‘Dorris’ Hazelnut

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Additional index words. *Corylus avellana*, filbert, *Anisogramma anomala*, eastern filbert blight, nut breeding

‘Dorris’ is a new hazelnut (*Corylus avellana* L.) cultivar for the blanched kernel and in-shell markets. It was released by the Oregon Agricultural Experiment Station in Feb. 2011. It combines high resistance to eastern filbert blight (EFB) caused by the fungus *Anisogramma anomala* (Peck) E. Müller and bud mites (primarily *Phytoptus avellanae* Nal.) with high nut yield, medium nut size, attractive nuts and kernels, and excellent kernel flavor. Compared with the standard ‘Barcelona’, ‘Dorris’ has smaller trees, similar yields per tree, higher nut yield efficiency, and similar nut maturity. Most of the pellicle is removed from ‘Dorris’ kernels by dry heat, giving an attractive white kernel. Also, kernel texture and flavor are excellent, making them suitable for many end uses, although they are larger than ideal for the kernel market. Large nuts of ‘Dorris’ are also suited to the in-shell market. ‘Dorris’ is recommended for Oregon’s Willamette Valley and other areas with a similar climate.

Origin

‘Dorris’, tested as OSU 876.041, resulted from a cross of OSU 309.074 × ‘Delta’ made in 1997 by Shawn A. Mehlenbacher and David C. Smith (Fig. 1). The pedigree includes ‘Barcelona’, which is Oregon’s leading cultivar, ‘Tonda Gentile delle Langhe’ from the Piedmont region of northern Italy, and ‘Extra Ghiaghli’, which is a clone of the important Turkish cultivar Tombul. The male parent, the pollenizer ‘Delta’, carries a single dominant allele for EFB resistance from ‘Gasaway’ (Mehlenbacher and Smith, 2004). Hybrid seeds were harvested in Aug. 1997, stratified, and the resulting seedlings grown in the greenhouse during the summer of 1998. In Oct. 1998, 307 seedlings from this cross were planted in the field. The designation OSU 876.041 indicates the row and tree location of the original seedling at the Oregon State University (OSU) Smith Horticultural Research Farm in Corvallis, OR. Nuts were first observed on the

original seedling in Sept. 2001. There were few nuts. Nuts were harvested from the original seedling tree and evaluated for 5 years (2001–05). OSU 876.041 was first propagated by tie-off layerage of the suckers in the summer of 2003. The rooted layers were lined out in a nursery row the year after layerage and then used to plant replicated yield trials the next spring. The first replicated yield trial, with four trees of each selection, was planted in Spring 2005. A second trial with seven trees of each selection was planted in 2006. The trials were located at the Smith Horticulture Research Farm and planted as randomized complete block designs with a single tree of each selection in each block. Oregon’s leading cultivar, Barcelona, and ‘Lewis’ and ‘Clark’ with quantitative resistance to EFB were included as checks in the first trial, and the EFB-resistant cultivars Jefferson, Santiam, and Yamhill were included as checks in the second trial. Several additional OSU numbered selections were included in both trials. The name honors George Dorris who established the first commercial hazelnut orchard in the United States and whose orchards and nursery played a key role in establishing the hazelnut industry in the Willamette Valley. In 1892, George and his wife Lulu bought 250 acres of fertile land near the confluence of the Middle and Coast Forks of the Willamette River in Springfield, OR. The Dorris homestead is maintained today as “Dorris Ranch” by Willamalane Parks and Recreation, and the orchard continues to be productive. Trees from the Dorris nursery were planted throughout the valley.

