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Norwest 553

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Hard Red Winter Wheat

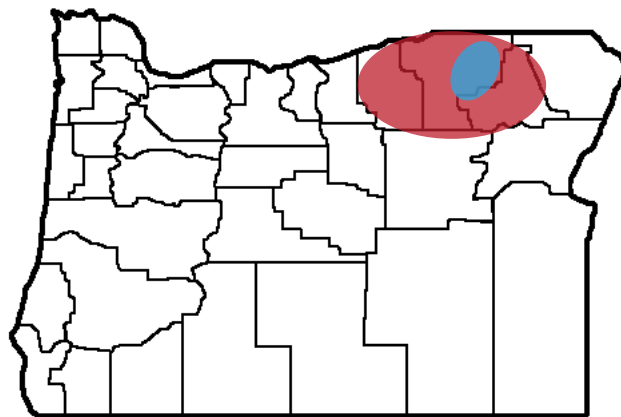
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Variety description

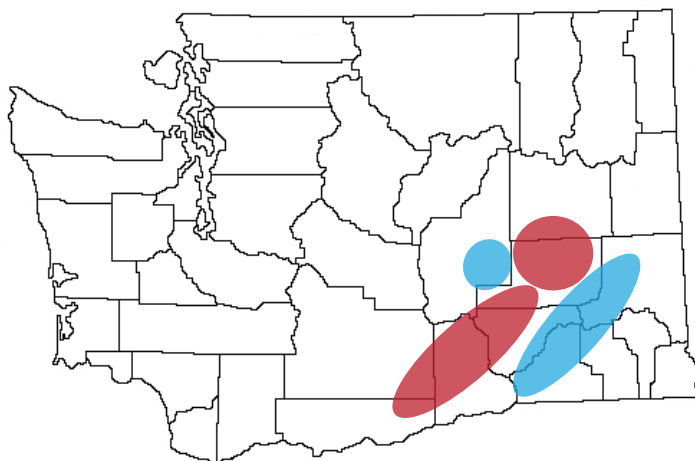
Norwest 553 is a common hard red winter wheat variety developed by Oregon State University and Nickerson U.K. in cooperation with USDA-ARS. It is an awned, short-statured, semidwarf variety with high-yield potential and good milling and baking quality. Norwest 553 is resistant to stripe rust and tolerant to *Fusarium* crown rot (dryland foot rot). Norwest 553 is moderately resistant to *Cephalosporium* stripe, powdery mildew, and Septoria leaf blotch. Norwest 553 is susceptible to strawbreaker (eyespot) footrot.

Area of adaptation

Norwest 553 is best adapted to the high rainfall (more than 16 inches) and irrigated regions of eastern Oregon and Washington (blue shaded regions). A secondary area of adaptation is the low-to-medium rainfall (12 to 16 inches) regions of eastern Oregon and Washington (red shaded regions). In these regions, the performance of Norwest 553 has been similar to other hard winter wheat varieties. However, tolerance of Norwest 553 to winter cold and/or drought conditions may be less than other hard red winter wheat varieties.



Figures 1 and 2: Norwest 553 is best adapted to high rainfall and irrigated regions of eastern Oregon and Washington (blue shaded). A secondary area is the low-to-medium rainfall regions of eastern Oregon and Washington



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Norwest 553 was released in 2007. It was co-developed and is co-owned by Oregon State University and Nickerson U.K. It is protected under Plant Variety Protection act with the Title 5 option. Seed of Norwest 553 is available only as Certified seed through licensed seed dealers. Commercial growers may not retain or sell seed for planting or replanting.



Figure 3: Norwest 553 in the field.

Agronomic characteristics

Height and lodging resistance

In trials over 12 site-years in Oregon and 19 site-years in Washington, Norwest 553 has averaged 28.6 and 28.3 inches, respectively. Norwest 553 is approximately 6 inches shorter than Bauermeister (HRW) and 3 inches shorter than Agripro Paladin (HRW) and Stephens (SWW; Tables 1 and 2). Straw strength is excellent, and lodging has not been observed in any production environment.

Maturity

Norwest 553 is a mid-season maturing variety, similar to Boundary (HRW), Tubbs (SWW), and Agripro Paladin. It heads 3 days earlier than Bauermeister and approximately 2 days later than Eddy (HRW; Tables 1 and 2).

Table 1. Grain yield and agronomic data for five hard red winter wheat and two soft white winter wheat varieties grown across a range of environments in Oregon from 2005 to 2007.

