

## PVP Application – Goetze Soft White Winter Wheat

### Exhibit A – Origin and Breeding History

Goetze is a semidwarf soft white winter wheat derived from the cross 'OR8303765/E81FR' which was made in 1995 by breeders of HybriTech Seed International, Inc., a division of the Monsanto Company. OR8303765 has the pedigree '6720-11//Ministerio de Agri 38/ WRM (Weique/Red Mace)'. Selection 6720-11 is a sister of CI17576 with the pedigree 'Cappelle Desprez/Pullman sel. 101//Druchamp'. The origin and pedigree of E81FR are unknown.

F2, F3, and F4 generations were advanced as unselected bulk populations at the HybriTech field breeding site near Meridian, Idaho. Goetze was derived from a single head selection from a bulk planting of F4 plants in 1999. Goetze was identified as an F<sub>5</sub> headrow at the Meridian research site in 2000 by HybriTech breeders. The selection was based on plant height, maturity, spike and grain size, and reaction to stripe rust (*Puccinia striiformis*).

Goetze was among the HybriTech wheat germplasm donated by Monsanto to Oregon State University in 2000. In 2001, it was selected as a single F6 plot grown in Pendleton, OR, and given the experimental number ORH010920. Beginning in 2002, Goetze was evaluated in multilocation yield trials in North Central Oregon and the Willamette Valley. Goetze was evaluated and selected for grain yield, yield stability, grain quality, and response to major diseases of the Pacific Northwest, including stripe rust, leaf rust, septoria leaf blotch, *Cercospora herpotrichoides*, *Cephalosporium* stripe, and *Fusarium* crown rot.

For each year from the F6 generation through release, Goetze was evaluated and selected for end-use quality traits in comparison with the established varieties Stephens and Madsen. The evaluations were conducted through the USDA-ARS Western Wheat Quality Laboratory in Pullman, WA. Traits measured include kernel hardness, kernel weight, break flour and total flour yield, flour ash, flour protein, water absorption, cookie diameter, and sponge cake volume. Goetze was evaluated by representatives of the milling and baking industries in the 2006 Pacific Northwest Wheat Quality Council trials.

Goetze was evaluated over 29 site by year combinations in Oregon variety trials from 2005 through 2007. It was evaluated over 30 site by year combinations in the USDA-ARS Western Regional Uniform Soft Wheat Nursery from 2004 through 2006. Goetze was evaluated in the Washington State University Extension Cereal Variety Trials in 2006. Goetze also was evaluated from spring plantings in the 2007 Oregon spring wheat variety trials.

In fall of 2005, approximately 1,500 heads of Goetze were threshed, screened for seed color and seed size, and provided to Washington State Foundation Seed for production of Breeder seed. These were planted as individual heads and off-type rows were removed prior to bulk harvest of Breeder seed.

## **Evidence of Uniformity and Stability**

Goetze has been observed to be uniform and stable. From the F6 generation through its release as a variety in 2007, uniformity and stability were evaluated each year in multilocation yield trials. From 2005 through 2007, Goetze was evaluated in a total of 77 replicated yield trials in Oregon, Washington, and throughout the Northwest in USDA-ARS sponsored Regional Nurseries.

Goetze soft white winter wheat may contain up to 10 red seed per pound in Breeders, Foundation, Registered, or Certified classes of seed multiplication. Goetze also may contain up to 5 in 10,000 combined of the naturally occurring variants: plants that are 2" to 6" taller; plants with awnless spike; and plants with bronze (red or tan) chaff spikes. Variations in plant height will be more distinct when grown in environments that are conducive to high grain yield, including irrigated or high rainfall conditions.

These variants described are distinct within the variety and are stable and predictable with a degree of reliability comparable to other varieties of the same kind, and within recognized tolerances, when the variety is reproduced or reconstructed and was originally part of the variety when released.

To further determine variants in kernel color, a phenol staining reaction was determined. It was observed that 11% of the kernels stained are fawn, 68% are light brown, and 21% are brown.

## **Exhibit B – Statement of Distinctness**

Goetze is most similar to the commercial varieties Stephens, Westbred 528, and Foote. Stephens and Westbred 528 are of the same market class, winter type, semi-dwarf, awned, similar maturity, and adapted to a similar growing area as Goetze. Origin of Stephens and Goetze can be traced back to the common parent 'Pullman 101'.

Goetze differs from Stephens and Westbred 528 in that it is a facultative wheat, meaning it is grown from fall plantings, but does not require cold-temperature vernalization to flower. Goetze was evaluated in spring plantings through the 2007 Oregon Spring Wheat Variety Trial. It flowered and produced grain at each of five test sites. Stephens and Westbred 528 are true winter wheats. They require a period of cold temperature, approximately five to six weeks below 40 degrees F, before they will begin reproductive growth, flower, and set seed.

Goetze is resistant to current races of stripe rust, including races PST-114 and PST-116, which were the predominant races in 2007. Foote is highly susceptible to current races of stripe rust, including PST-114 and PST-116.

