

**Progress Report to the Agricultural Research Foundation
Oregon Wheat Commission**

PROJECT: Development of wheat varieties adapted to Oregon production with enhanced disease resistance, stress tolerance, and superior end-use qualities

PROJECT LEADER: C. James Peterson, OSU Crop and Soil Science Dept.

COOPERATORS:

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FUNDING HISTORY:

2004-2005	200,000	2005-2006	200,000
2006-2007	190,000	2007-2008	218,000

ABSTRACT:

‘Goetze’ (ORH010920) soft white winter wheat was released in fall, 2007. Goetze is being targeted primarily for the Willamette valley and areas where the variety Gene is commonly grown. Goetze has been shown to have superior grain yield potential in state trials, similar or better than Tubbs. Its adaptation is limited, however, as it is a facultative type with cold tolerance less than Stephens. Goetze has short straw and is moderately-early maturing. It is resistant to stripe rust and is moderately resistant to septoria leaf blotch, which is an important disease in the Willamette valley. End-use quality of Goetze is similar or better than Stephens. ‘Norwest 553’ (ORN00B553) is a hard red winter wheat co-developed by OSU and Nickerson UK and co-released in fall, 2007. Norwest 553 was released for its protein and bread baking quality and fit for the US hard red market class. Norwest 553 is a short, mid-season variety targeted to moderate to high rainfall areas of eastern Oregon and SC and SE Washington. It has high yield potential, similar or exceeding that of Paladin or Eddy. Norwest 553 is being licensed for seed production through the OSU Clearfield Seed Associate network. Experimental lines advanced to Foundation seed increase include ORH010085, a soft white winter selection noted for high levels of resistance to Cephalosporium stripe, and ORI2042037, a CLEARFIELD selection with Eltan parentage being proposed for release as ORCF-103. One ‘super-soft’ white winter selection, OR2050910, derived from a cross with a Tubbs sister line, also was placed on a limited Foundation seed increase. The Oregon Winter Elite Yield Trial (OWEYT) was grown at 16 locations in 2007. Yield data were obtained from 14 of the sites. Average grain yields for the OWEYT ranged from a low of 43.7 bu/a at Lexington to 149.7 bu/a at Madras. The Oregon Hard Wheat Elite was grown at nine locations in 2007. Data were obtained from seven of the sites with average grain yields of 84 bu/a. Average grain protein ranged from 8.3% at Moro to 12.5% at Lexington. Data also were collected from 5 locations of the Oregon Spring Elite Yield Trial (OSEYT). These variety trials support breeding efforts, end-use quality testing, variety release decisions, variety quality recommendations, and provide important information on variety performance to Oregon wheat growers.

OBJECTIVES:

1. Develop and release new wheat varieties with superior disease resistance and enhanced tolerance to abiotic stresses that minimize production risks and increase economic returns to growers.
2. Provide growers with up-to-date information on near-release and newly released varieties in comparison with current leading varieties through field days and print and web media.
3. Increase demand and marketability of PNW wheat through development of soft and hard wheat varieties with superior end-use qualities. Identify germplasm, genes, and traits that contribute value-added or product-specific qualities and provide new marketing opportunities for wheat growers.
4. Identify germplasm, genes, and traits that will contribute to superior varietal performance and enhanced yield stability under diverse production conditions. Incorporate these new genetic resources and products of biotechnology into adapted varieties through efficient use of field and laboratory evaluation methods.
5. Identify and incorporate important genes for disease resistance, adaptation, and end-use quality using molecular marker technologies and biochemical analyses.

PROCEDURES:

Varieties and breeding materials must be evaluated under a wide array of environmental and management practices to characterize performance and adaptation. Early generation breeding materials (F1 through F5) are evaluated through a shuttle between Hyslop and Pendleton (Ruggs) to identify broadly adapted, disease resistant selections. Mid-late generation materials, (preliminary and advanced lines of F6 through F9) are evaluated in replicated trials at our core nursery sites at Pendleton (Rugg-Barnett), Moro (Sherman County Experiment Station), and Corvallis (Hyslop Research Farm). In addition, six 'satellite' testing nurseries are used to more rapidly characterize performance of our breeding lines. Each site includes three replications of the OWEYT, one or two replications of Advanced SW and HW nurseries, and unreplicated plots or observation rows of lines in preliminary and advanced yield trials (F6 through F8 generations). In fall 2007, the nurseries were planted at sites near Moro (Chris Kaseberg), Condon (Paul Bates), Arlington (Brad Anderson), Lexington (Chris Rauch), Hermiston (Kent Madison), and Baker City (Craig Ward). These sites were chosen to represent a diverse array of production conditions; from low rainfall to full irrigation, shallow to deep soils, and low residue to high residue management practices. With these diverse experimental locations we can more rapidly characterize performance of our breeding lines and parent stocks for adaptation, yield potential, stress tolerance, and disease resistance.

