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Introduction

The years following the severe losses in yield of winter wheat due to stem rust in 1962 and 1963 have seen the release for production of many varieties that resist stem rust. The South Dakota Agricultural Experiment Station released Hume and Winoka and also joined in testing and release of rust resistant varieties developed in neighboring states.

The breeding objective in the South Dakota program has been to select early, especially hardy, medium to short strawed lines having resistance to both stem and leaf rust, of good milling and baking qualities and of good yield and test weight. The success of such a program should enable growers to use fall sown wheat ever farther northward and eastward in this state. That such an objective is especially difficult is apparent from the fact that no one has yet developed a variety having to a significant degree all of those qualities. The ability to tiller heavily to fill out a stand depleted by winter losses also is an important trait.

Breeders and geneticists assume that early maturity, high yield, and hardiness exceeding Minter, Hume, Winalta or Winoka are possible to achieve, but the desired combination of superior qualities in a new strain has not been found either in the Upper Midwest or in the great winter wheat region of Eurasia. It seems apparent that such a goal can only be achieved over a long span of time and perhaps with improved techniques.

Hume, released in 1965, 20 years after the cross was made, combined a high level of hardiness, earliness, stem rust resistance and acceptable yield and quality. Hume however, lacked resistance to leaf rust, resistance to necrosis, and produced lower grain yields than less hardy vari-

Table 1. Agronomic comparisons

Variety	Winter Survival Brookings 1970* %	Winter Survival Highmore 1971* %	Winter Survival Brookings 1972† %	Date ½ headed June	Plant height inches	Leaf rust	Stem rust field	Necrosis‡
Bronze	77	78	68	8	41	MR	R	MR
Hume	91	88	88	9	40	S	R	S
Winoka	92	80	----	11	42	S	R	S
Lancer	50	24	----	10	38	S	R	MS
Scout 66	40	53	8	8	37	S	R	MS
Scoutland	----	23	----	----	37	S	R	MS
Centurk	74	28	23	9	35	MR	R,S	MS

*Average over 4 replicates
†Average over 2 replicates
‡Patches of gray tissue on leaves and sometimes heads and stems

Table 2. Grain yields in bushels per acre.

Variety	1970 Advanced Test 1 Bison	Wall	Highmore	Av.	1971 Advanced Test 4 Highmore	Hayes	Martin	Onida	Quinn	Av.	1971 Standard Variety Small Grain Trials Highmore	Wall	Onida	Martin	Av.	1972 Standard Variety Small Grain Trials Garden City	Presho	Wall	Onida	Bison	Av.	1973 Standard Variety Small Grain Trials Highmore	Garden City	Wall	Bison	21 station average
Bronze	30	28	23	27	54	37	36	46	43	43	49	48	49	31	44	40	42	40	29	42	39	36	27	41	30	40.2
Hume	25	26	20	23	51	38	31	40	38	40	45	50	45	23	41	40	41	43	24	43	38	33	30	38	26	37.7
Winoka	----	----	----	----	50	37	32	41	41	40	48	49	43	28	42	38	32	34	32	40	35	31	38	39	30	37.9
Lancer	33	32	22	29	50	39	29	45	42	41	46	51	51	35	46	45	36	38	31	43	39	28	22	38	33	39.0
Scout 66	24	34	24	27	----	----	----	----	----	----	51	62	61	34	52	40	38	39	37	30	37	35	31	45	36	
Scoutland	----	----	----	----	----	----	----	----	----	----	49	67	54	33	51	40	41	41	38	42	40	30	28	48	34	
Centurk	----	----	----	----	51	36	31	55	45	44	53	55	53	34	49	46	42	46	32	48	43	33	30	40	30	42.2
Weathermaster 106	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	42	41	49	34	47	43	----	----	----	----	----

Table 3. Test weights in pounds per bushel.

