‘Jefferson’ Hazelnut

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‘Jefferson’ is a new hazelnut (Corylus avellana L.) cultivar for the in-shell market. It was released by the Oregon Agricultural Experiment Station in Jan. 2009 as a replacement for ‘Barcelona’. It combines complete resistance to eastern filbert blight (EFB) caused by the fungus Anisogramma anomala (Peck) E. Müll with high nut yield, large nut size, and good kernel quality. Compared with ‘Barcelona’, Oregon’s leading cultivar, ‘Jefferson’ has smaller trees, higher nut yield, and much higher nut yield efficiency. Pellicle removal ratings are better than ‘Barcelona’, and kernel quality is suitable for use in chocolate products and baked goods, although kernel size is larger than ideal for the kernel market. ‘Jefferson’ is recommended for Oregon’s Willamette Valley and other areas with a similar climate.

Origin

‘Jefferson’, tested as OSU 703.007, resulted from a cross of OSU 252.146 × OSU 414.062 made in 1993 by Shawn A. Mehlenbacher and David C. Smith (Fig. 1). Hybrid seeds were harvested in Aug. 1993, stratified, and the resulting seedlings grown in the greenhouse during the summer of 1994. In Oct. 1994, 144 seedlings from this cross were planted in the field. This same progeny was propagated by tie-off layerage of the suckers in the summer of 1995. ‘Jefferson’ was propagated by tie-off layerage of the suckers in the summer of 2000. The resulting trees were lined out in a nursery row the next year and then used to plant two replicated yield trials in the spring of 2002. Eight trees of each genotype were planted in the first trial and four trees of each in the second trial. The trials were located at the Smith Horticulture Research Farm in Corvallis and planted as randomized complete block designs with a single tree of each genotype in each block. ‘Lewis’, ‘Clark’, and Oregon’s leading cultivar, Barcelona, were included as checks. Several additional numbered selections were included in both trials. The name ‘Jefferson’ is in honor of the third U.S. president, who sent Meriwether Lewis and William Clark to explore the Louisiana Purchase. Mt. Jefferson is the second highest mountain in Oregon.

Description

Trunk diameter was measured 30 cm above the soil line at the end of the growing season, in Dec. 2008, and used to calculate trunk cross-sectional area (TCA). TCA provides an estimate of tree size. In the first trial (Table 1), tree size of ‘Jefferson’ was 67% of the vigorous standard ‘Barcelona’, slightly smaller than ‘Lewis’ (73%), and slightly larger than ‘Clark’ (55%). Total nut yield per tree (third to seventh leaf) was 20.38 kg for ‘Jefferson’ versus 16.94 kg for ‘Barcelona’ or 120.3% of the control. Nut yield efficiency, which adjusts for differences in tree size, was much higher for ‘Jefferson’ (0.261 kg cm–2) than for ‘Barcelona’ (0.147 kg cm–2), or 178% of the control. In the second trial (Table 1), TCA of ‘Jefferson’ was 63% of the vigorous standard ‘Barcelona’, approximately the same as ‘Clark’ (64%), and slightly smaller than ‘Lewis’ (72%). Total nut yield per tree (third to seventh leaf) was 18.9 kg for ‘Jefferson’ compared with 14.8 kg for ‘Barcelona’, or 127% of the control. Yield efficiency was much higher for ‘Jefferson’ (0.298 kg cm–2) than for ‘Barcelona’ (0.149 kg cm–2), or 201% of the control. Because kernel percentage (the ratio of kernel weight to nut weight) is slightly higher for ‘Jefferson’ (45.0%) than ‘Barcelona’ (42.9%) (Table 2), yields of kernels per hectare are expected to be much higher than for ‘Barcelona’. ‘Jefferson’ trees have a more upright growth habit than ‘Barcelona’ (Fig. 2), making them easy to train as single-trunk trees and manage in an orchard. Occasional pruning is desirable to allow sunlight to penetrate the canopy. In Oregon, orchards of the vigorous ‘Barcelona’ are planted at a spacing of 6 × 6 m. Closer spacing of trees in the orchard would be appropriate to take advantage of the higher nut yield efficiency of ‘Jefferson’. ‘Jefferson’ is suitable for planting at double density (3 × 6 m) with removal of half of the trees when the branches of neighboring trees begin to touch.

