

# Skiles

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## Soft White Winter Wheat

Michael Flowers, C. James Peterson, Andrew Hulting, John Burns, Stephen Guy, and John Kuehner

### Variety description

'Skiles' is a common soft white winter wheat developed by Oregon State University in cooperation with the USDA Agricultural Research Service (USDA-ARS). It is an awned, short-statured, semidwarf variety with high yield potential, high test weight, excellent winter cold tolerance, and moderately early maturity.

Skiles is resistant to current races of stripe rust (*Puccinia striiformis*) and is moderately resistant to *Fusarium* crown rot (dryland foot rot) and *Cephalosporium* stripe.

The name Skiles was chosen to recognize the leadership and contributions of Richard "Dick" Skiles to the Oregon wheat industry.

### Area of adaptation

Skiles is best adapted to dryland wheat-growing regions in northeast Oregon and southeast Washington (Figure 1, blue-shaded regions) where 'Stephens', 'Tubbs 06', and 'Madsen' are commonly grown.

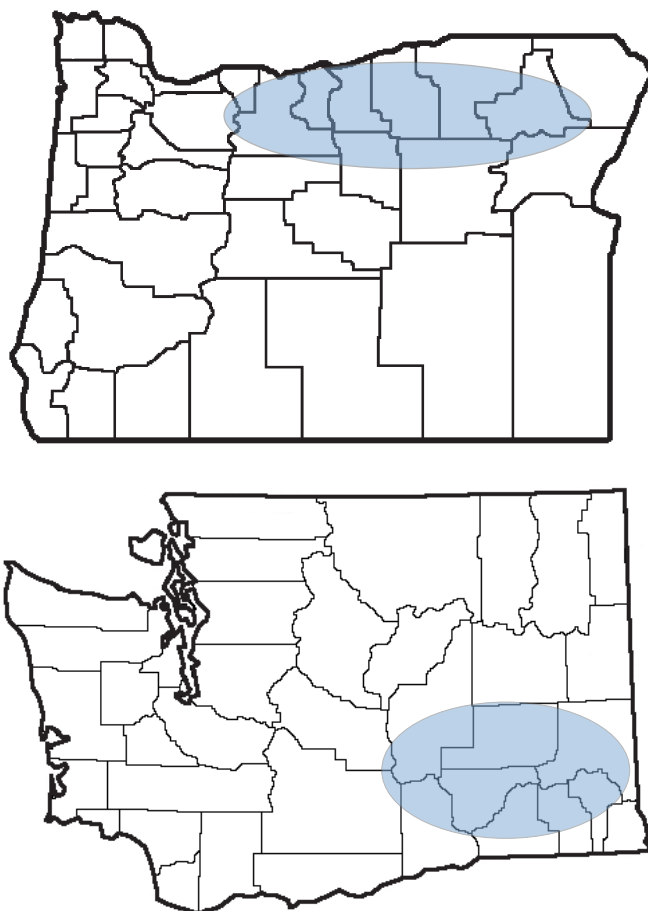


Figure 1. Regions of Oregon (top) and Washington (bottom) where Skiles is best adapted (blue).

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## Year released

Skiles was released in 2008 and is protected under the Plant Variety Protection Act without the Title 5 option.

## Agronomic characteristics

### Height and lodging resistance

The plant height of Skiles averaged 32.4 and 31.5 inches in trials over 19 site-years in Oregon and 39 site-years in Washington, respectively. Height is similar to that of Stephens and approximately 1 to 3 inches shorter than AP 700 CL, Brundage 96, Madsen, Masami, ORCF-101, ORCF-102, ORCF-103, Salute, Tubbs 06, Westbred 528, and Xerpha. Skiles is approximately 1 inch taller than Goetze (Tables 1 and 2). Straw strength of Skiles is good, and lodging has not been observed in any production environment.



Figure 2. Skiles wheat.

**Table 1. Grain yield and agronomic data for 14 soft white winter wheat varieties grown across a range of environments in Oregon, 2007–2009.**

