

# Growing Hazelnuts in the Pacific Northwest

## Hazelnut Varieties



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### Hazelnut Varieties

The tables in this publication summarize characteristics of the main hazelnut varieties produced commercially in the United States, list varieties' susceptibility to eastern filbert blight (EFB), and show varieties' compatibility with each other for pollination.

Barcelona is the principal hazelnut variety grown in the Pacific Northwest, accounting for more than 60% of the acreage in Oregon. It is used in both the kernel market and the in-shell market, which favors its round shape and superior flavor. Barcelona kernels have a coarse, brown, skin-like pellicle (outer coating), which is very difficult to remove completely, even after roasting. However, some processors have found ways to remove the pellicle. Many characteristics of Barcelona are undesirable for commercial producers. Barcelona

trees tend to bear a heavy crop only every other year and produce a high percentage of blank nuts.

The variety Daviana had been used extensively as a pollinizer for Barcelona. However, it is very susceptible to EFB and should no longer be planted. It also is susceptible to filbert bud mite (*Phytocoptella avellanae* Nal.), which causes blasted or deformed flower and vegetative buds. We recommend replacing Daviana with York, a variety with the same pollen shed timing and the EFB resistance gene.

The Oregon State University hazelnut breeding program is continually developing varieties that have EFB resistance, good annual production, and more desirable kernel characteristics, such as fewer blanks and kernel defects.

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**Table 1. Nut and kernel characteristics of hazelnut varieties with the Gasaway gene for resistance to eastern filbert blight**

Variety	Alleles	Nut wt. (grams)	Kernel <sup>1</sup> (%)	Nut shape	Grade size	Blanching <sup>2</sup>	Good nut (%)	Kernel fiber <sup>3</sup>
Dorris	1, 12	3.4	43	Round	Medium	2.4–2.9	79–81	2.0
Jefferson	1, 3	3.7	45	Round	Medium	4–5	76–84	3.0
Yamhill	8, 26	2.3	49	Round	Small	4.4–5.0	75–91	2.5
Wepster	1, 2	2.4	46	Round	Small	3.0	80	2.5
Felix	15, 21	2.5	50	Round	Small	1.8	95	3
York	2, 21	2.8	44	Round	Small	4.4–4.8	81–84	3
Eta	11, 26	2.8	48	Round	Small	3.0	75	3.5
Theta	5, 15	2.3	50	Round	Small	2.5	85–93	2.5
Gamma	2, 10	2.5	52	Round	Small	6.0	80	3

<sup>1</sup> Percentage of nut weight that is from the kernel.

<sup>2</sup> Scale is 1–7, with 1 = 100% removal of the pellicle and 7 = no pellicle removal after roasting at 266°F–302°F (130°C–150°C) for 15 minutes.

<sup>3</sup> Scale is 1–4, with 1 = no fiber and 4 = much fiber.

**Table 2. Nut and kernel characteristics of hazelnut varieties susceptible to eastern filbert blight**

Variety	Alleles	Nut wt. (grams)	Kernel <sup>1</sup> (%)	Nut shape	Grade size	Blanching <sup>2</sup>	Good nut (%)	Kernel fiber <sup>3</sup>
Barcelona (standard)	1, 2	3.3–3.8	39–43	Round	Medium to large	4–5	70–85	3
Casina	10, 21	1.4–2.2	50–53	Round	Small	6.0	78–89	2
Clark*	3, 8	2.5–2.8	48–51	Round	Small	2.6–3.5	69–81	2
Ennis	1, 11	3.1–4.6	43–46	Oblong	Large	6–7	64–92	2
Gem	2, 14	4.7–5.0	37–42	Long	Large	6.5–7.0	67–83	2
Hall's Giant	5, 15	3.3–4.5	38–44	Round	Medium	3.0	79–95	2
J-5	2, 3	3.4–3.6	50–51	Round	Medium	6.0	34–45	2.5
Lewis*	3, 8	2.7–2.9	46–48	Round	Small	4–5	83–90	1–2
Sacajawea*^	1, 22	2.8	48–50	Round	Small	2.5–3.5	84	1
Tonda di Giffoni^	2, 23	2.7–3.2	45–50	Round	Medium	2.5–3.5	71–79	2

<sup>1</sup> Percentage of nut weight that is from the kernel.

<sup>2</sup> Scale is 1–7, with 1 = 100% removal of the pellicle and 7 = no pellicle removal after roasting at 266°F–302°F (130°C–150°C) for 15 minutes.

<sup>3</sup> Scale is 1–4, with 1 = no fiber and 4 = much fiber.

\* Developed by Oregon State University.

^ Sacajawea and Tonda di Giffoni exhibit moderate resistance to EFB but do not carry the Gasaway gene for resistance. They are suitable for planting in locations where disease pressure is low, but EFB preventative sprays are required.

