EVALUATION OF A PUTATIVELY VERY HIGH YIELDING "MIRACLE" SPRING WHEAT.

P. Hucl (1), W.L. Crowle (2) and G.R. Hughes (3)

(1) Product Development Section, Saskatchewan Wheat Pool.

(2) Agriculture Canada Research Station, Saskatoon.

(3) Department of Crop Science and Plant Ecology, University of Saskatchewan.

ABSTRACT

A supposedly very high yielding branched spike wheat (BSW) was shown to yield as much as 75% less than standard Canada Western Red Spring (CWRS) cultivars when severely infected with leaf and stem rust. With little or no disease pressure BSW still yielded 25-30% less than semi-dwarf wheat cultivars under both dryland and irrigated conditions. The BSW was very tall and later maturing than HY 320. Kernel and quality characteristics of BSW would appear to limit its market potential regardless of yield.

INTRODUCTION

A branched spike spring wheat which supposedly yields up to 125 bu/acre received farm press and national television coverage in 1985 and 1986. Seed of this genotype was apparently being sold at $50.00/bu. Branched spike wheats (BSW) have been described (and illustrated) on several occasions (Percival, 1921; Bayles and Clark, 1954; Sharman, 1967). Genotypes with branched spikes have been classified as Poulard (syn. Rivet, Cone) wheat (Triticum turgidum L.). Percival (1921) describes three white seeded types of BSW (vars. pseudocervinum, Plinianum, mirabile) which were originally reported in 1885. Percival's BSW's were obtained from Turkey, Greece, Russia, Britain, France, Germany, Italy, Spain, Portugal, North Africa and the United States. American genotypes went under the following names; 'Alaska', 'Seven-headed','Mummy' and 'Miracle' wheat. The BSW genotype currently being promoted in Saskatchewan has been described as being of "Russian" origin.

Branched spikes can produce up to a dozen branches with as many as 14 spikelets per branch. Basal branches tend to be sterile. A large branched spike can produce 140-150 kernels and 115-120 spikelets (Percival, 1921, Pennell and Halloran, 1983). The norm, however, is closer to 80-100 kernels and 85-90 spikelets (Percival, 1921). To quote Percival: "the wheat is nevertheless not prolific in field culture, the tillering power being low, each plant rarely producing more than two straws".

MATERIALS AND METHODS

Seed of the BSW was obtained from growers in the North Battleford-Lloydminster, Saskatchewan area. In 1986, the trial (Table 2) was seeded at the University of Saskatchewan's Kernen Research Farm on May 30. The 1987 trials were seeded on May 7 (Saskatoon), May 14 (Watrous) and May 19 (Outlook). The harvested plot size was 4.4 m^2 (Saskatoon, 1986), 2.3 m^2 (Saskatoon, 1987), 4.3 m^2 (Watrous) and 3.8 m^2 (Outlook). Approximately 50 kg/ha of 11-51-0 fertilizer was drilled in with the seed at all locations. The Outlook site was fertigated during the growing season through a centre pivot irrigation system. The seeding rates were approximately 220 seeds/m^2 (Saskatoon, 1986), 250 seeds/m^2 (Saskatoon, 1987), 290 seeds/m^2 (Watrous) and 440 seeds/m^2 (Outlook). A randomized complete block design was used in all four trials with three replications at Saskatoon (1986) and four replications for the remaining trials.

RESULTS AND DISCUSSION

The North Battleford "Russian" wheat sample used in the 1987 Watrous and Outlook trials was a composite of three wheat genotypes and a small percentage of barley (Table 1). The predominant wheat genotype closely resembled the Triticum turgidum L. BSW's described and depicted in the literature. Root tip chromosome counts confirmed the tetraploid nature of the currently investigated BSW. The remaining wheat components of the seed mixture were unbranched Triticum aestivum genotypes (Table 1).

In 1986, the Saskatoon trial was characterized by a later seeding date and a very extensive rust infestation (Puccinia recondita and P. graminis). Yields of the BSW were very low, approximately 25% of that observed for standard CWRS cultivars Neepawa and Katepwa (Table 2). The BSW was nearly 30 cm taller than the CWRS cultivars but only lodged to about the same extent as the check cultivars. The marked effect of rust on the BSW is evident from the low kernel and test weights for that genotype in 1986.

