Progress Report to the Agricultural Research Foundation
Oregon Wheat Commission
Washington Wheat Commission
Idaho Wheat Commission

TITLE: Evaluation and utilization of Hybritech winter wheat germplasm for variety development in the Pacific Northwest

INVESTIGATOR: C. James Peterson — Crop and Soil Science Department, Oregon State University

COOPERATORS: Craig Morris — USDA-ARS WWQL, Pullman, WA
Bob Zemetra — University of Idaho, Moscow, ID

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IWC	15,000

ABSTRACT:

Growers throughout the Pacific Northwest have benefited from public and private investments in wheat breeding through the production and marketing of improved wheat varieties. Continued genetic advancements in grain yield, disease and insect resistance, and end-use quality require access and utilization of a wide array of wheat germplasms and genetic stocks. The HybriTech hybrid wheat breeding program was closed in 1999 after over 7 years of breeding and research efforts. During that time, they developed a large and aggressive breeding program based on germplasm from the PNW and throughout the US, from Western Europe, Argentina, and Australia. A large number of crosses and populations were developed with use of the 'Genesis' chemical hybridizing agent. In fall, 2000, the germplasm base was donated to OSU to be used in public variety development for the PNW. In summer of 2001, the Hybritech breeding stocks were evaluated for grain yield, grain quality, disease reaction and agronomic traits such as plant height, straw strength, leaf duration, and color. Electronic versions of all nursery lists and field books, with updated pedigree information, were provided to WSU, U of I, and ARS wheat breeders in May, 2001, for their use and selection of stocks. Promising materials were selected and advanced for further testing in the 2001-02 OSU nursery trials. Over 300 inbred lines were advanced to replicated yield trials and observation trials at 8 locations in Oregon. Nearly 700 new inbred lines were selected and advanced to preliminary yield trials. These were selected from among 24,000 headrows evaluated in 2001. Early generation stocks were advanced as bulks and headrow populations, primarily at the Pendleton nursery site. Based on our evaluations in the 2001 nursery trials, there is no doubt HybriTech stocks will contribute to new varieties and improved germplasm that will increase productivity and economic returns to wheat growers of Oregon and the PNW.

BACKGROUND:

From 1993 through 1999, Hybritech Seeds, Inc., developed an extensive breeding program targeted for the PNW; first based in Corvallis and then Boise. During this time, Oregon State University shared wheat germplasm with Hybritech under a Research Agreement to facilitate the development and commercialization of hybrid wheat. In September, 1999, Monsanto closed all their U.S. hybrid wheat breeding efforts, including the Boise program. The Hybritech PNW germplasm base was moved to Wichita, KS, and placed in temporary storage. During this time, we continued to pursue options for collaborative research with Monsanto. However, the Monsanto-Hybritech wheat breeding program was further downsized this past summer, which essentially ended all interest in wheat breeding activities in the company.

Monsanto has donated the Hybritech PNW wheat germplasm base to OSU. This includes seed stocks of essentially all materials that were under development at their Boise site. The germplasm released to us has no 'encumbrances'. That is, we have complete freedom to make selections, conduct research, publish information, and release public varieties directly from the stocks. Essentially all the breeding stocks being returned to us have an OSU parent contribution; derived from crosses of OSU by OSU lines, or crosses of OSU lines with those from WA, ID, other public programs, or Hybritech experimental lines (both from US and Europe). Approximately 36% of the parent base represents germplasm that is unique, currently unavailable, or not used by public breeding programs in the PNW.

OSU is the primary recipient of the material, but our goal has been to manage stocks as a public resource for the entire PNW. Public breeders in WA and ID were able to access seed stocks, make selections, use stocks for crossing, conduct research, and/or release varieties directly from the germplasm. This is being done in recognition of the germplasm contributions from all PNW public programs that were used in developing the Hybritech program. Private companies also can access the inbred lines for use in crossing, but can not release varieties directly from the materials. Any variety released directly from the Hybritech material, or derived from crossing with the germplasm, is expected to be released through Tri-state release channels and will require acknowledgement of Monsanto's contribution to development. We also will request acknowledgement of OSU's contributions in any public release for our handling and management of the material. The goal is that other public programs, and growers throughout the PNW, would benefit from access and benefit from HybriTech's breeding efforts.

A copy of the Material Transfer Agreement that covers donation and management of the HybriTech stocks is available on request.

OBJECTIVES:

1. Manage Hybritech winter wheat breeding stocks for use in public variety development efforts in the PNW.

2. Evaluate selected populations and advanced lines for yield potential, agronomic traits, winterhardiness, response to stripe rust, and end-use quality.

3. Distribute seed of Hybritech breeding stocks, as requested and as available, to public breeding programs in WA and ID. Coordinate evaluations and exchange of advanced lines, populations, and information in the Tri-state region.