Variety	Grain yield (bu/ac)				Agronomic data (2-year mean)			
	Northeast Oregon		OWEYT <sup>a</sup>		Test weight 19 site-years (lb/bu)	Grain protein 19 site-years (%)	Plant height 19 site-years (in)	Heading date 12 site-years (DOY) <sup>b</sup>
	2-year mean 14 site-years	3-year mean 22 site-years	2-year mean 19 site-years	3-year mean 31 site-years				
<i>Skiles</i>	80.0	83.0	92.1	93.1	61.2	10.1	32.4	148.6
AP 700 CL	75.8	79.5	90.1	92.4	59.9	10.1	35.1	147.5
Brundage 96	76.2	81.2	87.9	91.7	60.2	9.9	33.4	149.1
Goetze	82.2	81.1	95.2	93.5	59.7	9.7	31.7	144.2
Madsen	70.9	74.9	82.8	86.0	60.2	10.2	32.9	151.4
ORCF-101	75.1	76.8	85.8	86.9	59.8	10.4	33.1	148.7
ORCF-102	78.6	83.6	91.1	94.2	60.3	10.0	34.8	149.3
ORCF-103	77.0	80.5	87.7	90.1	59.8	9.7	33.5	152.1
Salute	77.6	82.2	90.0	93.1	59.0	9.9	34.8	148.2
Stephens	73.3	76.0	87.7	89.5	59.6	10.0	32.7	145.9
Tubbs	76.2	79.2	89.6	92.0	59.2	9.6	34.8	149.0
Tubbs 06	78.5	82.0	92.1	94.1	59.3	9.7	36.0	148.5
Westbred 528	82.5	84.2	95.9	96.2	61.6	10.1	33.4	145.7
Xerpha	80.4	83.6	90.5	93.8	59.6	9.5	34.9	151.5
Mean	77.4	80.6	89.9	91.9	60.0	9.9	33.9	148.6
LSD <sup>c</sup> (0.05)	3.1	2.7	3.1	2.7	0.3	0.3	0.5	0.5
CV <sup>d</sup> (%)	9.4	9.9	9.4	10.4	1.6	8.7	4.3	0.7

<sup>a</sup> Oregon Winter Elite Yield Trials

<sup>b</sup> Day of year

<sup>c</sup> Least significant difference

<sup>d</sup> Coefficient of variation

## Maturity

Skiles is a midseason-maturing variety, similar to Brundage 96, ORCF-101, ORCF-102, Salute, and Tubbs 06. It heads 1 to 3 days later than AP 700 CL, Goetze, Stephens, and Westbred 528. Skiles heads 1 to 3 days earlier than Eltan, Madsen, ORCF-103, and Xerpha (Tables 1 and 2).

## Vernalization and cold tolerance

Skiles is a winter wheat that requires vernalization to initiate flowering. Results from crown freezing tests (a measure of cold tolerance) conducted by the USDA-ARS have shown that the cold tolerance of Skiles is similar to Xerpha and greater than ORCF-102 and Tubbs 06 (Table 3). Under normal conditions, growers in northeast Oregon and southeast Washington are unlikely to observe winter injury.

## Disease resistance

Skiles is resistant to current races of stripe rust (*Puccinia striiformis*) and moderately resistant to *Fusarium* crown rot (dryland foot rot) and *Cephalosporium* stripe. Skiles is susceptible to *Pseudocercospora* strawbreaker (eyespot) foot rot, powdery mildew (*Erysiphe graminis*), and *Septoria* leaf blotch (Table 3). A fungicide seed treatment is recommended to control common bunt and other seed-borne diseases.

**Table 2. Grain yield and agronomic data for 14 soft white winter wheat varieties grown across a range of environments in Washington, 2008–2009.**

Variety	Grain yield 2-year mean 39 site-years (bu/ac)	Agronomic data (2-year mean)			
		Test weight 39 site-years (lb/bu)	Grain protein 39 site-years (%)	Plant height 39 site-years (in)	Heading date 39 site-years (DOY) <sup>a</sup>
Skiles	89.3	59.3	12.2	31.5	159.1
AP 700 CL	89.6	58.8	11.8	33.6	156.3
Brundage 96	88.1	58.5	11.6	31.4	157.0
Eltan	92.0	59.6	11.3	34.1	161.0
Madsen	85.5	59.1	11.8	32.3	160.0
Masami	89.8	58.3	11.2	33.2	161.2
ORCF-101	88.6	58.9	12.1	33.1	157.3
ORCF-102	94.8	59.8	11.5	34.8	158.1
ORCF-103	91.0	59.1	11.6	32.4	161.0
Salute	90.5	57.9	11.5	34.0	157.6
Stephens	85.5	58.4	11.7	31.6	155.1
Tubbs 06	91.4	58.4	11.4	34.8	158.2
Westbred 528	88.9	60.6	11.7	32.5	154.7
Xerpha	101.9	59.3	11.2	34.1	159.6
Mean	90.5	59.0	11.6	33.1	158.3
LSD <sup>b</sup> (0.05)	2.6	0.2	0.2	0.4	0.3
CV <sup>c</sup> (%)	12.1	1.4	6.4	5.2	0.7