Since fall of 2003, the state-wide variety testing program has been incorporated into our breeding trials. The Oregon Winter Elite Yield Trial (OWEYT) and Oregon Spring Elite Yield Trial (OSEYT) were established to collect important performance data needed for breeding, variety release and co-release decisions, and reports to the seed industry and Oregon growers. New varieties and variety candidates, both public and private, from throughout the region are evaluated in the trials. In addition to 9 locations of winter

wheat breeding trials, the OWEYT was evaluated at Madras, La Grande, Ontario, and Klamath Falls in cooperation with researchers at the OSU Ag Research Centers. A no-till site at CBARC was added in 2006. The OSEYT was evaluated at a limited number of sites, including Corvallis, Pendleton, Moro, and Klamath Falls. Through collaborations with Lee Jackson, UC-Davis, the OSEYT and OWEYT also are being evaluated at one and two sites in Northern California, respectively. The Hard White Elite Yield Trial (HWEYT) was reorganized in 2006 to include hard red and hard white varieties and experimental lines from across the region. This trial is being grown at 9 locations in 2008. Grain samples from the OWEYT, HWEYT, and OSEYT are used for end-use quality analyses to support wheat quality improvement efforts, release decisions, variety recommendations, and information for future marketing activities. In collaboration with Mike Flowers, results from the OWEYT and OSEYT are posted on our project web site and distributed electronically throughout the region.

A summary of winter and spring wheat plantings for 2008 is attached (addendum 1). The spreadsheet indicates number of entries, replications, and test sites for each breeding trial. The list does not include F1's, headrows (approx. 30,000 rows in F2-F5 generations), thesis research trials, or crossing blocks.

Germplasm collaborations and exchange are continuing priority. This past year, 455 lines were introduced from Turkey as candidates for the CIMMYT Facultative and Winter Wheat Observation Nurseries and International Yield Trials. Once cleared through quarantine seed increase, these lines will be distributed to breeding programs throughout the US. Through collaborations with Art Klatt, Oklahoma State University, CIMMYT spring wheat germplasm with improved rust resistance were introduced. We are also collaborating with Bob Graybosch, USDA-ARS, Lincoln, NE, on evaluation of waxy winter wheats and low PPO spring wheat germplasm.

REPORT OF ACCOMPLISHMENTS:

New varieties and performance updates:

'ORCF-101' and 'ORCF-102' are CLEARFIELD* varieties, developed in collaboration with BASF. These were released in 2003 and 2004, respectively, for their utility in control of grassy weeds with application of BeyondTM herbicide. Twenty six seed companies in the PNW are currently licensed to produce and sell seed of the OSU CLEARFIELD* varieties. In fall, 2007, approximately 430,000 acres of ORCF-101 and 102 were seeded in the PNW from sale of 537,000 bushels of Certified seed. This represents a significant increase in Clearfield plantings as compared with fall of 2005 or 2006, which were of approximately 330,000 acres each year. Washington seed sales represented 49% of the total, followed by Oregon at 41%. Idaho and Utah sales account for the remaining 10%. Approximately ½ the sales were of ORCF-101 and ½ from 102, with ORCF-101 favored in Oregon (64% of Oregon sales) and ORCF-102 favored in Washington (71% of Washington sales). The 2007 seed sales have returned over \$640,000 in royalties to OSU.

‘ORSS-1757’ was released in 2005 through an exclusive licensing agreement with Mid-Columbia Producers (MCP). ORSS-1757 has exceptional quality for the soft white market class. The exclusive license was established to promote identity preserved production and marketing of the variety and provide a mechanism for growers to capture value from its superior milling and baking quality.

ORSS-1757 performed inconsistently in 2007. Overall, grain yields for ORSS-1757 in the OWEYT were average relative to other released varieties. However, yields were reduced by shattering in some trials and production fields, especially in north Sherman County. Because of these inconsistencies and volatility in the wheat market, MCP has placed the *SuperSoft* program ‘on-hold’ for the next 2 years. This will allow time for introduction of a second variety into the program and allow the export markets and grain prices to stabilize.

‘Goetze’ (ORH010920) soft white winter wheat was released in fall, 2007, with sales of approximately 60,000 pounds of Foundation seed. Goetze is being targeted primarily for the Willamette valley and areas where the variety Gene is commonly grown. Goetze has been shown to have superior grain yield potential in state trials, similar or better than Tubbs, but adaptation is limited by its facultative nature and insufficient cold tolerance. Goetze is an open release and is being submitted for Plant Variety Protection.