Drought at the 1987 Saskatoon site severely curtailed grain yields and plant heights (Table 3). Under those dry growing conditions and in the absence of rust infestations the BSW grain yield was not significantly (-9%) different from the mean of the CWRS cultivar (Katepwa and Columbus) yields. Katepwa yielded 12% less than BSW but on the other hand, Columbus out yielded the latter by 28% ($P<0.01$). On average the semi-dwarf cultivars yielded 29% more than BSW, a highly significant difference (Table 3). As in the previous trial the BSW was approximately 30 cm taller than the mean of the CWRS cultivars.

The Watrous (dryland) and Outlook (irrigated) sites were moderate and high yielding, respectively. Leaf rust infection was slight to moderate at both sites. At both sites, the BSW yielded significantly less than the CWRS cultivar Columbus (Table 4). Under dryland conditions BSW yielded similarly

to the CPS semi-dwarf cultivar Oslo which matured a week earlier. At Outlook Oslo yielded significantly more (+16%) than BSW and still matured over a week earlier. The later maturing semi-dwarf cultivars HY 320 and Fielder significantly out yielded the BSW genotype under both dryland and irrigated conditions. Averaged over the two sites (Table 4) HY 320 yielded 23% more than BSW. The BSW genotype headed and matured significantly later than the remaining entries in most cases. The BSW headed and matured four days later than HY 320. As was observed elsewhere (Table 2, 3) BSW was very tall. Under the relatively low disease pressure experienced in 1987 the kernel and test weights of the BSW were similar to those of the check cultivars (Table 3 and 5). This is in sharp contrast to the results obtained under heavy disease pressure at Saskatoon in 1986 (Table 2).

The BSW produced nearly 6 branches/spike (range 2-9) in 1987 (Table 5). Due to the branching, BSW produced over twice as many spikelets/spike as Columbus and HY 320 and significantly more kernels/spike. The average number of spikelets/spike and kernels/spike for BSW are roughly half the figures reported by Percival (1921).

The protein content of BSW was higher than that of the semi-dwarfs and similar to that of the CWRS cultivar Columbus (Table 5). The kernels of BSW were harder than those of all cultivars (low PSI value) but the kernel hardness difference between BSW and Columbus does not appear to be statistically significant. The kernels of BSW are too soft to fall within the Amber Durum (AD) category (data not presented).

The original sample of BSW (Table 1) was tentatively classified as Canada Soft White Spring (Canadian Grain Commission, Personal Communication) due to the starchy appearance of the kernels. The protein content of the original seed sample was in the 8-9% range which is consistent with the extremely high level of piebald kernels (98%) observed. In 1987, however, (Table 5) the higher BSW protein levels were associated with lower starchy kernel levels (60.5±0.9%) resulting in a mixture of kernel types. Some resembled squat Amber Durums while others were similar to soft white wheat. The kernel of BSW is distinctly shorter than that associated with Amber Durums. The short, humped appearance and softer kernel texture of BSW is consistent with descriptions provided by Percival (1921) as well as Bayles and Clark (1954). Preliminary quality analyses on the original seed sample, indicated that very weak gluten properties of BSW preclude its use in commercial bread baking. Percival (1921) characcerizes Poulard wheat as having a 'weak' flour which is unsuited for baking purposes.

A BSW was tested by the University of Saskatchewan from 1914 to 1916. To quote the conclusion from Champlin and Goulden's (1922) study: "It possesses a large branched head which gives it the appearance of a very high producer and this characteristic has again and again been made use of by unscrupulous dealers to foist it upon the unsuspecting farmer at exorbitant prices. This periodic exploitation of the farmer has been

continually taking place ever since the introduction of this wheat to the New England states over one hundred years ago. Needless to say the buyers have been sadly disappointed not only in the yield but in the poor quality of the wheat".

SUMMARY

Claims of very high yield potentials for a branched spike wheat would appear to be unfounded based on yield trials conducted in 1986 and 1987. The kernel and quality characteristics of this BSW exclude it from current wheat market classes. Producers wishing to grow high yielding wheat for livestock feeding purposes should consider presently recommended semi-dwarf cultivars.