PROCEDURES:

Hybritech breeding materials were developed from selection and crossing among a wide array of parent stocks; a summary of parental origin is included in Table 2. The majority of seed stocks were planted at our Pendleton research site in October, 2000. Each F2 and F3 population was planted as a single 5' x 14' plot for evaluation and selection. Hybrids, F5 and F6 preliminary lines, and advanced inbred lines were planted in single replication yield trials with local checks throughout. A total of 4575 plots and 24,800 headrows were seeded over 18 acres. F1's were planted as single rows at the Hyslop Agronomy Farm. Seed stocks were inadequate to share with the other public programs without this initial planting and seed increase phase.

Breeders at WSU, U of I, and ARS were provided with field books and pedigree files of the Hybritech materials for evaluations in 2001. The breeders were invited to view plots, take notes, and make selections at the Pendleton site. OSU then harvested yield trials, made head selections from F3 populations, advanced early generation stocks, and selected headrows of the most promising materials for testing in the 2001-2002 growing season.

The majority of populations, headrows, and purelines selected by the OSU program in 2001 were planted again at the Rugg's site near Pendleton for evaluation in the 2002 growing season. Exceptional lines also were advanced to replicated yield trials and observation nurseries over eight locations in Oregon and at a collaborative north-central WA site for winterhardiness evaluations.

With support from Craig Morris, ARS-WWQL, the 308 advanced inbreds are currently being evaluated for end-use quality. New inbred lines selected from headrows are being evaluated for grain hardness using the Pertin Single Kernel Characterization System at OSU

REPORT OF ACCOMPLISHMENTS:

A total of 4575 plots and 24,800 headrows were seeded in mid-October, 2001, over 18+ acres at our Rugg's nursery site near Pendleton. The nursery had excellent moisture conditions at fall planting and excellent stand establishment. Winter conditions were mild and there was little or damage evident, even on the most winter-tender materials. Winter/spring rainfall was insufficient, however, and the nursery finished under moderate drought stress. Grain yields were comparable to past years at the site, with mean grain yield just over 100 bu/a, but grain protein was elevated, seed size and test weights were generally reduced. A late, natural infection of stripe rust helped us to identify and eliminate some of the most susceptible materials. Unfortunately, early maturing lines and populations generally escaped the infection. There was little other disease pressure to help in our selection efforts. The late-

season drought stress was very helpful, however, in identifying materials with better stress tolerance and grain filling characteristics.

Grain yields ranged from under 70 bu/a to over 140 bu/a for individual selections and plots. Relatively high selection intensities were used to retain promising selections while downsizing the HybriTech material to a more manageable size. Table 1 summarizes initial breeding stocks as compared to number of selections advanced for testing in 2002. Selection intensities ranged from 10% in Inbreds, 15% in F5 and F6 purelines, to 30% among the F2 populations.

Table 1. Hybritech seed stocks evaluated in 2001 and advanced to trials for 2002.

Evaluated - 2001		Retained - 2002		
Generation	# Lines/ Popn's	Nursery Gen.	# Lines/ Popns	# of Sites
F1's	676	F2 bulk (for 2002)	118	1
		F2 bulk (for 2003)	119	1
F2 bulk	635	F3 bulk	194	1
F3 bulk	696	F4 Hdrws	14,000	1
F4-F5 Headrows	24,800	F5/F6 PYT Inbreds	688	2
F5-F6 Inbreds	1705	Adv. Inbreds	280	3 +
Hybrids (Genesis)	920	F2 bulk (for 2002)	200	1
		F2 bulk (for 2003)	197	1
Double Haploids*	201			
Advanced Inbreds	295	Adv. Inbreds	28	3 +
Inbred reselections*	1665			
Inbred purification*	1800 hdrws			

* Purification, reselection stocks, and DH's were placed in cold storage for 2001.
\+ Planted in observation trials at 5 sites in addition to 3 sites of replicated trials for 2002.
Note: Planted numbers do not include check varieties included in the respective trials.

Summary of advanced lines: Among F5, F6, and Inbred purelines, there was a 'text-book perfect' normal distribution of grain yields around a mean of 103 bu/a (Figure 1). Purelines were initially selected based on plant type, disease resistance, and field observations during grain fill and harvest, then further truncated based on grain yield, test weight, and seed quality. Of the F5 and F6 purelines, 280 of 1705 were retained, while 28 of the 295 Advanced Inbreds were retained. The 'Advanced Inbreds' included established varieties, advanced lines from OSU and the region, and an array of reselections, all of which had been used as parents in hybrid crossing blocks. As such, there were fewer 'unique' materials worth retaining. The F5 and F6 generation purelines were 'new selections' developed by HybriTech and derived for future testing in hybrid combinations. These also have the most potential for direct use and near-term release as pureline varieties. Many of which were very short stature and/or high tillering, but less productive 'on their own', as yield components were relatively unbalanced. For HybriTech breeders, the intent was to identify lines with complementary phenotypes and yield components, such that they would perform in combination with other

parental stocks in a hybrid combination. Yield per se was somewhat less important. For our pureline breeding purposes, there were many promising high yielding lines worth further testing. The very short lines, double and triple dwarfs, and lines with unbalanced yield components were generally not advanced.