Goetze is a selection from the HybriTech germplasm donated to OSU in 2001. It is derived from a cross of an OSU experimental line with a French selection (6720-11//MDA38/ WRN/3/E81FR). It has a good disease resistance package, short straw, and has moderately-early maturity. Goetze is resistant to stripe rust and is moderately resistant to septoria leaf blotch, which is an important disease in the Willamette valley. Goetze does not have Madsen as a parent and it appears to carry a different source of strawbreaker footrot resistance as compared with Madsen or Tubbs. End-use quality of Goetze is similar or better than Stephens based on evaluations by ARS-WWQL and Wheat Quality Council. Testing by USDA-ARS in Pullman suggests that cold tolerance of Goetze is less than Stephens, similar to the variety Gene.

‘Norwest 553’ is a hard red winter wheat co-developed by OSU and Nickerson UK and co-released in fall, 2007. Norwest 553 was released for its protein and bread baking quality and potential to fit into the US hard red market class. Norwest 553 is a short, mid-season variety targeted to moderate to high rainfall areas of eastern Oregon and Washington. It has high yield potential, similar or exceeding that of Paladin or Eddy. Norwest 553 was evaluated by the Wheat Quality Council in January, 2007. It was considered superior for milling, mixing, baking quality as compared with the latest WSU HRW release, Bauermeister. Results from cold-hardiness testing have been mixed, but it appears that hardiness of Norwest 553 is similar to Stephens. As such, is it best adapted and grown in areas of NC Oregon and SE and SC Washington. Norwest 553 is being licensed for seed production through the OSU Clearfield Seed Associate network and will be protected with PVP, title 5.

Oregon Variety Testing:

The Oregon Winter Elite Yield Trial (OWEYT) was grown at 16 locations in 2007, including two sites in California. Yield data were obtained from 14 of the sites. Two sites (Arlington and Condon) were abandoned due to weather or insect related problems. Average grain yields for the OWEYT ranged from a low of 43.7 bu/a at Lexington to 149.7 bu/a at Madras. Leading varieties were Xerpha, ORCF-102, Westbred 528, Brundage 96, Salute, and Tubbs 06. Gene had the lowest average yield in the trial, which suggests that performance was impacted by cold temperatures during winter and / or early spring. There was relatively little stripe rust observed in 2007 and it appeared late in the growing season. Highly susceptible material was identified in the Pendleton nursery, but those with intermediate reactions or early maturity could not be adequately characterized. Grain yields at Moro (Kaseberg site) were influenced by varying susceptibility of the varieties to Crown rot. Grain yields at the Moro experiment station site were affected by wind-shattering.

The Oregon Hard Wheat Elite was grown at nine locations in 2007. Data were obtained from seven of the sites with average grain yields of 84 bu/a. Leading varieties were the Residence, Tubbs 06, Sinope, and Norwest 553. The HRW varieties Boundary, Paladin, and Eddy were ranked in the bottom 1/3 in average grain yield. Average grain protein ranged from 8.3% at Moro to 12.5% at Lexington. Grain from only one site, Lexington, was submitted to the ARS-WWQL for end-use quality analyses. In spite of early spring top-dress of N, grain proteins at other sites were too low for analyses of mixing and baking quality.

Data were collected from 5 locations of the Oregon Spring Elite Yield Trial (OSEYT). Stripe rust was a factor in performance of spring wheat varieties at Hyslop farm. Only the first rep was protected with fungicides. The Pendleton trial was damaged by cereal leaf beetle and Hessian fly. The top spring varieties for 2007 were the soft whites UI Cataldo, Nick (Westbred), Alpowa, (WSU), Louise (WSU). Top hard wheat varieties included Cabernet (RSI), UI Winchester, Blanca Grande, and Hank (Westbred). The top OSU spring selection was OR49900114, a hard red spring. Other OR selections were generally susceptible to Hessian fly, which reduced their grain yields.

Data from the 2007 OWEYT, OSEYT, and Hard Wheat Trials (HWEYT) are posted at: http://cropandsoil.oregonstate.edu/wheat/state_performance_data.htm. These variety trials support breeding efforts, end-use quality testing, variety release decisions, variety quality recommendations, and provide important information on variety performance to Oregon wheat growers.

Soft White Winter Wheat Improvement:

ORH010085 was advanced to Foundation Seed increase for 2008. ORH010085 is selection from the HybriTech germplasm donated to OSU in 2001 with the pedigree (Dusty/ZGP-4074//Unknown). It has medium-early maturity, short stature, and a promising yield record in Oregon trials. ORH010085 is noted for its high levels of

resistance to *Cephalosporium* stripe and good tolerance to Crown rot. Winter cold-hardiness of ORH010085 is significantly greater than Stephens. ORH010085 is initially being targeted for areas where Stephens is widely grown. It may also have utility in areas where cold tolerance of Stephens has been considered inadequate. End-use quality of ORH010085 is excellent, generally exceeding Stephens for key quality traits. A 5-acre increase field was established, which means Foundation seed of ORH010085 could be available in fall of 2008. ORH010085 is intended for open release.