**Table 3. Tree and orchard characteristics of hazelnut varieties with the Gasaway gene for resistance to eastern filbert blight**

Variety	Vigor (%) <sup>1</sup>	Growth habit	Cumulative yield <sup>2</sup>	Yield efficiency <sup>3</sup>	Harvest date <sup>4</sup>	Filbert bud mite <sup>5</sup>
Barcelona (standard; susceptible to EFB) <sup>6</sup>	100	Upright	Medium	Medium	Oct. 10–21	1
Dorris	60	Moderate spreading	Medium	High	–3 to +3	2.5
Jefferson	70	Upright	Medium	High	–3 to +3	2
Yamhill	60–70	Moderate spreading	High	High	–7 to –10	3
Wepster	80–110	Upright	High	High	–7 to –10	1
Gamma	100+	Upright, spreading	Medium	Medium	–7 to –10	2
York	75	Moderate spreading	Medium	Medium	–7 to –10	2.5
Felix	100+	Upright	Low	Low	–7 to –10	2
Eta	75	Upright	Medium	Low	–7 to –14	1
Theta	100	Upright	Low	Low	0 to +5	2

Note: Shaded rows indicate varieties released as pollinizers.

<sup>1</sup> As compared to the trunk cross-sectional area (TCSA) of Barcelona. TCSA is an indirect measure of tree size.

<sup>2</sup> Sum of all yields to date in a given year.

<sup>3</sup> Yield efficiency is a function of yield and tree size. Most new varieties produce more nuts on a smaller tree than the Barcelona standard.

<sup>4</sup> Expressed in days before (–) or after (+) the average harvest time for Barcelona in the Willamette Valley, Oregon.

<sup>5</sup> Scale is 1–5, with 1 = no mites and 5 = many blasted buds (big bug mite damage).

<sup>6</sup> Barcelona is the standard against which other varieties are typically compared.

**Table 4. Tree and orchard characteristics of hazelnut varieties susceptible to eastern filbert blight**

Variety	Vigor (%) <sup>1</sup>	Growth habit	Cumulative yield <sup>2</sup>	Yield efficiency <sup>3</sup>	Husk length <sup>4</sup>	Harvest date <sup>5</sup>	Filbert bud mite <sup>6</sup>	EFB suscep. <sup>7</sup>
Barcelona (standard) <sup>8</sup>	100	Upright	Medium	Medium	4	Oct. 10–21	1	3
Casina	90–110	Moderate spreading	High	Medium	6	–3 to –5	2.5	3
Clark	70	Upright	High	High	5	–7 to –10	2	2
Ennis	60–70	Moderate spreading	High	High	4	0 to +3	3	3
Gem	90–100	Moderate spreading to upright	Low	Low	4	+7	3	3
Hall's Giant	80–110	Upright	Low	Low	4	+7	1	2
J-5	100+	Upright	Low	Low	4	+7 to +10	2	3
Lewis	75	Moderate upright	High	High	5	–5 to –7	2.5	2
Sacajawea	85	Upright spreading	High	High	2	–7 to –10	1	1
Tonda di Giffoni	55	Upright	Medium	High	4	0	1	1
Willamette	100	Moderate spreading	Medium	High	6	+5 to +7	3	3

<sup>1</sup> As compared to the trunk cross-sectional area (TCSA) of Barcelona. TCSA is an indirect measure of tree size.

<sup>2</sup> Sum of all yields to date in a given year.

<sup>3</sup> Yield efficiency is a function of yield and tree size. Most new varieties produce more nuts on a smaller tree than the Barcelona standard.

<sup>4</sup> Relative to nut length. Scale is 2–8, with 2 = husk half as long as the nut and 8 = husk twice as long as the nut.

<sup>5</sup> Expressed in days before (–) or after (+) the average harvest time for Barcelona in the Willamette Valley, Oregon.

<sup>6</sup> Scale is 1–5, with 1 = no mites and 5 = many blasted buds (big bug mite damage).

<sup>7</sup> Scale is 0–3, with 0 = highly resistant with Gasaway gene, 1 = exhibits some resistance under low disease pressure, 2 = susceptible, and 3 = highly susceptible.

<sup>8</sup> Barcelona is the standard against which other varieties are typically compared.

**Table 5. Eastern filbert blight susceptibility ratings**

Highly susceptible	Susceptible	Some resistance	Highly resistant (have the Gasaway resistance gene)	
Ennis (++++++)	Barcelona (++++)	Clark (++)	Dorris	
Daviana (++++++)	Butler (++++)	Lewis (++)	Jefferson	
DuChilly (++++++)	Hall's Giant (+++)	Tonda di Giffoni (+)	Wepster	
Tonda Gentile delle Langhe (++++++)	Willamette (+++)	Sacajawea (+)	Yamhill	
Tonda Romana (++++++)	Gem (+++)		Eta	York
Casina (++++)			Felix	Epsilon
Negret (++++)			Gamma	Delta
			Theta	Zeta

Note: Plus symbols (+) indicate relative susceptibility within each column. For example, in the "Some resistance" column, Sacajawea and Tonda di Giffoni are more resistant than Lewis and Clark. Shading indicates varieties released as pollinizers.