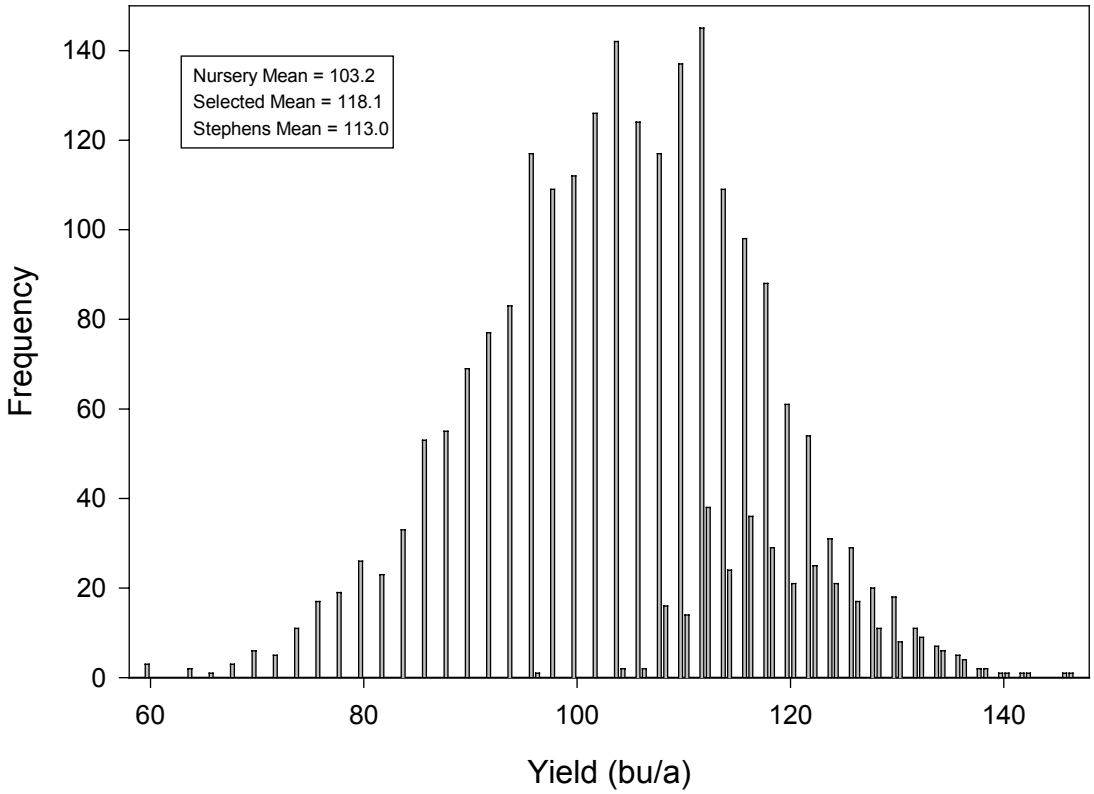

Figure 1. Distribution of grain yields for 2,000 F5 and F6 purelines and Inbreds evaluated in preliminary yield trials in 2001, Pendleton. Distribution of selection lines advanced to replicated yield trials for 2002 are indicated by the solid bars.

Parental contributions to inbred performance were examined as a rough measure of combining ability (Table 3). Based on mean yields, the top female parent lines were OSU lines that are continuing to contribute to our program. Top male parent lines include a French line, E81FR. This is a line for which we had not seen previously and that HybriTech had evidently used fairly extensively; evident in 56 of the inbred combinations. Selections from the WA variety Dusty, or a Dusty derivative, also as appeared as good combining parents in when used in combination with an array of OSU materials

The 308 pureline selections from F5, F6, and Inbred nurseries were advanced to replicated yield trials for evaluations at Pendleton, Hyslop, and Moro in 2002. These lines also were planted in observation rows at 5 other Oregon sites and planted in a north-central WA site with hopes to obtain winterhardiness information. Grain samples of each also were provided to Craig Morris, WWQL, for evaluation of end-use quality. The extensive field tests underway for 2002 should rapidly discriminate among these lines and identify those with high

yield, broad adaptation, and adequate disease resistance for further consideration in varietal development efforts.

Table 3. Male and female parents that contributed to superior F5 and F6 pureline perfornance. Parents are included only if they contributed to 5 or more progeny (N).