OR2050910 has the '*Super-Soft*' kernel trait, similar to ORSS-1757, and is being considered as a complementary release for the *SuperSoft* program. The selection was advanced to limited Foundation seed increase for 2008. OR2050910 was derived from a cross with OR939556, a sister selection of the variety Tubbs. Agronomic performance and grain yields of OR2050910 were similar to Tubbs in 2007. OR2050910 has superior stripe rust resistance as compared with Tubbs, but does not carry the VPM resistance to *Cercospora* footrot. It has a similar level of susceptibility to Ceph stripe and Crown rot as Tubbs. Quality evaluations have shown the line to have very soft kernel texture, similar to ORSS-1757, with superior milling yields and large cookie diameters.

Advanced SWW lines (F6-F8) now in the program are largely derived from crosses with Nickerson red wheat selections from the UK and France. Although in early stages of testing, these progeny have shown excellent yield potential and disease resistance. The selections, pre-screened for kernel hardness and color, are now moving into more extensive quality testing and multilocation yield trials. The most promising selections will be advanced to pre-Breeder increase next fall.

SWW lines advanced to USDA-ARS Regional Nursery testing for 2008:

New	OR2040726	SPN/MADSEN/3/WA 7163 SISTER/SA 463 - GBR//STEPHENS
	OR2040728	SPN/MADSEN/3/WA 7163 SISTER/SA 463 - GBR//STEPHENS
	OR2050293	MADSEN/MALCOLM/3/REMAN//MADSEN/MALCOLM
	OR2050299	MADSEN/MALCOLM/6/HILL/3/CER/YMH/HYS/4/CER/YMH/HYS/5/ROSSINI/1/YSATIS/2/ORACLE
	OR2050301	MADSEN/MALCOLM/3/ROSSINI/1/YSATIS/2/ORACLE//WEATHERFORD
	OR2051126	Tubbs//OR9800924 (Rossini/Ysatis//Oracle)/OR9900549
Retained	ORH010837	HYS/YY/63-112-66-4/3/OR87065,H-281/4/E81FR
	ORH010927	MRS/CI14482//YMH/HYS/3/SPN//YMH/HYS

Hard White Winter Wheat Improvement:

OR205046H, a hard white winter selection, was advanced to limited Foundation Seed increase in fall, 2006. It was dropped from further consideration in 2007. Grain yields of OR205046H were promising in 2007, but results from end-use quality evaluations were disappointing. Gluten strength and bread-making quality were inadequate relative to our goals for marketing hard white wheat. Winterhardiness of OR205046H also was considered inadequate for wide-scale production. Also dropped from further testing were **OR2050331H, 332H, 333H, and 334H**, sister selections derived from a cross with the hard white variety Nuwest. The selections were evaluated in the HWELT and under pre-

Breeder seed increase in 2007. USDA-WWQL Quality evaluations conducted by the USDA-WWQL in 2007 showed that the selections had inadequate gluten strength and bread-making quality for the hard white wheat export market.

A new series of hard white selections were advanced to state-wide and regional testing and pre-Breeder seed increase for 2008. These are largely based on 3-way crosses with hard winter wheats from Nebraska or Agripro and spring wheats from CIMMYT (see pedigrees below). Gluten strength and bread making quality of these selections have been very promising. The lines have good stripe rust resistance but all lack strawbreaker footrot resistance. As these selections all have spring wheat parentage in the background, winter-hardiness maybe an issue. We expect to learn much more about adaptation, cold-tolerance, and disease resistances among the selections in the coming year.

HWW lines advanced to Regional Nursery testing or pre-Breeder seed increase:

OR2050272H	KSSB-192-3/NE89529/4/MRS/C114482//YMH/HYS/3/RONDEZVOUS
OR2060074H	TJB368.251/BUC//WEAVER/3/SIERRA/WI88-052
OR2060076H	TJB368.251/BUC//WEAVER/3/SIERRA/WI88-052
OR2060077H	TJB368.251/BUC//WEAVER/3/SIERRA/WI88-052
OR2060091H	IVORY/N96L1226/3/TJB368.251/BUC//WEAVER
OR2060092H	IVORY/N96L1226/3/TJB368.251/BUC//WEAVER
OR2060096H	IVORY/N96L1226/3/TJB368.251/BUC//WEAVER
OR2060097H	IVORY/N96L1226/3/TJB368.251/BUC//WEAVER
OR2060098H	IVORY/N96L1226/3/TJB368.251/BUC//WEAVER
OR2060099H	IVORY/N96L1226/3/TJB368.251/BUC//WEAVER
OR2060101H	IVORY/N96L1226/3/TJB368.251/BUC//WEAVER

CLEARFIELD Soft White Winter Wheat Improvement:

ORI2042037 was advanced to Foundation seed increase for 2008 and is being proposed for release as **ORCF-103**. ORCF-103 is a CLEARFIELD herbicide resistant soft white winter selection developed from a cross with the Washington variety Eltan (Eltan/3/FS-4//SPN/Madsen). It has complementary adaptation to existing Clearfield varieties, with improved winterhardiness and superior resistance to snow mold. It will be targeted for the Eltan production areas of the PNW, such as NC Washington. ORCF-103 will be release through the OSU Clearfield Seed Associate program and protected under PVP, title 5.