‘Jefferson’ nuts are borne in clusters of two to three in husks ≈50% longer than the nuts. Some husks are slit down the side,
Table 2. Ten-nut weight, 10-kernel weight, and ratings for fiber, pellicle removal, and bud mite susceptibility for ‘Jefferson’ and other hazelnut cultivars and selections in the second trial planted in 2002.

| Selection | 10-Nut wt (g) | 10-Kernel wt (g) | Kernel percentage | Fiber | Blanching | Bud mite rating |
|-----------|---------------|-----------------|------------------|-------|-----------|----------------|
| OSU 684.104 | 27.26 | 13.90 | 51.04 | 3.2 | 2.9 | 1.8 |
| OSU 688.012 | 28.73 | 13.38 | 46.62 | 3.0 | 3.4 | 1.0 |
| OSU 688.013 | 26.70 | 11.48 | 43.03 | 3.3 | 3.6 | 1.8 |
| OSU 713.068 | 28.75 | 13.91 | 48.36 | 2.2 | 3.9 | 1.9 |
| Barcelona | 37.89 | 16.23 | 42.93 | 2.8 | 4.5 | 1.0 |
| Clark | 25.70 | 13.03 | 50.67 | 2.7 | 3.7 | 2.7 |
| Jefferson | 36.94 | 16.61 | 45.01 | 2.8 | 4.4 | 2.4 |
| Lewis | 29.04 | 13.45 | 46.36 | 1.1 | 4.4 | 2.4 |
| Zeta | 25.92 | 12.61 | 48.69 | 2.3 | 4.7 | 1.6 |
| LSD (0.05) | 0.71 | 0.33 | | | | |

*Means for nut and kernels are over 4 years (2005–2008).

**Susceptibility to bud mite (primarily Phytophthora avellanae Nal.) 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 3 years (2006–2008). LSD = least significant difference.

Table 3. Ten-nut weight, 10-kernel weight, and ratings for fiber, pellicle removal, and bud mite susceptibility for ‘Jefferson’ and other hazelnut cultivars and selections in the second trial planted in 2002.

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Fig. 2. Tree of ‘Jefferson’ hazelnut.

Fig. 3. Blanched kernels (top), raw kernels (middle), and nuts (bottom) of ‘Barcelona’ (left column) and ‘Jefferson’ hazelnuts (right column).
Table 3. Frequency of nut and kernel defects in ‘Jefferson’ and other hazelnut cultivars and selections in two hazelnut trials planted in 2002.

| Selection      | Good* | Blanks | Brown stain | Moldy | Shrivels | Poor fill | Twins | Black tips |
|----------------|-------|--------|-------------|-------|----------|-----------|-------|------------|
| First trial    |       |        |             |       |          |           |       |            |
| OSU 688.010    | 98.4  | 1.1    | 0.0         | 0.2   | 0.6      | 4.6       | 0.0   | 0.1        |
| Barcelona      | 86.6  | 5.6    | 0.0         | 4.6   | 6.0      | 4.2       | 4.8   | 0.0        |
| Clark          | 96.1  | 1.0    | 0.1         | 1.4   | 1.5      | 4.9       | 1.0   | 0.9        |
| Jefferson      | 94.2  | 1.1    | 0.0         | 2.1   | 1.0      | 5.5       | 0.2   | 1.6        |
| Lewis          | 89.8  | 0.4    | 0.0         | 6.6   | 4.7      | 7.5       | 1.5   | 1.0        |
| LSD 0.05       | 3.5   | 1.6    | 0.2         | 1.9   | 2.6      | 3.9       | 1.2   | 1.0        |
| Second trial   |       |        |             |       |          |           |       |            |
| OSU 684.104    | 81.6  | 4.2    | 0.4         | 2.1   | 1.8      | 9.7       | 0.2   | 0.4        |
| OSU 688.012    | 84.2  | 8.7    | 0.2         | 2.0   | 0.4      | 3.6       | 0.3   | 0.6        |
| OSU 688.013    | 95.6  | 2.0    | 0.1         | 0.2   | 0.3      | 1.8       | 0.0   | 0.1        |
| OSU 713.068    | 86.8  | 3.6    | 0.1         | 0.9   | 0.9      | 7.6       | 0.0   | 0.3        |
| Barcelona      | 63.6  | 6.0    | 1.5         | 2.6   | 1.6      | 21.8      | 4.0   | 0.1        |
| Clark          | 79.6  | 2.7    | 1.8         | 3.0   | 0.8      | 11.6      | 0.6   | 0.6        |
| Jefferson      | 76.2  | 4.1    | 0.3         | 3.0   | 0.9      | 14.2      | 0.4   | 1.2        |
| Lewis          | 67.6  | 2.6    | 0.3         | 7.8   | 3.6      | 19.1      | 1.0   | 0.1        |
| Zeta           | 80.1  | 9.7    | 0.4         | 2.3   | 0.8      | 5.1       | 1.6   | 0.3        |
| LSD 0.05       | 3.8   | 1.7    | 0.5         | 1.3   | 1.1      | 3.4       | 0.8   | 0.5        |