Class	Selection	Yield	Pedigree	N
Female	838	121	6720-11//MDA38/WRN	20
Female	91	113	CER/YMH/HYS	7
Female	83	113	HYS/T2484-35T-2T-1TCB75-270	48
Female	842	112	MRS/CI14482//YMH/HYS	44
Female	81	112	H73-F4-6210-3H-0P/BJY,F1/4/F1,TJB259//MHM/3/GLL/NAR	25
Female	189	110	AMD/HN4*2	19
Female	119	110	(UNKNOWN)	40
Female	807	110	HYS/YY/63-112-66-4/3/OR87065,H-281	90
Female	95185	110	PI559545	9
Female	9545	108	(UNKNOWN)	7
Female	827	108	TJB842-12919/SPN	29
Female	7	108	7C/CNO//CAL/3/YMH	53
Female	172	108	65-116-MBW//63-189-66-7/BEZO	35
Female	9509	108	(84X126VPM/M951//YMH/HYS///3518)	43
Female	1043	108	KVZ/3/HD/ON//BB/4/YPOPF/3/RBS1744//SU/GNS/5/SPN//AU/YMH	31
Male	918	118	**FRENCH LINE E81FR**	**56**
Male	6	118	**DUSTY (WA 6912)**	7
Male	9532	115	**DUSTY/ZGP-4074**	5
Male	1075	115	F12.71/COC//GLEN	7
Male	867	114	F60213-76//AU/ERA	7
Male	827	113	TJB842-12919/SPN	15
Male	9415	112	(UNKNOWN)	7
Male	859	112	SPN//AU/YMH/3/SPN	48
Male	85	111	(UNKNOWN)	5
Male	81	111	H73-F4-6210-3H-0P/BJY,F1/4/F1,TJB259//MHM/3/GLL/NAR	21
Male	95200	111	TOMTHUMB/7*DAWS-Rht3	7
Male	858	111	YMH/HYS/3/EG/178383//2*YMH,F1/4/YMH/HYS	8
Male	875	110	YMH/HYS/4/MRS/3/YMH//RBS/NCO	58
Male	9513	110	88-297A-3	8
Male	9510	110	(UNKNOWN)	5

Hybrids: The Hybritech stocks included 920 true hybrid wheats that had been generated with the 'Genesis' hybridizing chemical. These were evaluated in single-replication yield trial with frequent check varieties. Distribution of grain yields for the hybrids is presented in Figure 2. Mean yield of hybrids was 99.2 bu/a compared with Stephens at 105.7 bu/a; however, some individual hybrids had yields over 120 bu/a.

We evaluated the hybrids solely for their potential to generate segregating populations and pureline selections. As such, we advanced hybrids with superior performance, grain yield, plant type, and those with unique pedigree combinations to F2 bulk segregating populations. Due to the large number of promising hybrid combination and resources needed to manage early generation stocks, we planted 200 F2 populations last fall, and are holding another 200 populations for planting in fall, 2002. We have approximately 300 gms of each original hybrid combination as reserves in cold storage.

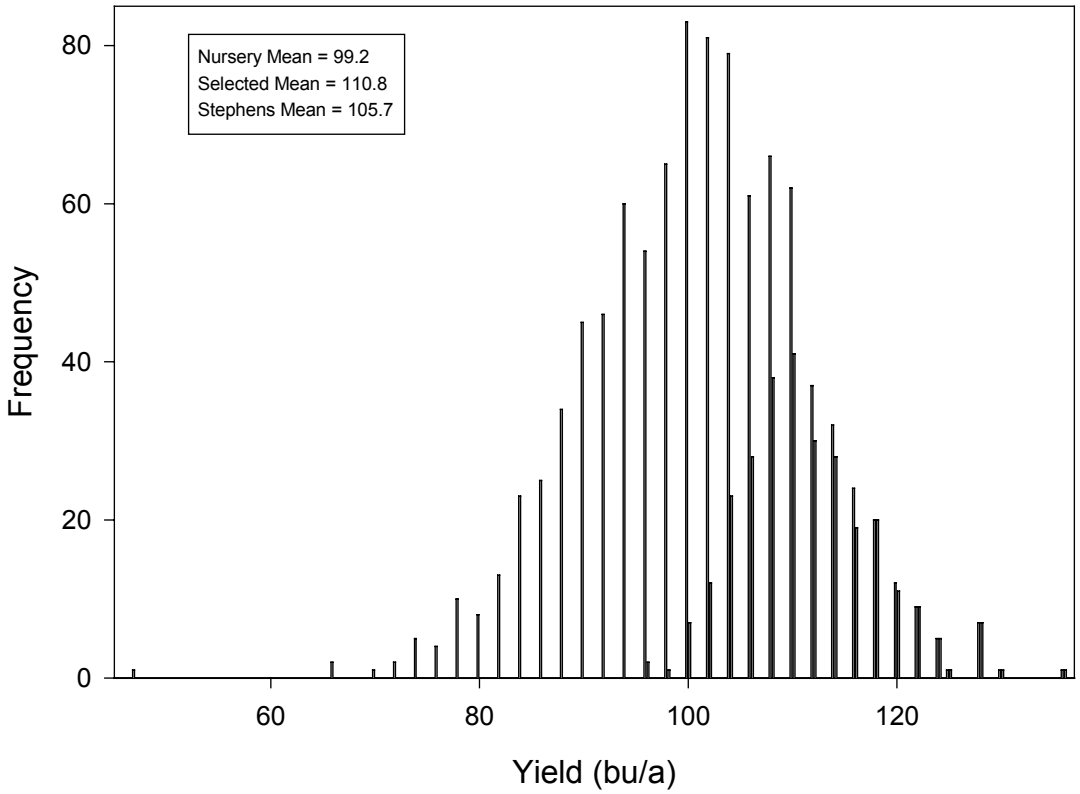

Figure 2. Distribution of grain yields for 920 Hybrids evaluated in yield trials in 2001, Pendleton. Distribution of Hybrids that were advanced to F2 populations for further evaluation and derivation of purelines are indicated by the solid bars.