Breeding efforts on 1-gene CLEARFIELD varieties have been significantly reduced as emphasis moves to developing varieties with two genes for herbicide tolerance. There are, however, a few promising 1-gene selections still being tested and considered for future release. These include a reselection of ORCF-101 and selections from three way cross of 'Tubbs/Aztec//ORCF-102'. Two-gene Clearfield materials are now mostly in F2 and F3 generations. The most advanced selections are now in headrows and will move into preliminary yield trials next fall.

Early Generations and Crossing:

Over 720 crosses were made in 2007, of which 370 were single crosses made for improvement of soft white winter wheats and 250 for improvement of hard white winter wheats. The remaining were top crosses to facilitate introgression of quality traits and disease resistance from red-seeded parents. Priority parents again included French and English lines from Nickerson, Plains hard wheats, CIMMYT spring wheats and synthetic wheats, and an assortment of lines from Eastern Europe and South America. In total, over 25,700 F4-F5 headrows, 500 F2 bulks, and 500 F3-F5 bulks were evaluated in 2007.

These numbers represent significant changes made in managing F3 material for 2007. To reduce labor costs and time for harvest and threshing, F3 populations are now planted in modified bulk plots rather than as headrows. This reduces the total number of headrows at Pendleton by approximately 40%, while increasing the total number of bulk plots by only 10%. Although we may lose some power by not selecting on single F2 plants and F3 headrows, we will gain significantly in efficiency and reduce turn-around time for fall planting.

End-use Quality:

End-use quality research and development efforts involve extensive collaborations with Dr. Andrew Ross, the OSU Quality Lab, the Wheat Marketing Center, USDA-ARS-Western Wheat Quality Lab, USDA-GIPSA-FGIS, and commercial companies. Resulting data and information are distributed in various forms and are too numerous to summarize here. Reports from major programs, such as the APC, OVA, USWRN, or WQC are distributed directly to cooperators and others in the wheat industry. Support from Craig Morris and the USDA-ARS Western Wheat Quality Lab in evaluating our preliminary and advanced breeding lines is gratefully acknowledged. Quality data for varieties and experimental lines in the 2006 and 2007 OWEYT are posted at: http://cropandsoil.oregonstate.edu/wheat/state_performance_data.htm. These data also were used in developing the OSU Preferred Variety Lists.

Prior to planting this fall, with support of Drs. Andrew Ross and Caryn Ong, 1450 lines selected from the F3, F4 and F5 segregating populations were prescreened for grain hardness, size, and weight. Over 250 of the hard selections also were screened for polyphenol oxidase activity. Approximately 17% of these 1,450 selections were discarded based on these preliminary quality tests. Over 900 soft white selections and 300 hard white selections were advanced to preliminary yield trials for 2008. By quickly eliminating early lines with questionable quality the overall efficiency of the breeding program is significantly improved.

Application of Molecular Marker Technology:

Molecular marker and gene discovery research is underway in collaboration with Oscar Riera-Lizarazu, Bob Zemetra (U of I), Deven See (USDA-ARS), and others. We have recently added to our in-house marker expertise with hiring of Adam Heesacker. Adam

assumes the FRA position vacated by Jari von Zitzewitz. Adam has extensive background in use of marker technologies and mapping software and will be a great asset in our collaborative research efforts. Jari returned to the INIA program in Uruguay last summer with his family, but continues on as a PhD student in our program.

Our molecular marker research is focused on the following populations and traits, which are also the bases for several graduate research studies. DArT marker analyses are already complete for each of these populations, contracted through the Triticarte program. A varying number of SSR markers have been characterized for each and are being added to more completely cover the three wheat genomes.

Stephens x Platte – resistance to stripe rust. Population developed by Oscar Riera-Lizarazu, currently growing at seven field locations (OR, WA, TX, Mexico) for rust analyses. Research is being conducted by MS Student Dolores Vasquez.

Stephens x OR9900553 – supersoft kernel characteristics. Population developed by Oscar Riera-Lizarazu; currently growing at 3 locations in Oregon (Pendleton, Moro, Corvallis); Research is being conducted by Oscar's PhD student Guomei Wang.

Coda x Brundage – resistance to cephalosporium stripe. Population developed by Bob Zemetra, U of I. The population was evaluated in inoculated trials at two sites in 2007 and planted at one site for evaluation in 2008. Research is being conducted by PhD student Martin Quincke.

Tubbs x ORN98-0995 – resistance to cephalosporium stripe, stripe rust, and other diseases and tolerance to environmental stress. Population developed by Jim Peterson, F5 derived lines are currently under seed increase and in initial stages of phenotyping. Research is being conducted by PhD student Jari von Zitzewitz.