Description

Trunk diameter was measured 30 cm above the soil line at the end of the growing season in the seventh leaf (Dec. 2011 and 2012 in the two trials, respectively) and used to calculate trunk cross-sectional area (TCA). In the first trial (Table 1), the tree size of

‘Dorris’ was 59% of the vigorous standard ‘Barcelona’ and slightly smaller than ‘Lewis’ and ‘Clark’. The total nut yield per tree was 20.0 kg for ‘Dorris’ vs. 19.0 kg for ‘Barcelona’ or 105% of the control. Nut yield efficiency for ‘Dorris’ (0.285 kg·cm⁻²), which adjusts for differences in tree size, was much higher than for ‘Barcelona’ (0.158 kg·cm⁻²), or 180% of the control. In the second trial (Table 1), TCA of ‘Dorris’ was similar to ‘Jefferson’ and slightly higher than ‘Santiam’ and ‘Yamhill’. Total nut yield per tree was 18.78 kg, not significantly different from ‘Jefferson’, ‘Yamhill’, ‘Santiam’, and ‘Sacajawea’. Nut yield efficiency of ‘Dorris’ (0.225 kg·cm⁻²) was similar to ‘Jefferson’, ‘Yamhill’, and ‘Santiam’ and higher than ‘Sacajawea’. The trees are low in vigor and have a spreading growth habit that is more upright than ‘Yamhill’ (Figs. 2 and 3). The trees should be easy for growers to manage with regular pruning to maintain vigor and allow sunlight to penetrate the canopy. A closer spacing of trees in the orchard is recommended to take advantage of the smaller tree size and higher yield efficiency.

‘Dorris’ nuts are borne in clusters of two to three in husks ≈25% longer than the nuts (Fig. 4). Some husks are slit down the side, whereas others form tubes that loosely hold the nuts at maturity. Approximately 90% of the nuts fall free at maturity (range, 60% to 95%). The other nuts would come out of the husks as they move through the harvester. Nut shape is round-oblate. Harvest date is the same as ‘Barcelona’, which is unfortunately not an improvement, because in many years, harvest would coincide with the start of the rainy season.

‘Dorris’ has larger nuts and kernels than ‘Yamhill’, and the kernels blanch better (Fig. 5). The kernel size of ‘Dorris’ is between ‘Lewis’ and ‘Barcelona’ (Table 2). Although average nut size is between ‘Lewis’ and ‘Barcelona’, it is not uniform. ‘Dorris’ shows more variation in nut size within a tree than many cultivars. Hazelnuts are sorted for size. Large nuts of ‘Dorris’ are suited to the in-shell market, and smaller nuts would be cracked and sold as kernels. Kernel percentage, the ratio of kernel weight to nut weight, was 43.0% for ‘Dorris’ and nearly identical to ‘Barcelona’ (42.6%) in the first trial based on well-filled nuts. Values in the second trial, based on field-run nuts, were slightly lower. The kernels are well suited for making chocolate-covered hazelnuts and other high-end products. Kernel texture and flavor are excellent and similar to the grandparent, ‘Tonda Gentile delle Langhe’, a highly regarded cultivar from the Piedmont region of northern Italy. Kernels 11 to 13 mm

Received for publication 19 Feb. 2013. Accepted for publication 24 Mar. 2013.

The OSU hazelnut breeding program is supported by State, Hatch Act and Oregon Hazelnut Commission funds and a specific cooperative agreement with the U.S. Dept. of Agriculture.

A technical paper of the Oregon Agricultural Experiment Station.

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Fig. 1. Pedigree of ‘Dorris’ hazelnut.

Table 1. Nut yields, trunk cross-sectional area, yield efficiency, and bud mite ratings of 'Dorris' in comparison with other hazelnut cultivars and selections in two trials in Corvallis, OR.