Parental contributions to hybrid performance were examined using simple means and ranks as rough measure of combining ability (Table 4). Based on mean yields, superior female parents included an OSU spring x winter combination based on the Chinese wheat variety Ai Feng2. Superior males included lines derived from WSU selections, such as inbreds from 'THOR/CI13645/PI178383' (Thor originally from Sweden) and 'VH0882254/ORCW8313'. Observations by HybriTech breeders regarding advantages in hybrid vigor and combining ability from 'inter-program' crosses appears to be confirmed by the yield and performance data. This points out the value and continued importance of germplasm exchange and collaborations among breeding programs in the region.

Table 4. Female and male parents contributing to superior hybrid performance. Parents are included only if they contribute to 5 or more (N) hybrid combinations.

Class	Selection	Yield	Pedigree	N
Female	1058.1	110	AFG2/BUC,F1//KVZ	8
Female	958	109	AFG2/BUC,F1//KVZ	5
Female	148	109	CBC148//CNOS/INIAS//LFN/3/KLPE/RAF	6
Female	1067.1	108	RBS/ANZA/3/KVZ/HYS//YMH/TOB/4/BOWS	19
Female	1164	107	(UNKNOWN)	11
Female	1062	107	AFG2/BUC,F1//KVZ	5
Female	964.1	106	MRS/3/YMH//RBS/NCO/4/YMHDW	6
Female	1047.1	105	SMB/HN4//SPN/3/WTS//YMH/HYS	9
Female	954	105	TJB406.892/MON"S"	26
Female	48	105	TJB240-1834/YMH	7
Female	1097	104	YMH/HYS/4/MRS/3/YMH//RBS/NCO	14
Female	1042	104	HYS703/3/55-1744/7C//SU/RDL,F1/4/YMH/P101-1//HYS	8
Female	877	104	SPN/QLP	12
Female	70	104	RMNF3-71/TORIM	21
Female	1047	103	SMB/HN4//SPN/3/WTS//YMH/HYS	25
Male	1036.1	109	ABEL/HUNTSMAN*2//SPN	24
Male	229	109	SPN//YMH/HYS	11
Male	973	106	MRS/3/YMH//RBS/NCO/4/YMHDW	9
Male	830	106	**THOR/CI13645/PI178383**	**46**
Male	807	105	69-153/YMH//YMHDW	12
Male	9742	104	6720-11//MDA38/WRM	9
Male	1057	103	**VH0882254/ORCW8313**	**50**
Male	957	103	S148/PCHS/5/AU/3/MINN//HK/38MA/4/YMH/ERA	7
Male	871	103	YMH/HYS//VPM/MOS	27
Male	9	103	Weatherford	19
Male	1029	102	MRS/3/YMH//RBS/NCO/4/YMHDW	8
Male	963	102	**FRENCH LINE E81FR**	**41**
Male	843	102	6720-10//YMH/HYS	30
Male	31.1	101	6720-11//MDA38/WRM	33
Male	27.1	101	TJB 841/1543//YMH/63-122-66-2	55

New F4 and F5 purelines: The HybriTech stocks included 24,800 headrows that had been selected from over 550 segregating populations. These were evaluated at harvest for plant type, grain filling and color, seed quality, and yield potential. Six hundred and eighty eight rows were selected and advanced to preliminary yield trials for 2002. These were planted in unreplicated yield trials at Pendleton and Hyslop last fall. A small grain sample of each was reserved for evaluation of grain hardness and quality using the Pertin Single Kernel Characterization System at OSU.

From the 696 F3 bulk populations evaluated in 2001, over 14,000 heads were selected, threshed and planted as individual F4 headrows. These will be used to derive new purelines selections in 2002.

Early generation stocks: In the F2 bulk populations, 194 of 635 populations were advanced as F3 bulks for 2002. Grain yields among the F2 populations were normally distributed, but grain yield was less a factor in the selection process (Figure 3) . Populations were selected on the basis of overall phenotype, phenotypic segregation within the population, and on the uniqueness of parentage. Each of the populations was advanced as a single yield trial plot with intent to select heads from the plots next summer.