Tubbs x Einstein – disease resistance, stress tolerance, adaptation. Population developed by Jim Peterson, F5 derived lines are currently under seed increase and in initial stages of phenotyping. Research is currently being conducted by Adam Heesacker, with graduate student TBA.

Genetic relationships among ninety four parents and breeding lines also have been characterized using molecular markers. These include elite varieties from the PNW, private germplasm from Nickerson, ancestral lines from the OSU wheat breeding program, and advanced germplasm in the program. Information was obtained for 537 marker loci, including 84 single sequence repeat (SSR) markers spanning 131 loci, and 406 (high quality) diversity array technology (DArT) markers (www.triticarte.com.au). These lines and marker information will serve as the basis for association mapping of markers related to key adaptive traits.

CLEARFIELD* production system research:

In collaboration with Dan Ball, we are continuing to evaluate tolerance of new CLEARFIELD* wheat selections to Beyond herbicide. Each year, herbicide response of new selections are evaluated in a rate / date herbicide efficacy trial at two locations. The research has contributed to release of ORCF-101, ORCF-102, and provided important information for growers and seed industry regarding herbicide response and potential crop damage. For 2008 efficacy trials, we have included two CLEARFIELD lines developed by Bob Zemetra at the University of Idaho and five experimental lines from our program, including ORI202047 (proposed for release as ORCF-103 with Eltan parentage) and two club wheat selections from crosses with Coda and Bruehle.

IMPACTS:

In 2007, 182,000 acres were planted to OSU varieties Tubbs or Tubbs 06 in Oregon. This represents 26% of the Oregon winter wheat acreage. Tubbs and Tubbs 06, either alone or in blends, were planted on 141,800 acres in Washington, representing 12% of the soft white winter wheat acreage. Tubbs represents a significant improvement in grain yield (8 to 10% higher than Stephens) and provides direct economic returns to Oregon wheat growers through increased productivity and production efficiency. ORCF-101 and ORCF-102, broadly adapted CLEARFIELD* herbicide resistant varieties, were grown on over 340,000 acres in Oregon and Washington in 2007. In 2008, the combined acreage of ORCF-101 and 102 in the Pacific Northwest is expected to be approximately 430,000 acres. These varieties help reduce economic losses from grassy weeds, increase management options, and further increase production efficiency. ORCF-103, proposed for release in 2008, will further extend the production and impact of our Clearfield varieties. Varieties with enhanced end-use quality, such as ORSS-1757, are expected to increase market demand for Oregon wheat and provide the basis for identity preserved marketing. The newly released variety 'Goetze' has contributed to a significant increase in wheat acreage in the Willamette valley for 2008, and provides growers with an economically viable alternative to grass seed production. Investments in wheat breeding continue to contribute to the state agricultural economy through increased grain yield, enhanced yield stability, increased production efficiency, superior end-use quality for marketing and novel quality for market development.

RELATION TO OTHER RESEARCH:

OSU wheat breeding and genetics research is conducted in collaboration with many researchers throughout Oregon, the PNW, and the world. Samples from the OWEYT, OSEYT, HWEYT and breeding trials are the basis for the OWC grant-funded end-use quality research of Andrew Ross, the USDA-WWQL and Wheat Marketing Center. Numerous crosses and populations are being developed for collaborative genetic studies on molecular marker development, end-use quality, disease resistance, adaptation, and stress tolerance. These studies involve collaborations with Ross on biochemical bases of end-use quality; with Oscar Riera-Lizarazu on development and applications of molecular markers; with Chris Mundt on laboratory and field evaluations of

Cephalosporium stripe and Pseudocercospora footrot resistance; with Dick Smiley on evaluations of Fusarium crown rot. Herbicide resistant wheat cultivar development and stewardship continues with Dan Ball and BASF. New studies on variety x management interactions and N management for hard white and hard red wheat varieties are being pursued in Mike Flowers and Stephen Machado. Germplasm development efforts involve collaborations with Nickerson, CIMMYT, Agripro and many others.

ACKNOWLEDGEMENTS:

Our appreciation is extended to the Oregon Wheat Commission and the OWGL for their ongoing support and commitment to the wheat breeding and variety development effort. We also wish to thank Larry Williams, Chris Kaseberg, Jeff Nelson, Paul Bates, Eric Anderson, Brad Anderson, Kent Madison, Chris Rauch, Brian Isaak, and Craig Ward for providing land and support for our field trials. Special accolades go out to Mary Verhoeven, Mark Larson, and Chris Gaynor for their tremendous efforts and contributions, particularly during transitions is staff and student support.