Variety	Class	Grain Yield						Agronomic Data			
		High Rainfall and Irrigated Sites			Low to Medium Rainfall Sites			Test Weight	Grain Protein	Plant Height	Heading Date
		1-Year Mean	2-Year Mean	3-Year Mean	1-Year Mean	2-Year Mean	3-Year Mean	13-Site Years	9-Site Years	12-Site Years	2-Site Years
		bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	lbs/bu	%	in	DOY
Norwest 553	HRW	130.4	115.7	114.7	58.6	57.7	61.5	63.0	11.5	28.6	137.3
Stephens	SWW	121.3	112.5	111.5	60.3	55.5	60.5	60.2	10.8	31.8	136.2
Tubbs-06	SWW	130.6	119.7		63.7	59.0		59.8	10.4	35.3	136.7
Boundary	HRW	118.4	107.6		57.7	53.7		61.1	10.8	32.3	137.2
Bauermeister	HRW	121.7	99.5	96.4	65.7	58.9	61.6	60.0	10.8	34.7	141.0
Eddy	HRW	121.5			57.8			63.2	10.9	32.9	135.3
Agripro Paladin	HRW	115.7	110.2	108.1	55.4	52.5	54.7	63.1	11.5	31.9	135.8
Mean		122.8	110.9	107.7	59.9	56.2	59.6	61.4	11.0	32.4	137.1
LSD (0.05)		12.6	10.7	10.1	7.4	4.9	3.9	1.1	0.5	0.8	0.7

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Vernalization and cold tolerance

Norwest 553 is a winter wheat that requires vernalization to initiate flowering. Results from crown freezing tests, a measure of winter cold tolerance conducted by the USDA-ARS, have been mixed. Norwest 553 appears to have less cold tolerance than Boundary and slightly less tolerance than Bauermeister, Agripro Paladin, and Eddy (Table 3). Norwest 553 should not be planted north of Highway 2 in Washington. Growers south of Highway 2 in Washington might experience winter kill or injury during unusually cold winter temperatures, especially without adequate snow cover. Under normal conditions, growers in southeast Washington and northeastern Oregon are unlikely to observe winter injury during production of Norwest 553.

Disease resistance

Norwest 553 is resistant to current races of stripe rust and moderately resistant to *Fusarium* crown rot. Both are important wheat diseases in eastern Oregon and Washington. Norwest 553 also is moderately resistant to *Cephalosporium* stripe, powdery mildew, and Septoria leaf blotch. Norwest 553 is susceptible to strawbreaker footrot. A seed treatment is recommended to control bunt and other seedling diseases (Table 3).

Table 2. Grain yield and agronomic data for five hard red winter wheat varieties grown across a range of environments in Washington from 2005 to 2007.

Variety	Class	Grain Yield					Agronomic Data			
		High Rainfall and Irrigated Sites			Low to Medium Rainfall Sites		Test Weight	Grain Protein	Plant Height	Heading Date
		1-Year Mean	2-Year Mean	3-Year Mean	1-Year Mean	2-Year Mean	19-Site Years	19-Site Years	19-Site Years	19-Site Years
		bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	lbs/bu	%	in	DOY
Norwest 553	HRW	118.9	127.1	131.2	41.0	45.0	61.3	12.6	28.3	147.3
Boundary	HRW	125.2	132.3	134.9	54.6	58.7	60.7	12.1	32.0	148.4
Bauermeister	HRW	126.1	120.3	121.0	55.5	56.4	59.5	12.1	35.6	150.5
Eddy	HRW	121.3	123.3	125.7	47.2	50.6	62.3	12.4	31.4	145.6
Agripro Paladin	HRW	115.9	121.6	124.0	44.6	48.0	61.9	12.7	31.9	146.3
Mean		121.5	124.9	127.4	48.6	51.8	61.2	12.4	31.8	147.6
LSD (0.05)		8.3	6.9	6.7	4.7	3.6	0.3	0.2	0.5	0.4

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Yield

Norwest 553 has been shown to have high yield potential across a range of environments in Oregon and Washington. It excels in the high rainfall and irrigated production systems in both states. In more than 6 site-years of OSU variety testing in high rainfall and irrigated environments, Norwest 553 averaged 114.7 bushels per acre, similar to Agripro Paladin and Stephens and 18 bushels per acre higher than Bauermeister (Table 1). Similarly, in 10 site-years of WSU variety testing in high rainfall and irrigated environment, Norwest 553 averaged 131.2 bushels per acre, similar to Boundary and 5 to 10 bushels higher than Eddy, Agripro Paladin, and Bauermeister (Table 2).



Figure 4: Norwest 553 ripening in the field near Lexington, Oregon.

In low-to-medium rainfall environments in Oregon, Norwest 553 averaged 61.5 bushels per acre across 9 site-years. This is similar to Bauermeister and Stephens and 6 bushels per acre higher than Agripro Paladin. In low-to-medium rainfall environments in Washington, Norwest 553 averaged 45.0 bushels per acre across 9 site-years. This is similar to Agripro Paladin and 5 to 13 bushels per acre lower than Eddy, Bauermeister, and Boundary.