Selection	Nut yield (kg/tree) ^z					Total	TCA ^y (cm ²)	Yield efficiency ^x (kg·cm ⁻²)	BM ^w
	Third	Fourth	Fifth	Sixth	Seventh				
	2007	2008	2009	2010	2011				
First trial									
OSU 796.037	0.30	1.48	3.32	4.57	10.46	20.13	124.60	0.162	1.0
OSU 879.031	0.29	1.61	3.03	5.29	7.04	17.27	83.20	0.210	1.5
OSU 914.082	0.22	1.05	5.19	8.91	9.10	24.46	86.00	0.289	1.2
Barcelona	0.74	1.43	5.52	4.73	6.62	19.03	121.60	0.158	1.0
Clark	0.80	2.05	4.75	5.16	6.82	19.57	76.50	0.256	3.0
Dorris	0.35	3.31	4.58	4.65	7.11	20.00	71.20	0.285	1.0
Lewis	1.10	2.26	5.08	6.29	10.72	25.44	80.10	0.320	2.6
York	0.26	0.90	3.85	3.07	8.19	16.26	84.20	0.194	1.1
LSD (0.05)	0.28	0.47	1.06	1.21	1.38	2.70	17.50	0.046	0.6
Second trial	2008	2009	2010	2011	2012	Total			
OSU 833.082	0.71	2.60	2.25	5.95	2.46	13.97	68.1	0.205	
OSU 879.031	0.31	1.42	2.13	5.17	6.54	15.58	87.2	0.179	
OSU 880.027	0.29	1.13	2.44	6.54	6.71	17.11	86.9	0.198	
OSU 881.078	0.23	1.08	2.08	5.08	6.67	15.15	112.4	0.135	
OSU 894.030	0.24	1.56	2.56	6.62	8.68	19.67	99.2	0.198	
Dorris	0.42	2.84	3.30	6.51	5.70	18.78	84.0	0.225	
Jefferson	0.41	3.55	3.35	6.97	5.79	20.07	85.4	0.235	
Sacajawea	0.26	1.92	2.51	6.52	6.76	17.97	93.7	0.196	
Santiam	0.29	1.76	3.73	7.25	6.34	19.36	79.2	0.244	
Yamhill	0.78	2.79	3.88	7.34	4.94	19.73	78.5	0.249	
York	0.41	1.52	2.48	6.13	4.42	14.97	85.6	0.175	
LSD (0.05)	0.17	0.55	0.75	0.89	1.26	2.62	10.4	0.027	

^zNut yields in kg per tree, four trees per selection in the first trial, and seven trees per selection in the second.^yTrunk cross-sectional area calculated from trunk diameter 30 cm above the soil line.^xYield efficiency = total nut yield/TCA.^wSusceptibility to bud mite (primarily *Phytoptus avellanae*) was rated on four trees of each genotype in early winter on a scale of 1 (no blasted buds) to 5 (many blasted buds). Shown are mean ratings for 4 years (2008–11).

LSD = least significant difference.

in diameter are preferred for many chocolate products, but 'Dorris' kernels are larger than this. Its raw kernels are attractive and have a light brown pellicle with a moderate amount

of attached fiber. Most of the pellicle is removed from the kernels with dry heat in the blanching process. In the first trial (Table 2), the blanching rating for 'Dorris'

is better than for 'Barcelona', 'Lewis', and 'Clark'. In the second trial (Table 2), 'Dorris' and 'Sacajawea' had very good blanching scores.

Table 2. Nut weight, kernel percentage, and frequency of defects in 'Dorris', other hazelnut selections, and standard cultivars in two trials planted in Corvallis, OR.

