AGASSIZ: A NEW HARD RED WINTER WHEAT VARIETY FOR NORTH DAKOTA

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Agassiz is a new, winterhardy variety of hard red winter wheat released August 4, 1983 by the Agricultural Experiment Station, North Dakota State University. Agassiz is the second winter wheat variety released by the Agricultural Experiment Station; Roughrider was the first release. Seed of Agassiz will be available for commercial production in 1984. The North Dakota Agricultural Experiment Station will maintain Breeders and Foundation Seed of Agassiz hard red winter wheat as long as the variety is in commercial demand.

The development and evaluation of Agassiz was a cooperative effort of the Departments of Agronomy, Cereal Chemistry and Technology, and Plant Pathology, North Dakota State University, and the NDSU Branch Experiment Stations. Scientists of the USDA-ARS also have participated in evaluation and testing. The NDSU Seedstocks Project supervised the seed increase phase. John R. Erickson, former associate professor, NDSU, was responsible for originating the cross, early selection, and initial yield testing of Agassiz.

History of Agassiz HRWW

The name Agassiz is taken from the ancient glacial Lake Agassiz named after the Swiss-borne naturalist, Louis Agassiz, who explored, mapped and surveyed the Red River Valley. The Red River Valley of North Dakota and Minnesota is the southern bay of Lake Agassiz. The acreage of hard red winter wheat is expanding in eastern North Dakota with highest density on the western edge of the eastern border counties in North Dakota. Agassiz is considered more adapted in this area than Roughrider.

Agassiz, PI 478771, is a selection from the cross YTO-117/Trader made in 1969. YTO-117 is an experimental line from the Montana Agricultural Experiment Station, and Trader is a variety released by the Nebraska Agricultural Experiment Station. A single plant selection made in the F_3 generation in 1973 resulted in the variety. Agronomic, disease and quality tests have been conducted in North Dakota since 1977 and regionally beginning in 1983. Agassiz was designated ND7687 during testing.

Agronomic performance

Grain yield comparisons of Agassiz with several other winter wheats are presented in Table 1. Roughrider, Norstar and Winoka were chosen for comparison because together they comprised more than 90 percent of the North Dakota winter wheat acreage in recent years. Agassiz was the highest yielding variety at Carrington and Minot and yielded more than Roughrider at Casselton, Williston, and Dickinson. Agassiz has yielded similarly to Norstar at Casselton and Langdon. Comparative yield data from the North Dakota Stations (Table 2) indicate that Agassiz performs more favorably in the eastern and central portions of North Dakota. Other agronomic traits also are compared in Table 2. Agassiz is later in maturity than Roughrider and is intermediate in height to Roughrider and Norstar. Winter survival of Agassiz surpassed that of the winter wheats entered in the regional test evaluated in North Dakota,

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Table 1. Average grain yield (bu/A) of selected entries in the 1980-83 hard red winter wheat variety trials at North Dakota Agricultural Experiment Stations.

Variety	Casselton	Langdon	Carrington	Minot	Williston	Dickinson	Hettinger	Mean	% Roughrider
No. of tests	4	1	2	3	4	2	2	18	18
Agassiz	50.9	32.2	29.5	42.7	38.2	39.9	35.8	40.4	105.2
Roughrider	46.6	38.9	24.9	38.2	36.9	38.4	38.5	38.4	100.0
Norstar	52.1	33.6	27.9	41.6	39.6	41.1	39.6	41.2	107.3
Winoka	49.8	25.1	27.5	37.1	38.2	41.4	40.8	39.3	102.3

Table 2. Performance of Agassiz compared with three winter wheats grown in North Dakota, 1980-1983.