*Means of 4 years (2005–2008).

In ‘Jefferson’ as are all RAPD markers between them. ‘Jefferson’ trees in orchards in the northern Willamette Valley adjacent to infected trees of susceptible cultivars have remained free of disease. ‘Jefferson’ is heterozygous and transmits resistance to half of its seedlings. EFB is now present throughout the Willamette Valley where 99% of the U.S. hazelnut crop is grown. Pruning to remove cankers and fungicide applications are currently used to manage the disease in orchards of ‘Barcelona’ and other susceptible cultivars. Like ‘Yamhill’, released in Jan. 2008 (Mehlenbacher et al., 2009), ‘Jefferson’ is suitable for planting in areas with high disease pressure. The response of ‘Jefferson’ to inoculation with other isolates of EFB from the eastern United States has not been tested. Inoculations to date have been only with the Oregon isolate.

Susceptibility to bacterial blight caused by Xanthomonas campestris pv. Corylina has not been quantified, but two of the four trees in the second trial appear to have been affected. They had a stressed appearance at the end of the growing season, and one tree showed liquid oozing from a crack where a large scaffold limb joined the main trunk. Several siblings in the original seedling block showed shoot dieback, which is a typical symptom of bacterial blight. Shoot dieback was being noted in some ‘Jefferson’ plantings in grower orchards, particularly after the cool, wet spring of 2008. These observations indicate a level of susceptibility comparable to the standard ‘Barcelona’. Copper sprays to minimize damage from this pathogen are recommended.

Susceptibility to bud mite (primarily Phytophthora Avellanae, Nal.) was rated in the second replicated trial (Table 2) after leaf fall once per year for 3 years (Dec. 2006–2008). The scale was from 1 (no blasted buds) to 5 (many blasted buds). The average ratings indicate a high level of resistance for ‘Jefferson’ (1.08) and ‘Barcelona’ (1.00), moderate resistance for ‘Lewis’ (2.40), and an intermediate response for ‘Clark’ (2.73). Because blasted buds are very rare on ‘Jefferson’, chemical applications should not be necessary to control bud mite.

Layers generally root easily and abundantly. Rooted layers are vigorous and similar in height and caliper to those of ‘Barcelona’. Scions of ‘Jefferson’ were first distributed to nurseries in January 2002 and annual updates provided subsequently. Nurseries were instructed to propagate additional trees 1 year before the formal release of ‘Jefferson’. In vitro cultures of ‘Jefferson’ were first established at Oregon State University (OSU) in 2002. The cultures have performed very well with multiplication rates higher than for most other cultivars. Cultures were made available to private companies for micropropagation on a commercial scale. Several interested growers established trials of ‘Jefferson’ in their orchards before its release. Many orchards have been established in the Willamette Valley using micropropagated trees.

**Availability**

‘Jefferson’ was released as a public cultivar and may be propagated in the United States without restriction. A list of micropropagators and nurseries, and small quantities of scion wood, may be obtained from S.A. Mehlenbacher. A licensing agreement between OSU and Viveros Nefuen Ltda. (Hijuelas, Chile) granted that company the exclusive right to propagate and sell trees of ‘Jefferson’ in South America. Legal protection is being sought in Chile, and OSU reserves the right to seek legal protection in other countries for a period of 6 years after release. Nurseries in other countries interested in a licensing agreement for ‘Jefferson’ should contact the Technology Transfer Office at OSU.

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