleaned varies with the occupation of the person using the publication.

"The engineers, salesmen and designers in farm building concerns use the book in planning their structures," he said, giving an example.

"Even though they have their own package buildings, there are still many unique applications for which they need the planning information this book provides. Lumberyards do the same thing."

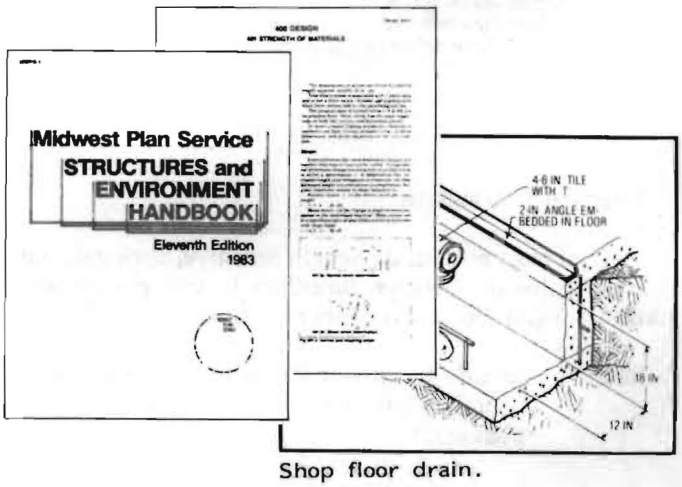
Innovative farmers, he continued, often use the handbook to pick up the basic data they need to plan new structures or modernize older ones. Bankers often use it to verify proposed loans for new farm structures.

As a whole, he said, most people use the book to keep up with what's going on in their own specialty. "Hog barn builders often scan what's new in that section of the book and incorporate it into their own publications. The same goes for any number of specialty construction operations."

Johnson sums up the publication's worth in a few words.

"Someone planning a new farm building couldn't ask for much more; it's got the newest information and basics together between two covers."

Those interested in purchasing the eleventh edition of the "Structures and Environment Handbook," MWPS-1, can do so through their county agent's office, or from the Extension Agricultural Engineering office at NDSU, Fargo, ND 58105. The cost of the new edition is $15.



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