Variety	1970 Advanced Test 1 Bison	Wall	Highmore	Av.	1971 Advanced Test 4 Highmore	Hayes	Martin	Onida	Quinn	Av.	1971 Standard Variety Small Grain Trials Highmore	Wall	Onida	Martin	Av.	1972 Standard Variety Small Grain Trials Garden City	Presho	Wall	Onida	Bison	Av.	1973 Standard Variety Small Grain Trials Highmore	Garden City	Wall	Bison	21 station averages
Bronze	60	59	59	59	62	58	57	60	59	59	63	61	62	61	62	61	62	62	57	62	61	60	60	62	56	60.3
Hume	61	59	60	60	63	58	58	60	60	60	64	63	61	61	62	62	62	62	55	63	61	60	62	62	56	60.7
Winoka	----	----	----	----	62	60	60	61	60	61	64	63	62	62	63	63	62	64	59	64	62	60	63	61	59	61.6
Lancer	62	60	61	61	63	59	59	59	62	60	62	62	62	63	62	63	63	63	58	63	62	59	61	62	57	61.1
Scout 66	61	61	61	61	----	----	----	----	----	----	64	63	61	63	63	61	62	63	60	61	61	61	62	63	59	
Scoutland	----	----	----	----	----	----	----	----	----	----	64	63	62	62	63	62	62	63	60	62	62	62	61	63	58	
Centurk	----	----	----	----	61	58	57	59	60	59	63	61	61	62	62	61	61	62	**57**	**63**	**61**	60	62	62	57	60.4
Weathermaster 106	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	62	62	63	58	63	62	----	----	----	----	----

eties often being seeded in the northern and eastern high risk areas. Winoka also was susceptible to leaf rust and necrosis.

Recurrent Selection Program

Bronze is the result of efforts to develop an early, hardy wheat to correct the shortcomings of Hume and Winoka. Bronze is being released 8 years after the last cross was made in 1965 to begin the second cycle of recurrent selection for earliness combined with hardiness. With many additional new lines and varieties in the parentage, the recurrent selection program is continuing.

During the testing period, Bronze —named for its brown chaff—was designated SD6753. Its level of winterhardiness is greater than Lancer and similar varieties but less than that of Hume and Winoka, as shown in Table 1. Bronze is as early as Scout 66 and earlier than the other varieties listed. Bronze is shorter than Winoka but taller than the other varieties listed. However, Bronze has good straw strength.

Bronze is moderately resistant to leaf rust, rusting late in the season, whereas Hume and Winoka are susceptible.

Bronze also is resistant to stem rust. In field tests at the University of Minnesota Bronze resisted stem rust while Centurk was 10% susceptible and Scout 66 showed a mixed reaction. In winter tests of adult plants from vernalized seedlings in Puerto Rico, Bronze resisted race 32 while Winoka, Hume, Centurk and Scoutland were susceptible. At Brookings in the field Bronze was resistant to races 56 and 151 of stem rust and Centurk was susceptible to race 151.

Some Necrosis Resistance

Bronze is moderately resistant to necrosis which is quite severe on Hume and Winoka. Bronze has also shown moderate resistance in a single test to yellow leaf spot caused by *Pyrenophora trichostroma* but the actual influence of that disease upon grain yields is not yet known. Hume and Lancer are also resistant but Centurk was susceptible in the one test made.

In two tests, Bronze has been significantly tolerant of wheat streak mosaic and about as susceptible as Hume. It should therefore be considered susceptible to streak mosaic.

Bronze has not been observed to shatter appreciably.

Grain yields are shown in Table 1. Bronze yielded about 2½ bushels an acre more than Hume and Winoka and 1 bushel more than Lancer but was often outyielded by the other entries.

Test weights are shown in Table 2. Bronze had good test weight but averaged about the same as Hume but 1 pound less than Winoka.

The milling value of Bronze is good, falling between those of Omaha and Lancer. The baking quality of Bronze is equal to or better than that of Lancer and Scout 66.

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