Selection	Nut wt (g) ^z	Kernel wt	Kernel percentage ^y	Fiber ^x	Pellicle removal ^w	Frequency (%) ^v							
						Good	Blanks	Brown stain	Moldy	Shriveled	Poor fill	Twins	Black tips
First trial													
OSU 796.037	2.6	1.2	47.2	1.8	5.0	83.5	6.8	0.1	2.9	0.7	6.0	0.2	0.2
OSU 879.031	2.6	1.3	50.4	3.2	4.7	87.4	5.9	1.2	1.7	0.3	3.0	0.4	0.3
OSU 914.082	2.9	1.3	45.6	2.7	2.7	77.9	3.9	0.1	3.6	1.6	9.9	2.5	1.1
Barcelona	3.9	1.7	42.6	2.8	4.4	69.4	7.0	0.9	3.2	1.5	14.4	3.8	0.3
Clark	2.5	1.3	51.2	2.9	3.4	80.9	2.7	0.8	5.5	1.0	7.6	0.6	1.0
Dorris	3.4	1.5	43.0	2.0	2.4	79.1	7.0	0.6	3.5	0.3	8.7	0.0	1.3
Lewis	2.9	1.4	47.2	1.3	3.9	72.2	2.9	0.1	12.5	1.3	10.3	1.1	1.3
York	2.9	1.3	46.3	2.7	4.4	81.3	9.7	1.1	2.9	0.4	3.9	0.0	1.1
LSD (0.05)	0.3	0.1	1.8	0.6	0.7	7.9	5.6	1.3	4.6	1.6	7.0	1.3	1.4
Second trial													
OSU 833.082	2.7	1.1	41.3		2.6	87.0	4.4	0.0	4.0	2.8	0.7	0.5	0.6
OSU 879.031	2.3	1.2	49.0		5.2	92.7	3.7	0.4	1.0	1.0	0.6	0.3	0.3
OSU 880.027	2.4	1.2	50.7		3.8	88.0	2.7	0.0	1.0	7.5	0.5	0.0	0.3
OSU 881.078	2.4	1.0	41.0		4.5	84.7	8.9	0.0	2.1	2.8	1.1	0.1	0.3
OSU 894.030	2.2	1.0	43.9		3.1	86.7	7.6	0.2	1.1	2.7	1.4	0.1	0.3
Dorris	3.2	1.3	40.8		2.9	80.7	7.5	0.2	4.2	4.3	1.9	0.1	1.2
Jefferson	3.5	1.5	42.8		4.8	84.2	3.8	0.1	4.4	2.8	3.8	0.5	0.5
Sacajawea	2.5	1.3	51.2		2.8	87.8	3.1	0.0	3.4	3.1	1.2	0.1	1.3
Santiam	2.1	1.0	49.5		5.1	76.2	3.0	0.0	7.9	9.4	2.3	0.2	0.9
Yamhill	2.2	1.0	46.4		5.0	91.3	2.3	0.1	2.2	2.5	1.6	0.0	0.1
York	2.6	1.1	43.4		4.8	83.7	8.7	0.3	1.7	2.8	1.2	0.0	1.6
LSD (0.05)	0.2	0.1	3.0		0.7	5.6	3.6	0.9	2.2	2.7	2.3	0.5	0.9

^zNut weight, kernel weight, and kernel percentage are based on two 10-nut samples in the first trial and one 100-nut sample in the second trial. Well-filled nuts were used in the first trial and field-run nuts in the second trial.^yKernel percentage = (kernel weight/nut weight) * 100.^xFiber on pellicle rated in the first trial from 1 (none) to 4 (much).^wPellicle removal (blanching) rated on a scale of 1 (complete pellicle removal) to 7 (no pellicle removal) after roasting at 150 °C for 15 min and rubbing.^vMean frequencies of good nuts and seven types of defects are for 5 years in the first (2007–11) and second (2008–12) trials. A sample of 100 nuts was evaluated from each tree in each year.

LSD = least significant difference.

A high percentage of the nuts and kernels of 'Dorris' is marketable (Table 2). For some defects, the differences in the means lack statistical significance because of the small number of replications. 'Dorris' has a lower incidence of poorly filled nuts and doubles and a higher incidence of good kernels than 'Barcelona'. The frequency of moldy kernels is low, similar to 'Barcelona' and lower than 'Lewis' and 'Clark'. Kernel mold is a problem in 'Lewis', particularly when the weather

is cool and wet in spring and early summer. This is reflected in the average 12.5% mold in 'Lewis' over the 5 years in the first trial. In the second trial, no major defect problems were seen for 'Dorris', although 'Santiam' had a high frequency of kernel mold.