Table 3. Agronomic and disease ratings for five hard red winter wheat varieties grown in Oregon and Washington.

Variety	Maturity	Winter Hardiness*	Rust [†]		Septoria [†]	Crown Rot [†]	Cephalosporium Stripe [†]	Strawbreaker Foot-Rot [†] <i>Pseudocercospora</i>
			Stripe	Leaf				
Norwest 553	Mid-Season	5	MR/R		MR/MS	MR/MS	MR/MS	S
Boundary	Mid-Season	8	MS	R		MS/MR		S
Bauermeister	Mid-Late	6	MR/MS			MR/MS	MR	S
Eddy	Mid-Season		MR/MS			S		S
Agripro Paladin	Mid-Season	6	MS/MR		R	MR/MS	MR	S

* Scale: 1 to 10, with 10 being excellent and 1 being poor.

† Scale: R = Resistant; MR = Moderately Resistant; MS = Moderately Susceptible; S = Susceptible

Data is compiled from the following sources: Winter Grain Varieties for 2003, Special report 775, Oregon State University Extension Service; 2004 through 2007 Oregon Winter Elite Yield Trial Disease Ratings; and Variety Characteristics, Washington State Crop Improvement Association.

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Test weight and quality

Test weight of Norwest 553 averaged 63 pounds per bushel across 13 site-years in Oregon and 61.3 pounds per bushel across 19 site-years in Washington. These test weights are similar to Eddy and Agripro Paladin. Test weight of Norwest 553 ranged from 2 to 3 pounds per bushel more than Bauermeister and Boundary in Oregon and 2 pounds per bushel more than Bauermeister in Washington (Tables 1 and 2).

Grain protein of Norwest 553 averaged 11.5% in Oregon and 12.6% in Washington similar to Agripro Paladin. Norwest 553 averaged 0.5 to 0.7% higher grain protein than Bauermeister and Boundary in Oregon and Washington (Tables 1 and 2).



Figure 5: Red seed of Norwest 553 harvested near Lexington, Oregon.

Milling and baking evaluations from the USDA-ARS Western Wheat Quality Laboratory and the Wheat Quality Council confirm that Norwest 553 meets the specifications for the hard red winter wheat class. Flour yield, flour ash, and flour protein values were similar to Agripro Paladin and Bauermeister. Mix absorption was similar to Agripro Paladin and 1.5% lower than Bauermeister. Norwest 553 has superior protein and mixing quality as compared with current PNW hard red winter wheat varieties. Mixing time was 2.1 minutes longer than Bauermeister and 1.3 minutes longer than Agripro Paladin. Loaf volume was equal to Bauermeister and 44 cc lower than Agripro Paladin. Crumb ratings were equal to Bauermeister and Agripro Paladin (Table 4).

Table 4. End-use quality analyses of Norwest 553 hard red winter wheat in paired comparisons with Bauermeister and Paladin. Data provided by USDA-ARS Western Wheat Quality Lab.

Variety	Flour Yield	Flour Ash	Milling Score	Flour Protein	Mix Absorption	Mixing Time	Loaf Volume	Crumb Rating
	%	%		%	%	min	cc	1-9
Norwest 553	72.1	0.39	87.4	12.2	62.1	5.1*	877	4.3
Bauermeister	71.8	0.42	85.1	12.0	63.6*	3.0	909	4.7
Norwest 553	71.6	0.39	87.0*	12.2	61.9	5.1*	887	4.0
Agripro Paladin	71.6	0.41	85.7	12.3	61.7	3.8	931*	4.0

* Indicates a statistically significant increase ($p < 0.05$) based on a paired t-test.

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Norwest 553 was derived from the cross 95B343/Isengrain made in 1996 by the Verneuil Company, FR. Norwest 553 was developed as a doubled haploid from an F1 plant in the 1997-1998 growing season and given the selection designation 00B553. From 1998 to 2001, 00B553 was evaluated in France in Verneuil Company breeding trials. In 2001, Verneuil was acquired by Limagrain Agro-Industrie S.A. In fall, 2001, seed of 00B553 was provided to Oregon State University under a germplasm exchange agreement with Nickerson, UK, a division of Limagrain Agro-Industry S.A. The selection was subsequently tested in Oregon under the experimental designation ORN00B553.

Breeder and Foundation seed will be maintained by Washington State Crop Improvement Association (WSCIA). Norwest 553 is being submitted for Plant Variety Protection with the Title 5 option. Certification classes recognized for Norwest 553 include Foundation, Registered and Certified. Certified seed will be produced and sold only under non-exclusive license with Oregon State University. Commercial growers may not retain seed for purposes of planting or replanting. Seed of Norwest 553 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

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