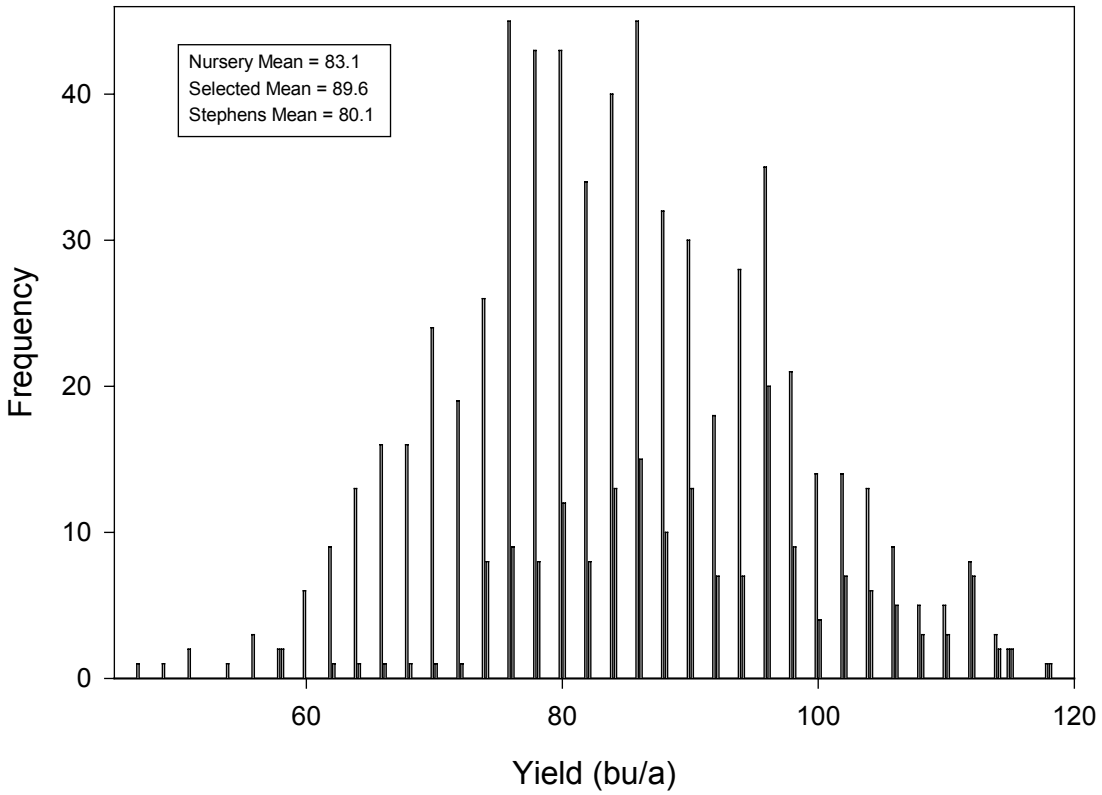

Figure 3. Distribution of grain yields for 635 F2 bulk populations evaluated in 2001, Pendleton. Distribution of F2's which were advanced for further evaluation and selection as F3 populations are indicated by the solid bars.

Parentage of superior F2 bulks shows evidence of contributions from the HybriTech soft red winter breeding program, such as in female parent lines X89-27a and XY92-13C1, and Y93-998 (SRW dwarf) on the male side. The male parent with pedigree 'Madsen//Stephens/ZGP-4074' originates from the U of I breeding program.

The HybriTech stocks included 676 F1 combinations made either by hand, or with 'Genesis'. These were evaluated in short rows at Hyslop. A total of 237 of the F1's were selected, with selection based on plant type and 'uniqueness' of pedigree. The large number of F1's was

such that we advanced ½ the crosses as F2 bulk populations at Pendleton for 2002. The remaining 119 bulks are being held for planting this coming fall.

Although not apparent in the pedigree tables included in this report, the HybriTech breeders had made significant strides in developing a hard white germplasm base in the program. Primarily in early generations, such as F1 through F3, there are significant number of populations derived from crosses with Midwest hard reds and whites. The Kansas variety Jagger, in particular, was used extensively as a parent.

Table 5. Female and male parents that contributed to superior performance in F2 bulk populations. Parents are included only if contributing to 5 or more (N) F2 populations.