<sup>a</sup> Day of year

<sup>b</sup> Least significant difference

<sup>c</sup> Coefficient of variation



## Yield

Skiles has been shown to have very high yield potential across a range of environments in Oregon. Skiles averaged 93.1 bushels per acre across 31 site-years of OSU variety testing, compared to 91.7, 93.5, 86.9, 94.2, 89.5, 94.1, and 96.2 bushels per acre for Brundage 96, Goetze, ORCF-101, ORCF-102, Stephens, Tubbs 06, and Westbred 528, respectively. Skiles averaged 83.0 bushels per acre across 22 site-years in its primary production area of northeast Oregon, compared to 79.5, 81.2, 81.1, 76.8, 83.6, 82.2, 76.0, 82.0, 84.2, and 83.6 bushels per acre for AP 700 CL, Brundage 96, Goetze, ORCF-101, ORCF-102, Salute, Stephens, Tubbs 06, Westbred 528, and Xerpha, respectively (Table 1). Skiles also averaged 89.3 bushels per acre in 2 years of testing in Washington (39 site-years), equal to or better than AP 700 CL, Brundage 96, Madsen, Masami, ORCF-101, ORCF-103, Salute, Stephens, Tubbs 06, and Westbred 528 (Table 2).

## Test weight and quality

Test weight of Skiles averaged 61.2 pounds per bushel across 19 site-years in Oregon and 59.3 pounds per bushel across 39 site-years in Washington. These test weights are similar to those for Westbred 528. Test weight of Skiles was approximately 1 to 1.5 pounds per bushel greater than AP 700 CL, Brundage 96, ORCF-101, Salute, Stephens, Tubbs 06, and Xerpha.

**Table 3. Agronomic and disease ratings for 15 soft white winter wheat varieties grown in Oregon and Washington.**

Variety	Maturity	Winter hardiness <sup>a</sup>	Rust <sup>b</sup>		Septoria <sup>b</sup>	Crown rot <sup>b</sup>	Cephalosporium stripe <sup>b</sup>	Strawbreaker foot rot <sup>b</sup> <i>Pseudocercospora</i>
			Stripe	Leaf				
<i>Skiles</i>	Midseason	7	R	—	S	MR	MR	S
AP 700 CL	Midseason	5	MR	R	MS	S	S	MR/MS
Brundage 96	Midseason	5	MR	MS	S	MS/MR	MS	S
Eltan	Mid-late	9	MR	S	MS	S	MR/MS	S
Goetze	Early-mid	2	R	MR	MR	MS	MS	MR/MS
Madsen	Midseason	5	R	MR	MS	MR/MS	MR	R
Masami	Midseason	5	MS	—	S	MR	MR/MS	R
ORCF-101	Midseason	3	MR/MS	MS	MS	MS	S	S
ORCF-102	Midseason	4	R/MR	MR	MS/MR	MR/MS	MR/MS	R
ORCF-103	Mid-late	8	R/MR	—	MS	MR	MR/MS	S
Salute	Midseason	5	R	—	MS	S	MS	S
Stephens	Early-mid	3	R	S	S	S	S	S
Tubbs 06	Midseason	5	MR/MS	MS	MS	S	S	R
Westbred 528	Early-mid	4	MS/MR	MS	S	MS/S	S	S
Xerpha	Midseason	7	MR	—	MS	MR/MS	MR/MS	S

Data compiled from the following sources: *Winter Grain Varieties for 2003*, Special Report 775, Oregon State University Extension Service; 2004–2008 Oregon Winter Elite Yield Trial Disease Ratings; and *Variety Characteristics*, Washington State Crop Improvement Association.

<sup>a</sup> Scale: 1–10 (10 = excellent; 1 = poor)

<sup>b</sup> R = resistant; MR = moderately resistant; MS = moderately susceptible; S = susceptible



Grain protein of Skiles averaged 10.1 percent in Oregon and 12.2 percent in Washington, similar to AP 700 CL, Brundage 96, Goetze, Madsen, ORCF-101, ORCF-102, Salute, Stephens, and Westbred 528.

Milling and baking evaluations conducted by the USDA-ARS Western Wheat Quality Laboratory and the PNW Wheat Quality Council suggest that Skiles is similar to Stephens and acceptable for a soft white winter wheat. Grain hardness values for Skiles are similar to Stephens and 15 points lower than Tubbs 06, when measured with the Pertin Single Kernel Characterization System. Average break flour yields and flour protein contents were similar to those for Stephens and Tubbs 06. The mix absorption of Skiles is similar to Stephens and 0.9 percent greater than Tubbs 06. The average cookie spread for Skiles was similar to Stephens and 0.21 centimeters greater than Tubbs 06. Flour swelling volume tests suggest Skiles has normal starch properties (Table 4).