## **Exhibit D. Additional Description of the Variety**

'Goetze' is a soft white winter wheat (*Triticum aestivum L.*) developed by Oregon State University in cooperation with USDA-Agricultural Research Service. Goetze was released for its superior yield potential, disease resistance, short stature, medium-early maturity, and adaptation to Oregon production conditions. Goetze is best adapted to the Willamette valley and areas of Oregon where the variety Gene is commonly grown. Crown freezing tests conducted by USDA-ARS suggest that Goetze has less cold tolerance than the leading varieties Stephens or Tubbs, more similar to the variety Gene. Goetze is considered a facultative type, meaning that it does not require vernalization to initiate flowering. These factors increase the risk of winter damage when the variety is grown further north and east.

**Release document for Goetze (approved 8-20-07)**

## **Release of 'Goetze' Soft White Winter Wheat**

'Goetze' is a soft white winter wheat (*Triticum aestivum* L.) developed by Oregon State University in cooperation with USDA-Agricultural Research Service. Goetze is being released for its superior yield potential, disease resistance, short stature, and adaptation to Oregon production conditions. The name was chosen to recognize the leadership and contributions of Norm Goetze, former OSU Cereal Extension Specialist, to the Oregon wheat industry.

Goetze is a semidwarf soft white winter wheat from the cross 'OR8303765/E81FR' which was made in 1995. OR8303765 has the pedigree '6720-11//Ministerio de Agri 38/ WRM (Weique/Red Mace)'. Selection 6720-11 is a sister of CI17576 with the pedigree 'Cappelle Desprez/Pullman sel. 101//Druchamp'. The origin and pedigree of E81FR are unknown. Goetze is an F<sub>5</sub>-derived line which was identified as a headrow in 2000 by breeders of Hybritech Seed International, Inc., a division of the Monsanto Company. Goetze was among the HybriTech germplasm donated by Monsanto to Oregon State University in 2000. In 2001, it was selected as a single F<sub>6</sub> plot grown in Pendleton, OR, and given the experimental number ORH010920.

Goetze is best adapted to the Willamette valley and areas of Oregon where the variety Gene is commonly grown. Crown freezing tests conducted by USDA-ARS suggest that Goetze has less cold tolerance than Stephens or Tubbs, more similar to the variety Gene. Goetze is considered a facultative type, meaning that it requires little or no vernalization to initiate flowering. These factors increase the risk of winter damage when the variety is grown further north and east. Vulnerability of Goetze to cold temperatures was confirmed in 2005 WSU variety trials, as significant winter damage was observed in north central Washington test sites.

Goetze is moderately resistant to Septoria leaf blotch (*Septoria tritici* Roberge in Desmaz.), an important disease of the Willamette valley. Disease ratings for Goetze have been similar to significantly lower than those for Madsen. In USDA-ARS field evaluations, Goetze has resistant reaction type and adult plant resistance to stripe rust (*Puccinia striiformis* Westend.), with infection intensities less than Stephens or Madsen. It is moderately resistant to current races of leaf rust (*Puccinia triticina* Eriks.) and postulated to carry Lr17. Goetze has intermediate response to strawbreaker footrot (*Psuedocercospora herpotrichoides* (Fron.) Deighton). It does not carry the Pch-1 gene for resistance to strawbreaker footrot from VPM-1. Goetze is moderately susceptible to Cephalosporium stripe (*Cephalosporium gramineum* Nis. & Ika.), with infection ratings higher than for Madsen, but less than Stephens. Goetze is susceptible to dwarf bunt (*Tilletia controversa* Kuhn in Rabenh).

Goetze was evaluated in Oregon breeding trials from 2001 through 2006. From 2004 to 2006 it was evaluated in statewide variety trials and the USDA-ARS Western Regional

Uniform Soft Wheat Nursery (WRUSWN). Over 29 site by year combinations from Oregon trials, Goetze averaged 95.5 bu/a, as compared with Stephens, Madsen, and Tubbs at 90.9, 86.7, and 93.9 bu/a, respectively. In 31 site by year combinations from the WRUSWN, Goetze averaged 112.6 bu/a, as compared with 108.5 for Stephens and 107.0 for Madsen. Grain test weight of Goetze has been similar to Stephens, averaging 61 lb/bu over 32 locations, approximately 1 lb/bu greater than that for Tubbs. Goetze has lower thousand kernel weight than Tubbs, however, averaging 38 gm vs 40.4 gm for Tubbs over 17 test sites. Grain protein concentration of Goetze is similar to Tubbs, averaging 0.3 to 0.5% lower in grain protein than Stephens or Madsen. Goetze averages 2 d earlier in heading date than Stephens and 4 d earlier than Tubbs. Plant height of Goetze averages 3.6 cm less than Stephens and 14.7 cm less than Tubbs. ORH01920 has good straw strength, comparable to Stephens.