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TABLE 1. COMPOSITION OF THE "RUSSIAN" SPRING WHEAT.*

Component	% of Stand	Plant Type	Kernel Type
1. Branched spike (awned)	78±3	Tall, late maturity	Unclassified
2. Awned	8±1	Short, medium maturity	USA - Spring
3. Awnless	10±1	Medium, early maturity	CWRS
4. Barley	<5	2-row	-

* Mean ± SE for two blocks 0.6 m2 in area (Watrous, 1987)

TABLE 2. PERFORMANCE OF A BRANCHED SPIKE WHEAT (BSW) AT SASKATOON (U OF S KERNEN FARM) IN 1986.

	Yield (kg/ha)	Height (cm)	Lodging (1-9)	1000K (g)	Test Wt (kg/hl)
Neepawa	4494	104	2.0	36.3	78
Katepwa	4405	105	3.0	35.9	78
ND #1	4233	92	1.5	35.6	78
ND #2	4150	87	4.0	32.4	77
BSW	1177	133	2.8	20.5	64
LSD (0.05)	519	4	0.6		

TABLE 3. PERFORMANCE OF A BRANCHED SPIKE WHEAT (BSW) AT SASKATOON (AGRICULTURE CANADA) IN 1987.

	Yield (kg/ha)	Height (cm)	1000K (g)	TEST WT. (kg/hl)
Katepwa	1100	58	32.1	73.2
Columbus	1578	70	34.6	-
HY 320	1461	57	46.7	75.0
Pitic 62	1713	67	38.7	72.4
BSW	1230	93	42.8	73.0
LSD (0.05)	203			

Single degree of freedom contrasts

Katepwa & Columbus (averaged) vs BSW NS

HY320 & Pitic 62 (averaged) vs BSW **

NS = non significant, ** = Significant at P < 0.01.

TABLE 4. AGRONOMIC PERFORMANCE OF A BRANCHED SPIKE WHEAT (BSW) RELATIVE TO STANDARD SPRING WHEAT CULTIVARS. (SWP, 1987).

	Yield (kg/ha)			Heading (Days)			Maturity (Days)			Height (cm)	Lodging (1-9)
	WTR	OTL	%HY320	WTR	OTL	±HY320	WTR	OTL	±HY320	OTL	OTL
Columbus	4531	6281	90	49	55	0	100	111	+2	120	1.0
Oslo	3699	6405	84	44	47	-6	95	104	-4	86	1.0
HY320	5050	6973	100	48	55	0	99	108	0	90	2.0
Fielder	4227	7054	94	49	56	+1	100	111	+2	96	1.0
B.S.W.	3799	5510	77	54	57	+4	102	113	+4	145	4.0
LSD (0.05)	391	685		3	2		3	1		10	
Single degree of freedom contrasts.											
Clms vs BSW	**	*		*	*		NS	**		**	
Oslo vs BSW	NS	*		**	**		**	**		**	
HY320 & Fielder vs BSW	**	**		**	NS		*	**		**	

SWP = Saskatchewan Wheat Pool
WTR = Watrous
OTL = Outlook
NS = Nonsignificant; *, ** Significant at P< 0.05 and P< 0.01, respectively

TABLE 5. KERNEL AND SPIKE CHARACTERISTICS OF A BRANCHED SPIKE WHEAT RELATIVE TO STANDARD SPRING WHEAT CULTIVARS (SWP, 1987)+

	1000K (g)	Test Weight kg/hl	Protein 13.5%mb (%)	PSI (%)	Branches/ Spike	Spikelets/ Spike	Kernels/ Spike
Columbus	35.2 ± 2.9	78 ± 4	14.8 ± 0.6	58.8 ± 1.0	0	12.9 ± 0.1	24.4 ± 2.4
Oslo	30.5 ± 0.5	73 ± 1	13.3 ± 0.1	72.4 ± 0.4	0	-	-
HY320	34.4 ± 0.6	77 ± 1	11.3 ± 0.2	75.6 ± 3.0	0	14.6 ± 0.3	38.3 ± 0.4
BSW	35.9 ± 0.1	75 ± 1	14.5 ± 0.6	57.0 ± 0.9	5.8 ± 0.4	34.1 ± 1.9	50.2 ± 0.6

+ For kernel characteristics, mean of 2 sites ± SE
For spike traits mean ± SE of 2 Watrous samples
Sites (1987) = Watrous and Outlook
PSI - Particle size index (NIR determination)