## Development

Skiles was derived from the cross ‘Dusty’/‘ZGP-4074’/‘Unknown’ made in 1995.

ZGP-4074 is an experimental line believed to originate from the Institute for Breeding and Production of Field Crops located in Zagreb, Croatia. The ‘Unknown’ parent is believed to be a variety or breeding line from Oregon State University. Skiles is an F<sub>5</sub>-derived line that was identified as a headrow in 2000 by breeders of Hybritech Seed International, Inc., a division of the Monsanto Company. Skiles 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 ORH0100085.

**Table 4. End-use quality analyses of Skiles soft white winter wheat in paired comparisons with Stephens and Tubbs 06.**

Variety	Kernel hardness (SKCS) <sup>a</sup>	Break flour yield (%)	Flour yield (%)	Flour ash (%)	Milling score	Flour protein (%)	Mix absorption (%)	Cookie diameter (cm)
Skiles	26.2	48.7	68.7	0.39	83.5	9.1	55.3	9.5
Stephens	33.0	47.5	70.3	0.40	85.1	8.9	55.1	9.3
Skiles	25.9 <sup>b</sup>	48.7	69.2	0.39 <sup>b</sup>	84.2	9.2	55.3	9.4 <sup>b</sup>
Tubbs 06	40.9	48.0	70.4 <sup>b</sup>	0.42	84.0	8.0	54.5 <sup>b</sup>	9.2

Data provided by USDA-ARS Western Wheat Quality Laboratory, Pullman, Washington.

<sup>a</sup> Single Kernel Characterization System

<sup>b</sup> Statistically significant difference ( $p < 0.05$ ), based on a paired *t*-test





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## Seed availability

Breeder and Foundation seed will be maintained by the Washington State Crop Improvement Association (WSCIA). Skiles is protected under U.S. Plant Variety Protection without the Title 5 option (PVP 200900465). Certification classes recognized for Skiles include Foundation, Registered, and Certified.

Seed of Skiles has been deposited in the USDA National Small Grains Collection, Aberdeen, Idaho (PI 658154). It is requested that the source of this material be acknowledged in future use by wheat breeding and genetics programs.



Figure 3. Foundation seed increase of Skiles wheat.

## Variety development team

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## Management guidelines

### Planting date

Skiles is a broadly adapted variety that has shown excellent performance across a wide range of planting dates in Oregon. The incidence of diseases such as *Fusarium* crown rot, strawbreaker (eyespot) foot rot, and *Cephalosporium* stripe, as well as insect-vectored diseases such as Barley Yellow Dwarf Virus, increases in early wheat plantings. Skiles is

**Table 5. Grain yield of seven soft white winter wheat varieties in a planting date study at Moro, Oregon, 2007–2008.**

Planting date	Stephens (bu/ac)	Tubbs 06 (bu/ac)	ORCF-101 (bu/ac)	ORCF-102 (bu/ac)	ORCF-103 (bu/ac)	Goetze (bu/ac)	Skiles (bu/ac)	LSD <sub>(0.05)</sub> <sup>a</sup> (bu/ac)
<b>2007</b>								
September 12	84.6	90.4	87.8	88.3	—	85.3	89.3	7.9
October 3	90.3	92.3	91.6	90.1	—	94.8	88.9	9.5
October 27	66.3	71.3	70.8	71.2	—	68.5	63.3	5.4
November 20	53.5	66.2	52.6	62.7	—	64.2	67.9	7.0
<b>2008</b>								
September 12	55.5	55.9	—	54.5	61.4	65.0	63.9	7.3
October 10	53.7	51.6	—	50.8	51.5	58.1	54.8	3.9
November 14	48.5	46.4	—	45.8	47.2	52.7	48.3	3.6

<sup>a</sup> Least significant difference

moderately resistant to *Fusarium* crown rot and *Cephalosporium* stripe, making this variety an excellent choice for early plantings. Planting date studies have confirmed this recommendation; for September plantings in years with high disease pressure, yields of Skiles were up to 9 bushels more per acre than those of Stephens, ORCF-101, ORCF-102, Goetze, and Tubbs 06 (Table 5).

In “on-time” plantings, Skiles has shown high yield potential across a wide range of environments in Oregon and Washington. Plantings in early to mid-October are considered “on-time” for much of Oregon.