Class	Selection	Yield	Pedigree	N
Female	875	101	YMH/HYS/4/MRS/3/YMH//RBS/NCO	8
Female	887	101	68-47/HYS/3/SPN/3/EG/178383//2*HYS,F1/4/69-153/YMH//2...	6
Female	9589	96	**X89-27a**	**31**
Female	885	95	YMHDW/3/YMH//1523/DRC,F1/4/SPN//AU/YMH	9
Female	1213	95	(UNKNOWN)	8
Female	825	92	CEBECO 148//CNO/INIA//LFN/3/K//PET/RAF	8
Female	1036	92	VH0882254/ORCW8313	5
Female	9425	90	VPM/MS951/YMH/HYS/HILL81//WA6910	21
Female	9596	90	**XY92-13C1**	**12**
Female	871	90	ADAM/SPN	9
Female	1037	90	SPN/QLP	5
Female	96137	88	PI590271	11
Female	842	88	MRS/CI14482//YMH/HYS	7
Female	9584	87	LY234f	14
Female	859	86	SPN//AU/YMH/3/SPN	5
Male	27	97	TJB 841/1543//YMH/63-122-66-2	7
Male	957	96	YMH/HYS/VPM/MOS/F1/4F1,CER/3SPN/AU/HYS	9
Male	9707	96	**Y93-998 a (SRW DWF)**	**5**
Male	886	94	HYS703/3/55-1744/7C//SU/RDL,F1/4/YMH/P101-1//HYS	11
Male	842	94	MRS/CI14482//YMH/HYS	11
Male	865	93	YMH/HYS//VPM/MOS	7
Male	871	92	ADAM/SPN	14
Male	9803	92	Madsen//Stephens/ZGP-4074	9
Male	9706	92	**Y91-28B1 (SRW DWF)**	**7**
Male	954	91	TJB406.892/MON"S"	5
Male	887	90	68-47/HYS/3/SPN/3/EG/178383//2*HYS,F1/4/69-153/YMH//2...	5
Male	96	88	SPN//YMH/HYS	10
Male	96146	86	MKS/Daws//WA7433,VH091705	14
Male	825	86	CEBECO 148//CNO/INIA//LFN/3/K//PET/RAF	10
Male	859	86	YMH/HYS//HYS/YY/3/ND/VG9144	5

General observations: Although the HybriTech breeding stocks were being developed and selected for commercialization of hybrid wheat, the stocks will be of tremendous benefit in our pureline breeding efforts. Initial downsizing of the stocks was very difficult due to superior plant type, high yield potential, and overall promising performance of the germplasm. Although OSU germplasm played a dominant role in the HybriTech program, there were many unique parental combinations in the stocks and germplasm represented for which we had not had access. Parents such as 'F81FR' and 'X89-27a' represent novel germplasm, while others, such as 'Xian Yan 86 Dwarf', represent stocks previously 'overlooked' or which were less utilized in our program. The 2001 nursery trials were very helpful to characterize plant type and yield potential. We expect that more extensive, multilocation testing of the HybriTech stocks in 2002 will help to characterize disease resistance, adaptation, yield potential, and end-use quality attributes of the material, as well as identify lines and populations with inadequate levels of winterhardiness.

The HybriTech program had, in a relatively short time, developed high-yielding and broadly adapted materials for hybrid wheat commercialization. The quality and quantity of the HybriTech germplasm stocks, from novel cross combinations to the superior inbred selections, are a reflection of the very talented and dedicated breeders working with the HybriTech program. Their efforts and germplasm stocks will be of benefit to the PNW breeding programs for years to come. We appreciate the donation by Monsanto such that these valuable stocks will not be lost, but rather will benefit growers throughout the PNW.

IMPACTS:

The Hybritech germplasm will be of significant benefit to our breeding effort at OSU, to the Tri-state programs, and to our wheat growers. Monsanto invested considerable resources in research and development on this germplasm base. There is unique genetic diversity in the program, for both soft and hard wheats, that we do not have in our programs, or for which we do not currently have access. While the goal of the Monsanto-Hybritech program was release of hybrid wheat varieties, much of the germplasm will be of direct benefit for pure-line variety development. Hybrid wheats developed in the PNW have shown potential for high yields, broad adaptation, and tolerance to environmental stresses. Approximately 70% of heterosis in wheat hybrids is a function of enhanced general combining ability and additive x additive genetic variances, which can be captured in pureline varieties.

RELATION TO OTHER RESEARCH:

OSU wheat breeding and genetics research is conducted in collaboration with OSU faculty in Crops, Soils, Extension, and Plant Pathology throughout the state. Our collaborations on germplasm development, evaluation, and genetic research extend throughout the Tri-state region, including projects and collaborative trials with researchers at the University of Idaho, USDA-ARS, and Washington State University.

ACKNOWLEDGEMENTS:

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RELATED PUBLICATIONS:

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Table 2. Summary of top 30 of 2,000 lines in the Hybritech F5, F6, and Inbred nurseries with actual grain yield (bu/a) and yield as a % of the nearest Stephens check plot.