	Station years	Agassiz	Roughrider	Norstar	Winoka
Agronomic		Eastern and central North Dakota			
Yield, bu/A	11	42.7	38.9	42.2	39.1
Winter survival %	7	70.4	77.5	79.1	66.0
Test weight, lb/bu	11	59.3	59.4	59.2	60.0
Heading date, June	6	19.5	19.2	21.7	18.3
Height, in.	9	37.5	35.9	39.3	36.7
		Western North Dakota			
Yield, bu/A	8	38.0	37.6	39.9	39.7
Winter survival %	7	85.1	88.6	87.7	88.7
Test weight, lb/bu	8	56.7	57.6	56.7	59.1
Heading date, June	7	18.0	16.4	18.3	15.3
Height, in.	6	34.6	33.4	35.8	34.5

Table 3. Reactions of Agassiz and three other wheats to prevalent diseases in North Dakota.

	Stem rust race, stage and reaction*								
	5		151		11-32-113		Field	Leaf	Tan***
Cultivar	Seedling	Adult**	Seedling	Adult**	Seedling	Adult**	Adult	rust	spot
Agassiz	R,MS	R,S,MS	S	MR-MS,S	S	S	R	S	4
Roughrider	S	MS-S	R	R	S,MS	S,MS	R	S	5
Norstar	S	S	S	S	S	S	S	S	4
Winoka	S	S-MS	MS	S	S	S	R	S	4

*R = resistant, MS = moderately susceptible, S = susceptible.
Comma = plant mixture.
Dash = range, first reaction predominant.
**Adult greenhouse reading based on 2 or 3 plants per race.
***1 = no symptom, 10 = severe symptom.

with the exception of Roughrider and Norstar. The data for the western North Dakota Stations (Table 2) suggest that Agassiz, Norstar, Roughrider and Winoka have an equal level of winterhardiness. However, this is misleading and most likely incorrect due to the lower frequency of severe winters in western North Dakota and the difficulty of obtaining information on differential winter kill.

Disease reaction of Agassiz

Agassiz has shown resistance to prevalent races of stem rust (caused by *Puccinia graminis* f. sp. *tritici*) in field trials. When exposed to naturally occurring rust, adult Agassiz plants were resistant. Its response was similar to those of Roughrider and Winoka and much better than the susceptible response of Norstar (Table 3). Seedling and adult Agassiz plants inoculated with stem rust in the greenhouse were mixed for reaction, and some plants showed a resistant reaction to common race 15 and a higher level of resistance than other varieties (Table 3). Its susceptible seedling reaction to race 151 was similar to that of Norstar and lacked the resistance shown by Roughrider. Agassiz's susceptible reaction to race group 11-32-113 was similar to those of the other three winter wheats.

Agassiz, like Roughrider and Norstar, is susceptible to leaf rust (caused by *Puccinia recondita* f. sp. *tritici*). Agassiz has displayed intermediate field reactions to tan spot (caused by *Pyrenophora tritici-repentis*).

Wheat and Flour Quality

Wheat and flour quality of hard red winter wheat is evaluated by a large number of tests including milling, physical dough and baking properties. Tables 4 and 5 show comparable average data for Agassiz, Roughrider, Norstar and Winoka obtained from samples grown over a three-year period at Williston and Fargo.

Two factors of primary economic importance are test weight, used not only as a quality consideration but also as a grading factor, and protein percentage. The test weight of Agassiz is nearly equal to Norstar and Roughrider but lower than Winoka. The wheat and flour protein percentages of Agassiz are similar to those of Roughrider and Winoka.

Table 4. Average quality data for Agassiz and three other winter wheat varieties grown in North Dakota.[1]

Variety	Test weight	Wheat protein[2]	Flour protein[2]	Flour yield	Flour ash[2]
	lb/bu	%	%	%	%
Agassiz	60.9	15.0	14.0	69.0	0.38
Roughrider	61.1	14.9	14.0	70.0	0.41
Norstar	60.9	14.5	13.6	70.4	0.36
Winoka	62.2	14.8	13.9	69.3	0.37

[1]Quality samples were grown at North Dakota Agricultural Experiment Stations during 1980-82.
[2]Expressed on 14% moisture basis.