Yields of all varieties are reduced when they are planted late compared to “on-time” plantings. However, Skiles is also a good choice for late plantings. Planting date studies have shown that yields of Skiles are similar to those of Tubbs 06, but slightly less than those of Goetze, for late plantings. Additionally, late plantings of Skiles yield an average of 3 to 15 bushels more per acre than Stephens, ORCF-101, and ORCF-102 (Table 5).

## Seeding rate

The recommended seeding rate for soft white winter wheat in Oregon is 22 seeds per square foot. For late-planted wheat, increase the seeding rate to 33 seeds per square foot. Seeding rate trials have confirmed that these general recommendations are valid for Skiles. Increased seeding rates in late plantings resulted in a yield increase of about 8 bushels per acre for Skiles (Table 6).

**Table 6. Grain yield of Skiles across three seeding rates at Moro and Pendleton, Oregon, 2007.**

Planting date	Seeding rate (seeds/ft <sup>2</sup> )			LSD <sub>(0.05)</sub> <sup>a</sup> (bu/ac)
	11 (bu/ac)	22 (bu/ac)	33 (bu/ac)	
<b>Moro</b>				
October 3	85.1	96.4	85.1	15.9
October 27	61.2	63.4	65.1	10.7
November 20	59.0	68.2	76.3	5.5
<b>Pendleton</b>				
October 10	84.9	79.1	81.9	28.4
October 27	70.3	72.0	75.8	19.4
November 20	55.1	44.8	65.2	18.2

<sup>a</sup> Least significant difference



Seeding rates for most equipment are adjusted in pounds per acre. To avoid heavy or light plantings, it is important to determine the proper seeding rate using the number of seeds per pound. Conversions for a range of seeds per pound are found in Table 7.

The number of seeds per pound depends on seed size and varies depending on variety, production environment, and year. Skiles has above-average kernel weight, and the number of seeds per pound is equal to or greater than that of Stephens and ORCF-102. Seeds per pound may be obtained from your seed dealer or can be determined by weighing a 50-seed sample and using Table 7.

### Fertilization

Skiles has been grown across a wide range of environments, and no special fertility requirements have been observed. Therefore, it is recommended that growers follow the recommended fertilization guidelines for soft white winter wheat in their area.

### Herbicide applications

Wheat varieties may have differential sensitivity to commonly applied herbicides. To date, no adverse effects of herbicide application have been observed with Skiles. Many, but not all, of the currently labeled herbicides for use in wheat in Oregon have been applied to Skiles without visible crop damage. Herbicide applications should be made in accordance to label directions and all applicable state and federal regulations.

### Fungicide applications

A fungicide application is unlikely to be necessary when growing Skiles in its primary region of adaptation. However, no sensitivity to current fungicides is known. When applying fungicides, follow label directions and all applicable state and federal regulations.

**Table 7. Seeding rate conversion from seeds per square foot to pounds per acre.**

Seeds per pound	Weight of 50-seed sample (g)	Seeding rate	
		Pounds per acre needed for 22 seeds/ft <sup>2</sup>	Pounds per acre needed for 33 seeds/ft <sup>2</sup>
8,000	2.84	120	180
9,000	2.52	106	160
10,000	2.27	96	144
11,000	2.06	87	131
12,000	1.89	80	120
13,000	1.75	74	110
14,000	1.62	68	103
15,000	1.51	64	96



Figure 4. Skiles wheat.



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## Yield components

Wheat yield consists of three components: head number, kernels per head, and kernel weight. Both head number and kernels per head are determined early in wheat development, at Feekes 2–5. Kernel weight is determined later in the growing season at Feekes 10.1–10.5.

Although environment plays an important role in yield, genetic factors heavily influence the ways in which the three components combine to determine yield. Total grain yield of Skiles is determined by factors influencing head fertility and kernel weight more than by head number and head size. Compared to widely grown varieties such as Stephens and Tubbs 06, Skiles is characterized by low to average head numbers, average head size, average to high head fertility, and high kernel weights (Table 8).

## Acknowledgments

Appreciation is extended to the Monsanto Company for their contributions to development of Skiles 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.

**Table 8. Yield component comparison of Skiles, Tubbs 06, and Stephens.**

Yield component	Variety comparison
Head number	Skiles < Tubbs 06 < Stephens
Head size	Skiles ≤ Stephens < Tubbs 06
Head fertility	Tubbs 06 < Stephens ≤ Skiles
Kernel weight	Tubbs 06 < Stephens ≤ Skiles

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