UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Services
Washington, D.C

NOTICE OF RELEASE OF USDA ARS VERA HOP VARIETY

The Agricultural Research Service (ARS) announces the release of a new aroma hop variety, 'USDA-ARS Vera' (*Humulus lupulus* L.). Notable characteristics of USDA-ARS Vera hop include: a complex, tropical, stone-fruit, and citrus aroma that is consistent between the dry rub and final beer, and resistance to the prevalent races of the causal pathogen of hop powdery mildew (*Podosphaera macularis*) presently in the Pacific Northwest (PNW) hop production region of the U.S.

USDA-ARS Vera originated from a former Washington State University (WSU) hop breeding program in Prosser, WA and was evaluated in its final stages by USDA-ARS as part of a material transfer agreement. USDA-ARS Vera is a diploid, female hop which resulted from a bi-parental cross made in 2011 between 'Brewers Gold' (PI 302781; Wild Manitoba BB1 x OP) and a powdery mildew resistant male hop 'USDA 64103M' (PI 302777; Wild American x OP) of Wild American descent. USDA-ARS Vera was tested under the experimental name W1108-333 and later as Hop Research Council 003 (or HRC003).

USDA-ARS Vera initially gained interest among industry stakeholders due to its aroma profile. It consistently ranked highly among other experimental public hops in annual data-gathering sensory events. This inspired the establishment of two, 0.8-ha on-farm commercial trials that were initiated in 2022 in WA and ID. Yield of USDA-ARS Vera ranged from 1723-3049 kg/ha when mature (2+ years). As a comparison, statewide average hop yields in WA and ID for those years ranged from 2014 - 2396 kg/ha. USDA-ARS Vera's yields were markedly lower in the first year of production (112-336 kg/ha). The yield trends on-farm were consistent when compared with values obtained in small plot trials in Prosser, WA in 2023 and 2024, where yields were low in the first year (294 kg/ha) and higher in the second (1890 kg/ha), where in both years USDA-ARS Vera yielded statistically similar to 'Cascade', but less than 'Zeus' commercial checks (alpha = 0.05). USDA-ARS Vera is an aroma hop with low alpha-acids (3.79 in small plot trials, where it was statistically similar to Cascade, and 5.44% on-farm), moderate beta acids (4.59% in small plot trials, and 4.65% on-farm), and is mid-late maturing (median harvest date 19 September in the Pacific Northwest). USDA-ARS Vera produced 0.814 mL/100g oil in small plot trials and 1.31 mL/100g on-farm. Based on small-plot trials, USDA-ARS Vera has significantly higher percent co-humulone in the alpha acids (45%), and higher terpene content of linalool (0.85%), farnesene (19.3%), and lower caryophyllene (3.98%) compared with Cascade and Zeus. Humuluene (10%) and geraniol (0.58%) were similar to Cascade, and myrcene (42.5%), and b-pinene (0.65%) were similar to both Cascade and Zeus.

Powdery mildew was never observed in field evaluations. Under laboratory conditions, USDA-ARS Vera showed resistance when inoculated with representative isolates of the hop powdery mildew fungus with complex virulence including HPM-609 (virulence Vb, V3, V4, V5, V6, HPM-1084 (virulence Vb, V3, V5, and Cascade-adaptation), and HPM-200 (virulence Vb, V1, V3). USDA-ARS Vera was susceptible when inoculated with HPM-204 (virulence Vb, V1, V2, V3, V5). This suggests that USDA-ARS Vera putatively possesses the R2 form of resistance, consistent with its male parent, USDA-64013M. Only trace levels of hop downy mildew (caused by *Pseudoperonospora humuli*) were observed in experimental plots in Prosser, WA. USDA-ARS Vera was not tested on a large scale in OR where hop downy mildew is endemic but was

evaluated under controlled environment conditions for foliar susceptibility to hop downy mildew. USDA-ARS Vera showed moderate susceptibility that was significantly lower when compared with 'Nugget' and 'Pacific Gem' susceptible checks. Vera was not specifically evaluated for arthropod pest resistance under controlled conditions. No serious pest issues were observed in WA and ID during the on-farm or experiment station trials and hop aphid (*Phorodon humuli*) and twospotted spider mites (*Tetranychus urticae*) were controlled with minimal chemical inputs.

The aroma profile of USDA-ARS Vera, as described by brewers in dry-rub analyses, is tropical, stone fruit, and citrus and the hop ranked first place in two consecutive years in sensory analyses of approximately 30 experimental public lines in 2022 and 2023. In 2023, USDA-Vera ranked ahead of commercial check lots of 'Chinook', 'Comet', and 'Cashmere' (hedonic scores of 7.68, 7.00, 6.56, and 6.30, respectively), and in 2022 ahead of commercial check lots of 'Vista' and 'Cashmere' (hedonic scores of 7.24, 6.93 and 6.80). USDA-ARS Vera has been primarily evaluated by brewers in pale ales and lagers and the most common descriptors used to describe the beer include tropical, citrus, stone fruit, and floral (average hedonic scores of 6.23, 6.34 and 6.17).

The release of USDA-ARS Vera provides brewers and growers a new, publicly available aroma hop variety with powdery mildew resistance that is free of intellectual property rights restrictions and offers new market opportunities and germplasm for use by the industry. With the support of many industry partners, USDA-ARS Vera represents one of several products to emerge from the large-scale effort to evaluate, release, and utilize beneficial germplasm from a former WSU breeding program to benefit the industry and the public. Certified virus and viroid-free plant material has been deposited in the National Plant Germplasm System at the USDA-ARS Pacific West Area National Clonal Germplasm Repository in Corvallis, OR under the PI no 707888 and from the Clean Plant Center Northwest in Prosser, WA. The material will be available for commercial production, research purposes, and the breeding and development and commercialization of new cultivars. It is requested that the appropriate recognition be given if this germplasm contributes to the development of a new breeding line or cultivar. Requests for germplasm should be made via the Germplasm Resources Information Network website (https://www.ars-grin.gov/).

ARS GIVES NO WARRANTIES OR GUARANTEES, EXPRESSED OR IMPLIED FOR THE MATERAL, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Signatures:

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Deputy Administrator, Crop Production and Protection — Date
Agricultural Research Service, U.S. Department of Agriculture