Expt	Plot	ID	Selection	Pedigree	Grain Yield bu/a	Rank	Yield % Stephens	Plant Height cm
HTF5B	927	HT95p02834274	842/96.1	MRS/CI14482//YMH/HYS/3/SPN//YMH/HYS	145.9	1	127.9	100
HTF5B	903	HT95p02744251	827.2/875	TJB842-12919/SPN/5/YMH/HYS/4/MRS/3/YMH//RBS/NCO	141.2	2	123.8	100
HTF5B	19	HT95p00053426	9509/111.1	(84X126VPM/M951//YMH/HYS///3518)/3/69-153/YMH//YMHDW	138.8	3	120.0	95
HTF5B	14	HT95p00053422	9509/111.1	(84X126VPM/M951//YMH/HYS///3518)/3/69-153/YMH//YMHDW	136.8	4	118.2	95
HTF5B	913	HT95p02794261	838/918	6720-11//MDA38/WRN/3/FRENCH LINE E81FR	136.7	5	119.8	95
HTF5B	13	HT95p00053421	9509/111.1	(84X126VPM/M951//YMH/HYS///3518)/3/69-153/YMH//YMHDW	136.3	6	117.8	90
HTF6B	1289	HT95p01644612	83.1/918	HYS/T2484-35T-2T-1TCB75-270//FRENCH LINE E81FR	136.1	7	124.6	95
HTF5B	333	HT95p01243719	95185/1035.1	PI559545/MACVICAR	135.7	8	122.1	110
HTF5B	869	HT95p02604220	810/95202	MacVicar//KARCAGI/7*DAWS-Rht12	135.3	9	126.0	110
HTF5B	1001	HT95p03064343	1040.1/1052	MACVICAR/5/H73-F4-6210-3H-0P/BJY,F1/4/F1,TJB259//MHM/3/GLL/NAR	134.4	11	117.4	90
HTF5B	2		9425/44	VPM/MS951/YMH/HYS/HILL81//WA6910/5/KVZ/3/HD/ON//BB/4/YBOPR/3/55-1744//SU/GNS	134.2	12	116.0	100
HTF5B	18	HT95p00053425	9509/111.1	(84X126VPM/M951//YMH/HYS///3518)/3/69-153/YMH//YMHDW	133.9	13	115.7	95
HTF5B	910	HT95p02784258	838/875	6720-11//MDA38/WRN/5/YMH/HYS/4/MRS/3/YMH//RBS/NCO	133.2	14	116.7	100
HTF5B	942	HT95p02864288	842/807.1	MRS/CI14482//YMH/HYS/4/HYS/YY/63-112-66-4/3/OR87065,H-281	133.1	15	123.8	95
HTF5B	121		9568/113	WR58SHORT/3/67-109/NUG//RBS/P101	133.0	16	116.5	110
HTF5B	12	HT95p00053420	9509/111.1	(84X126VPM/M951//YMH/HYS///3518)/3/69-153/YMH//YMHDW	132.9	17	114.9	95
HTF5B	823	HT95p02514177	807.1/918	HYS/YY/63-112-66-4/3/OR87065,H-281/4/FRENCH LINE E81FR	132.3	18	123.2	95
HTF5B	837	HT95p02524190	807.1/918	HYS/YY/63-112-66-4/3/OR87065,H-281/4/FRENCH LINE E81FR	131.9	19	122.8	95
HTF6B	1220	HT95p01274547	7.1/92	7C/CNO//CAL/3/YMH/4/CER/YMH/HYS	131.6	20	120.5	95
HTF5B	81	HT95p00353484	9543/81	(UNKNOWN)/5/H73-F4-6210-3H-0P/BJY,F1/4/F1,TJB259//MHM/3/GLL/NAR	131.5	21	107.9	105
HTF5B	943	HT95p02874289	842/807.1	MRS/CI14482//YMH/HYS/4/HYS/YY/63-112-66-4/3/OR87065,H-281	131.5	22	122.3	90
HTF5B	909	HT95p02784257	838/859	6720-11//MDA38/WRN/4/SPN//AU/YMH/3/SPN	131.2	23	115.0	95
HTF5B	829	HT95p02524182	807.1/918	HYS/YY/63-112-66-4/3/OR87065,H-281/4/FRENCH LINE E81FR	131.1	24	122.1	85
HTF5B	3	HT95p00013411	9425/44	VPM/MS951/YMH/HYS/HILL81//WA6910/5/KVZ/3/HD/ON//BB/4/YBOPR/3/55-1744//SU/GNS	130.7	25	113.0	95
HTF5B	656	HT95p01924021	172/918	65-116-MBW//63-189-66-7/BEZO/3/FRENCH LINE E81FR	130.6	26	117.7	95
HTF5B	673	HT95p01984037	189.1/865.1	AMD/HN4*2/3/YMH/HYS//VPM/MOS	130.5	27	117.6	105
HTF6B	1415	HT95p02354729	804/847	VPM/MOS951//2*HILL/3/(UNKNOWN)	130.5	28	120.2	95
HTF6B	1453	HT95p02524765	807.1/918	HYS/YY/63-112-66-4/3/OR87065,H-281/4/FRENCH LINE E81FR	130.3	29	120.0	105
HTF5B	904	HT95p02744252	827.2/875	TJB842-12919/SPN/5/YMH/HYS/4/MRS/3/YMH//RBS/NCO	130.1	30	114.0	95
HTF5B	532	HT95p01633905	83.1/875	HYS/T2484-35T-2T-1TCB75-270/5/YMH/HYS/4/MRS/3/YMH//RBS/NCO	130.0	31	102.5	95