Table 5. Average quality data for Agassiz and three other winter wheat varieties grown in North Dakota.

Variety	Baking data					Farinogram data			
	Absorption	Loaf volume	Symmetry[1]	Grain & texture[1]	Crumb color[1]	Peak time	Tolerance	MTI	Classification[2]
	%	cc				min.	min.		
Agassiz	61.5	820	8.2	7.5	7.1	6.6	7.2	31	4.7
Roughrider	61.7	875	9.7	8.2	7.7	9.0	13.2	16	6.5
Norstar	59.6	883	10.0	7.9	8.5	11.4	12.4	25	6.7
Winoka	61.8	870	10.0	7.9	8.5	15.8	16.4	15	7.3

[1]Highest score 10.0.
[2]Highest score 8.0.

High flour extraction is a very important and desirable quality trait. The flour yields of Agassiz and Winoka are similar but less than those of Roughrider and Norstar. However, the flour ash value of Agassiz is less than that of Roughrider.

The baking test provides the cereal chemist with another set of criteria upon which to judge the quality of a wheat. The baking absorption of a flour refers to its ability to take up water and produce a dough with the correct consistency for baking. A flour with a high absorption is desirable from an economical standpoint. The baking absorption of Agassiz as shown in Table 5 is similar to that of Roughrider and Winoka and superior to that of Norstar.

The average loaf volume of Agassiz is less than that of the other three wheats in this comparison, reflecting a difference in protein quality. Agassiz also is less desirable for loaf symmetry and the internal characteristics, grain and texture, and crumb color, but these are not considered major faults.

The mixing properties of a dough are measured by an instrument called a Farinogrpah. The data recorded in Table 5 include peak time, which is the time required for a flour-water dough to reach a specified consistency; tolerance, which is the length of time a dough can be mixed before the gluten properties begin to deteriorate; MTI, an index of mixing tolerance; and an overall classification. Most desirable are a relatively short peak time with good tolerance and a large classification number. Agassiz exhibits considerably weaker mixing properties than the other three varieties being compared and would be considered somewhat undesirable from this aspect.

Summary

Agassiz is a new hard red winter wheat variety released by North Dakota Agricultural Experiment Station. Agassiz is higher yielding than Roughrider and has outyielded Norstar in the central and eastern portions of North Dakota. Its winterhardiness is superior to that of Winoka although slightly less than that of Roughrider. Agassiz displays field resistance to stem rust but is susceptible to leaf rust.

The overall milling and baking quality of Agassiz has been satisfactory. It was faulted for lower loaf volume than Roughrider and inferior crumb color and grain and texture. Agassiz has a similar protein percentage to Roughrider and Winoka but shows weaker mixing properties when compared to the other three varieties in this test.

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3. Improved cultural practices (feriltizer, pesticides) were 19 to 26 percent; and

4. Mechanization was 26 to 32 percent.

These factors can easily vary with the situation. For example, doubling of yield is not unusual in fertilizing nitrogen-depleted soils.

The equations quantify the value of water. Each inch of water after the initial yield point produces about 5 bushels of spring wheat per acre. If the stored soil water is increased 1 inch by weed control or other water conservation practices, the value to the grower is $17.50 per acre with wheat selling for $3.50 per bushel.

These curves or equations can be used in estimating spring wheat production. Seasonal evapotranspiration is predicted from estimates of soil water and probabilities of precipitation for the growing season. For example, if there are 5 inches of stored soil water at Fargo at planting time and precipitation probability tables indicate a 72 percent chance of receiving at least 6 inches of growing season precipitation, there would be 11 inches of water available for evapotranspiration. The equation could then be used to estimate yield at this probability level. The maximum growing season ET for spring wheat in North Dakota is about 16 inches, which gives an upper limit to yield. Precipitation probability data for North Daktoa can be found in "Soil Water Guidelines and Precipitation Probabilities" available from the Departmentof Soil Science.

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