End-use quality of Goetze has been evaluated through the USDA-ARS Western Wheat Quality lab from 2004 through 2006. Results from the milling and baking evaluations suggest that Goetze has quality similar to Stephens and Tubbs and is considered acceptable for soft wheat applications. Goetze averaged 0.4 percentage points lower in grain protein than Stephens, similar to Tubbs. Grain hardness values for Goetze averaged 6 points higher than Stephens and 3 points less than Tubbs when measured with the Pertin Single Kernel Characterization System. Goetze had lower average kernel weight than both Stephens and Tubbs, but with test weight similar to Stephens, greater than Tubbs. Average break flour yields of Goetze were not significantly different from Stephens or Tubbs. Flour ash concentrations of Goetze were similar to Tubbs, slightly higher than for Stephens. Goetze has cookie baking performance similar to Stephens, averaging 0.22 cm wider cookie spread than Tubbs. It also has lower water absorption than either Stephens or Tubbs. Flour swelling volume tests suggest that Goetze has normal starch properties, with average volume only slightly higher than for Stephens. Goetze was evaluated through the PNW Wheat Quality Council in 2006. It was considered to have acceptable milling and baking quality for the soft white market class, similar to the check variety Stephens.

In fall, 2005, 1,500 heads of Goetze were threshed, screened for seed color and seed size, and provided to Washington Foundation Seed for production of Breeder seed. These were planted as individual headrows and off-type rows were removed prior to bulk harvest of Breeder seed. Breeder and Foundation seed will be maintained by Washington State Crop Improvement Association (WSCIA). Goetze is an open release with Plant Variety Protection, but without the Title 5 option. Certification classes recognized for Goetze include Foundation, Registered and Certified. Seed of Goetze has been deposited in the USDA National Small Grains Collection, Aberdeen, Idaho. It is requested that the source of this material be acknowledged in future use by wheat breeding and genetics programs.

**Acknowledgements:** Appreciation is extended to the Monsanto Company for their contributions to development of Goetze and for donation of germplasm developed by HybriTech Seed International, Inc., to Oregon State University. Appreciation also is extended to the Oregon Wheat Commission for financial support. Financial support provided by the Washington Wheat Commission and Idaho Wheat Commission for initial screening and evaluation of the HybriTech germplasm is gratefully acknowledged.

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Grain yield and test weight summary for soft white winter selections GOETZE and ORH010085

2006 Entry No.	Selection	Grain Yield							Test Weight		Grain Protein	
		29-site 3-yr OR mean	2006 OWEYT 12-site		2005 OWEYT 10-site		2004 OWEYT 7-site		McGregor '06 7-site	2006 OWEYT 8-site	2005 OWEYT 9-site	2006 OWEYT 8-site
		bu/a	bu/a	rank	bu/a	rank	bu/a	rank	bu/a	lb/bu	lb/bu	%
1	STEPHENS	90.9	81.6	18	88.9	7	109.7	7	90.9	60.3	60.5	10.3
2	MADSEN	86.7	77.2	35	88.0	8	101.3	18	83.1	60.1	60.5	10.5
3	GENE		71.1	39	95.9	2				59.7	59.8	10.9
5	TUBBS	93.9	85.4	2	92.9	5	109.8	6	89.0	59.6	59.7	10
6	TUBBS-06		84.8	5					91.0	59.7		9.9
32	GOETZE	95.5	83.0	10	99.6	1	111.1	3	90.4	60.2	60.3	10
34	ORH010085		80.9	23	95.4	3				61.8	61.2	10.7

Grain yield summary for soft white winter selections GOETZE and ORH010085 grown in the Western Regional Nursery.

2006 Entry No.	Selection	Grain Yield						
		2004 WRSWN 10-site		2005 WRSWN 11-site		2006 WRSWN 10-site		WRSWN 3yr mean
		bu/a	rank	bu/a	rank	bu/a	rank	bu/a
1	STEPHENS	118.7	18	102.8	14	104.4	15	108.5
2	MADSEN	116.6	25	100.2	19	105	13	107.0
3	GENE							
5	TUBBS							
6	TUBBS-06							
32	GOETZE	122.0	11	110.6	1	105.5	12	112.6
34	ORH010085					103.6	17	



Agronomic summary for soft white winter selections GOETZE and ORH010085 grown in the OWEYT.

2006 Entry No.	Selection	Plant height (cm)				Heading date (from 1/1)			
		2006	2005	2004	3yr ave	2006	2005	2004	3 yr ave
		11 sites	8 sites	7 sites	26 sites	5 sites	3 sites	3 sites	11 sites
1	STEPHENS	81.8	88	94.4	87.1	144.7	143.6	139.7	143
2	MADSEN	82.5	92.2	97.1	89.4	149.6	147.4	144.3	147.6
3	GENE	73.1	86			143.3	141.4		
5	TUBBS	89.2	98.4	100.9	98.2	147.5	146.1	141.3	145.4
6	TUBBS-06	90.4				146.5			
32	GOETZE	77.1	87.8	88.7	83.5	143.3	139.4	137.7	140.7
34	ORH010085	79.1	90.8			147.4	144		

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**July 27, 2008**

**To: PNW Certification agencies and seed growers**

**From: C. James Peterson, Professor  
Wheat Breeding and Genetics**

**RE: Variance Statement for Goetze Soft White Winter Wheat**

Goetze soft white winter wheat may contain up to 10 red seed per pound in Breeders, Foundation, Registered, or Certified classes of seed multiplication.

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