RELATED PUBLICATIONS AND PRESENTATIONS:

Refereed journal articles

Verbyla, R., Appels, A., Saint Pierre, C., Ross, A.S., and Peterson, C.J. 2007. Fourier modeling, analysis and interpretation of high-resolution Mixograph data. Accepted. *J. Cereal Sci.*

Saint Pierre, C., C.J. Peterson, A.S. Ross, J.B. Ohm, M.C. Verhoeven, M. Larson, B. Hoefler. Winter wheat genotypes under different levels of nitrogen and water stress: changes in grain protein composition. *J. Cer. Sci.* Accepted 5/23/2007.

Saint Pierre, C., C.J. Peterson, A.S. Ross, J.B. Ohm, M.C. Verhoeven, M. Larson, B. Hoefler. 2008. White wheat grain quality changes with genotype, nitrogen fertilization, and water stress. *Agron. J.*, 100:414-420.

Ohm, J.-B., A.S. Ross, C.J. Peterson, and Y.-L. Ong. Relationships of high molecular weight glutenin subunit composition and molecular weight distribution of wheat flour protein with water absorption and color characteristics of noodle dough. *Cer. Chem.* Accepted 8-29-2007.

Popular articles

Peterson, C.J. 2007. National and global initiatives to combat cereal rust diseases. *Oregon Wheat*. June, pgs 16-18.

Variety releases and PVP

‘Tubbs 06’ Soft White Winter Wheat. C.J. Peterson, M. Verhoeven, M. Larson, B. Hoefler, J. von Zitzewitz, M. Flowers, A. Ross, J. Ohm, C. Morris, D. Engle, R. Smiley, C. Mundt, X. Chen, J. Robinson. Plant Variety Protection Certificate No. 200700423. Issued December, 2007.

‘Goetze’ Soft White Winter Wheat. C.J. Peterson, M. Verhoeven, M. Larson, B. Hoefler, J. von Zitzewitz, M. Flowers, A. Ross, J. Ohm, C. Morris, D. Engle, R. Smiley, C. Mundt, X. Chen, D. Skinner, K. Campbell, J. Robinson. Release date: 8/24/2007.

‘Norwest 553’ Hard Red Winter Wheat. C.J. Peterson, M. Verhoeven, M. Larson, B. Hoefler, J. von Zitzewitz, M. Flowers, A. Ross, J. Ohm, C. Morris, D. Engle, R. Smiley, C. Mundt, X. Chen, D. Skinner, K. Campbell, and J. Robinson. Release date: 8/20/2007.

Web sites

OSU Wheat improvement

<http://cropandsoil.oregonstate.edu/wheat/>

OSU Variety testing

http://cropandsoil.oregonstate.edu/wheat/state_performance_data.htm

OSU CLEARFIELD wheat varieties – release, licensing, stewardship

<http://cropandsoil.oregonstate.edu/wheat/clearfield/>

National Wheat Improvement Committee

<http://cropandsoil.oregonstate.edu/wheat/reports/NWIC/>

Presentations and Meetings – Invited

CSREES Plant Breeding Forum. February 8, 2007. Raleigh, NC. Session Chair for ‘Safe and Secure Food Supply’.

OSU wheat breeding and variety update. Sponsored by Wilber Ellis, OWGL, and OWC. February 23, 2007. Forest Grove, OR.

Wheat breeding and royalty update. OWGL Marketing Video Conference. February 28, 2007.

NWIC / NAWG Research Priorities. Wheat Summit II. Sponsored by National Association of Wheat Growers and North American Miller’s Association. April 19, 2007. Kansas City, MO.

Wheat breeding and royalty update. OWGL Research Committee. April 25, 2007. The Dalles, OR.

Wheat varieties for the Valley. Western Farm Service grower meeting, McMinnville, OR. September 4, 2007.

Breeding and variety update. OSU Fall Cereal Workshop. September 6, 2007. Pendleton, OR

Hard Wheat Varieties and Management Issues. Grower meeting sponsored by Larry Coppock, September 6, 2007. Adams, OR.

OSU Wheat Breeding, Research, and Impact. The Campaign for OSU – Event Launch. October 26, 2007.

OSU Wheat Breeding and Variety Updates. WSCIA Annual Meeting. November 13-14, 2007. Pasco, WA.

National Research Priorities and NWIC Update. Tri-state Research Session. PNW Grains Conference, Portland, OR. November 28, 2007.

Wheat Stem Rust: Back in Black. Commodity Classic. February 28, 2008. Nashville, TN.

Wheat research at OSU. OWC sponsored Young Grower Meeting. Portland, OR. January 25, 2008.

Current status of stem rust and US vulnerability. National Workshop on New Virulences in Wheat and Barley Stem Rust. March 6, 2008. Baltimore, MD.

Service as Chair of National Wheat Improvement Committee

Presentation of NWIC Research Priorities to NAWG Research and Production Committee, February 28, 2008, Nashville, TN

Informational meetings with ARS administrators, legislative aides to US Senators and Representatives. March 3-4, 2008; March 5-6, 2007; March 7-8, 2006; March 17-18, 2005; March 7-9, 2006. Washington DC. Organized appointments and meetings for 2006 and 2007; Co-organized same in 2008.