The trees set a moderate to high number of catkins that shed copious amounts of pollen late in midseason with 'York', 'Gamma', and 'Yamhill'. Pollen has been collected and used in several controlled pollinations, and both

quantity and viability appear to be very good. 'Dorris' has incompatibility alleles S_1 and S_{12} as determined by fluorescence microscopy. Both alleles are expressed in the female inflorescences and pollen, because they are codominant. 'Dorris' female inflorescences emerge in midseason. Pollenizers that shed compatible pollen in midseason and late midseason are recommended. The recommended pollenizers (and percentages of the total number of pollenizers) are 'York' ($S_2 S_{21}$) (50%), 'Gamma' ($S_2 S_{10}$) (25%), and 'Felix' ($S_{15} S_{21}$) (25%). The planting of three pollenizers that shed pollen at different times during the period that female inflorescences are receptive is recommended to increase the likelihood that they will be pollinated. The planting of pollenizers with very high resistance to EFB would eliminate the need for fungicide control in the entire orchard.

'Dorris' has complete resistance to EFB conferred by a dominant allele from 'Gasaway'. In 2005, three grafted trees of 'Dorris' were inoculated in the greenhouse with fungal spores of *Anisogramma anomala* as described by Sathuvalli et al. (2010) and all three remained free of disease, whereas seven of 16 inoculated trees of the susceptible control 'Ennis' developed cankers. Random amplified polymorphic DNA markers 152-800 and 268-580 that flank the resistance allele in 'Gasaway' (Mehlenbacher et al., 2004) are present in 'Dorris' and resistance is transmitted to half of its seedlings. Eastern filbert blight is now present throughout the Willamette Valley where 99% of the U.S. hazelnut crop is grown. Pruning to remove cankers and fungicide applications is currently used to manage the disease in orchards of 'Barcelona' and other susceptible cultivars. Like 'Yamhill', released in 2008 (Mehlenbacher

Fig. 2. Tree of 'Dorris' hazelnut in the summer, seventh leaf.

Fig. 3. Tree of 'Dorris' hazelnut in the winter, after seventh leaf.

Fig. 4. Husks of 'Dorris' hazelnut in September.

Fig. 5. Nuts, raw kernels, and blanched kernels (from top to bottom) of 'Jefferson' (left) and 'Dorris' hazelnuts.

et al., 2009), and 'Jefferson', released in 2009 (Mehlenbacher et al., 2011), 'Dorris' is suitable for planting in areas with high disease pressure.

Susceptibility to bacterial blight caused by *Xanthomonas campestris* pv. *corylina* has not been quantified, but no trees in the two trials were. Nevertheless, copper sprays to minimize damage from this pathogen are recommended.

Susceptibility to bud mite (primarily *Phytoptus avellanae* Nal.) was rated in the first trial (Table 1) after leaf fall once per year for 4 years (Dec. 2008–11). The scale was from 1 (no blasted buds) to 5 (many blasted buds). The average ratings indicate a very high level of resistance for 'Dorris' and 'Barcelona', moderate resistance for 'Lewis', and an intermediate response for 'Clark'. Blasted buds are very rare on 'Dorris', so chemical applications should not be necessary to control bud mite.

Layers generally root well, although the number of roots is less than on 'Jefferson'. Rooted layers have moderate vigor compared to 'Barcelona' and 'Jefferson'. Scions of 'Dorris' were first distributed to nurseries in Jan. 2005 under the restrictions listed in OSU Material Transfer Agreements. Nurseries and the Oregon Hazelnut Commission were annually supplied with information on the performance of 'Dorris', while it was in trials. In vitro cultures were established at OSU several years before release. The 'Dorris' cultures have performed well with multiplication rates similar to other recently released cultivars. In vitro cultures were made available to private companies for micropropagation on a commercial scale, and nurseries were instructed to increase the selection 1 year before release. 'Dorris' trees were available in small numbers for sale at the time of release. A few interested growers established trials of 'Dorris' in their orchards before release.

Availability

An application for legal protection under a U.S. Plant Patent was submitted for 'Dorris'. Interested nurseries should contact OSU. Licensing agreements will be issued to nurseries in the United States on a non-exclusive basis. Nurseries in other countries interested in an exclusive licensing agreement for a specified geographic area should contact OSU. All sales will include a royalty payment.

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