Table 6. Compatibility of hazelnut varieties with the Gasaway gene for resistance to eastern filbert blight

Female parent <sup>2</sup> (alleles expressed in female flowers)	Pollen source <sup>1</sup> (alleles expressed in pollen)									
	Yamhill (8)	Dorris (1, 12)	Gamma* (10)	Sacajawea^ (1)	Wepster (1)	Jefferson (3)	York* (21)	Felix* (15, 21)	Eta* (11, 26)	Theta* (5, 15)
Sacajawea^ (1, 22)	+M						+L			
Yamhill (8, 26)			+M		+L	+M-L	+L			
Wepster (1, 2)	+E		+M				+M	+L		
Dorris (1, 12)	+E						+E	+M-L		
Jefferson (1, 3)							+E	+M	+M-L	+L
Gamma* (2, 10)	+E-M			+E	+M-L	+M	+M	+L		
York* (2, 21)	+E	+E-M	+M	+E-M	+L	+L				
Felix* (15, 21)	+E	+M	+M	+M	+M-L	+L				
Eta* (11, 26)					+E	+E	+E	+M		+L
Theta* (5, 15)						+E			+M	

Note: + symbol indicates a compatible cross. Letters indicate the time of pollen shed relative to bloom of the female parent (E = early, M = mid, L = late). Nuts will not set when either of the alleles in the female flower matches either of the alleles in the pollen.

<sup>1</sup> Pollen source varieties are listed in order of earliest to latest pollen shed by calendar date.

<sup>2</sup> Female parent varieties are listed in order of earliest to latest female bloom.

\* Should be planted as a pollinizer only, not for main crop production.

^ Sacajawea has quantitative resistance, which means it does not have the EFB resistance gene but does have some resistance to EFB infection. Scouting and spraying for EFB infections are still required.

Table 7. Compatibility of hazelnut varieties susceptible to eastern filbert blight

Female parent <sup>2</sup> (alleles expressed in female flowers)	Pollen source <sup>1</sup> (alleles expressed in pollen)											
	Tonda di Giffoni (2)	Barcelona (1)	Butler (3)	Clark (3, 8)	Willamette (3)	Lewis (3, 8)	Ennis (1)	Daviana (3)	Casina (10, 21)	Hall's Giant (5, 15)	Gem (14)	Jemtegaard #5 (3)
Tonda di Giffoni (2, 23)	-	+M	+L	+M	+M	+	+M	+L	+L	+L	+	+
Barcelona (1, 2)	-	-	+M	-	+M	-	+M	+L	+L	+L	+	+
Butler (2, 3)	-	+E	-	-	-	-	+M	+M	+M	+M	-	-
Willamette (1, 3)	+M	-	-	-	-	-	-	+M-L	+M-L	+M-L	+L	-
Lewis (3, 8)	+E	+E	-	+E	-	-	-	+M	+M	+M	+M-L	-
Ennis (1, 11)	+	-	+M	-	+E	+M	-	+E	+M	+L	+L	+L
Daviana (3, 11)	+E	-	-	-	-	-	+E	+M	+E	+E	-	-
Casina (10, 21)	+E	+E	+E	+	+E	+	+	-	+M	+M	+M	+
Gem (2, 14)	-	+	+	+	+	+	+	+	+	+	-	+
Hall's Giant (5, 15)	+E	+	+M	+	+	+	+M	+	-	+	+	+
Jemtegaard #5 (2, 3)	-	+	+	-	-	+	-	+	+	+	+	-
Clark (3, 8)	-	-	-	-	-	-	-	+E	+E	+E	+	-

Note: + symbol indicates a compatible cross. - symbol indicates an incompatible cross. Letters indicate the time of pollen shed relative to bloom of the female parent (E = early, M = mid, L = late). Nuts will not set when either of the alleles in the female flower matches either of the alleles in the pollen.

<sup>1</sup> Pollen source varieties are listed in order of earliest to latest pollen shed by calendar date.

<sup>2</sup> Female parent varieties are listed in order of earliest to latest female bloom.

## For More Information

Many Oregon State University Extension publications on hazelnut production are available through the OSU Extension Catalog: <http://extension.oregonstate.edu/catalog/>



The Oregon State University hazelnut breeding effort dates back to the 1960s. Horticulture professor and breeder Shawn Mehlenbacher (pictured above) leads the program and works with a team of plant breeders and Extension scientists to develop new high-quality, highly productive, disease-resistant varieties.

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