Research Priorities for Fiscal Year 2008. National Association of Wheat Growers and National Wheat Improvement Committee. March 2007. 66 pgs.

Research Priorities for Fiscal Year 2009. National Association of Wheat Growers and National Wheat Improvement Committee. March 2008. 59 pgs.

Meetings – sponsored, organized, or Chaired

OSU Clearfield Program – Stewardship Issues and Updates. WSCIA Annual Meeting. November 13-14, 2007, Pasco, WA.

Tri-state Wheat Research. Session Chair. PNW Grains Conference, Portland, OR. November 28, 2007.

National Wheat Improvement Committee Annual Meeting. December 5, 2007. Kansas City, MO.

OSU - MCP SuperSoft program: status and future. MCP grower meeting. January 9, 2008. Moro, OR.

2008 Wheat Trials	# of entries - 2008	Corvallis	Pendleton	Moro	Kaseberg	Arlington	Condon	Hermiston	Lexington	Baker City	CBARC No-Till	CBARC Fld Day	Madras	La Grande
# Rows		6	7	4	4	4	4	7	4	7	7			
Seed date		15-Oct	10-Oct	15-Sep	15-Sep	15-Sep	15-Sep	10-Oct	10-Oct	15-Sep	10-Oct			
OWELT **	40	3	4	3	3	3	3	3	3	3	3	1	3	3
SWADV-1	40	3	3	3	2	2	2	2	2	2				
SWADV-2	40	3	3	3	2	2	2	2	2	2				
SWADV-3	40	3	3	3	2	2	2	2	2	2				
SWRPN-1	80	3	3	1	Obs	Obs	Obs	Obs	Obs	Obs				
SWRPN-2	80	3	3	1	Obs	Obs	Obs	Obs	Obs	Obs				
SWRPN-3	80	3	3	1	Obs	Obs	Obs	Obs	Obs	Obs				
SWRPN-4	80	3	3	1	Obs	Obs	Obs	Obs	Obs	Obs				
SWRPN-5	80	3	3	1	Obs	Obs	Obs	Obs	Obs	Obs				
SWPYT	975	1-short plot	1											
HWELT	40	3	3	3	3	3	3	3	3	3				
HWRPN	80	2	3	2	Obs	Obs	Obs	Obs	3	Obs				
HWPYT	320	1-short plot	1											
IMIADV	20	3	3	3	Obs	Obs	Obs	Obs	Obs	Obs				
IMI-2G PYT	56	1-short	1											
IMI-EFFIC	10		4x10	4x10										
White F2	273	2 plots												
Red F2	229	2 plots												
R / W F2 - Moro	293			1										
Wh-F3 - Pendl.	184		2 plots											
Red F3 sorted	267		2 plots											
<i>Nick Elite</i>	60	2	2	2				2						
<i>NE Waxy</i>	40		3											
OR-ID-IRR	30							3						
WRSWN	36	3	3											
WRHWN	21	1	3											
Drill Strips	43		Strips											
Seeding rate: 95 gm/packet														
Package untreated seed if possible for greenhouse and disease nurseries														

2008 Wheat Trials	# of entries - 2008	Ontario	K-Falls	Tule Lake	N. Calif.	2 Pkts for Obs	2-95 gm Lab/GH/CB	ARS Genot. 10 gm	Mundt Ceph Stripe	Mundt Cercosp	Smiley Fusar. Crown rot	2-10 gm Stripe rust	So.TX Rust 20 gm
# Rows						7							
Seed date						15-Sep			15-Sep	15-Sep	15-Sep	1-Oct	1-Oct
OWELT **	40	3	3	3	3		X	X	2-25 gm	3-50gm	X	X	X
SWADV-1	40						X	X		2-50gm	X	X	X
SWADV-2	40						X	X		2-50gm	X	X	X
SWADV-3	40						X	X		2-50gm	X	X	X
SWRPN-1	80					X	X	X				X	
SWRPN-2	80					X	X	X				X	
SWRPN-3	80					X	X	X				X	
SWRPN-4	80					X	X	X				X	
SWRPN-5	80					X	X	X				X	
SWPYT	975						X						
HWELT	40						X	X	1-25gm	2-50gm	X	X	
HWRPN	80					X	X	X				X	
HWPYT	320					X	X						
IMIADV	20					X	X					X	
IMI-2G PYT	56												
IMI-EFFIC	10												
White F2	273												
Red F2	229												
R / W F2 - Moro	293												
Wh-F3 - Pendl.	184												
Red F3 sorted	267												
<i>Nick Elite</i>	60						X	X			X		
<i>NE Waxy</i>	40												
OR-ID-IRR	30						10 gm						
WRSWN	36												
WRHWN	21												
Drill Strips	43												
Seeding rate: 95 gm/packet													
Package untreated seed if p													