

‘USDA-Spiers’ Rabbiteye Blueberry

Stephen J. Stringer

US Department of Agriculture, Agricultural Research Service, Thad Cochran Southern Horticulture Laboratory, 810 Highway 26 W., Poplarville, MS 39470, USA

Arlen D. Draper

US Department of Agriculture, Agricultural Research Service, 604 East Park Drive, Payson AZ 85541, USA

Blair J. Sampson, Hamidou F. Sakhanokho, and Ebrahiem Babiker

US Department of Agriculture, Agricultural Research Service, Thad Cochran Southern Horticulture Laboratory, 810 Highway 26 W., Poplarville, MS 39470, USA

Keywords. blueberry breeding, interspecific hybrid, *Vaccinium virgatum*

Blueberries are a highly valuable specialty crop in the United States with a market value exceeding \$900 million in 2019 [US Department of Agriculture (USDA) National Agricultural Statistics Service 2019]. Production from the southeastern United States, primarily from the rabbiteye blueberry (*Vaccinium virgatum*, Aiton), accounts for approximately a third of that market (Draper 1997). At the beginning of the 20th century, commercial rabbiteye blueberry production involved plantings of land races that were harvested for shipment to the northeastern United States (Ballington 2001). Increasing demand for southern-grown fresh market blueberries created the opportunity to develop a new specialty crop industry and subsequently the need for improved rabbiteye blueberry cultivars. In the early- to mid-1900s, rabbiteye blueberry breeding programs were established at the USDA Agricultural Research Service (USDA-ARS) followed by North Carolina State University in the 1930s and the University of Georgia in 1945, and by the early 1960s, new rabbiteye blueberry cultivars were in commercial production (Hancock 2006). The range of modern commercial plantings of the rabbiteye blueberry in the United States currently extends from east Texas to southern Virginia and to the Pacific Northwest (Ehlenfeldt et al. 2015). To capitalize on a relatively narrow market window, rabbiteye cultivars are frequently hand-harvested for the more lucrative fresh berry market while later ripening berries are mechanically harvested and sold for processing. Over the past few decades, blueberry production from new plantings of early ripening southern highbush blueberry cultivars (*Vaccinium corymbosum*, L. interspecific hybrid, $2n = 4x = 48$) in more

temperate regions of the United States, as well as Central and South America, have eroded the rabbiteye blueberry’s niche in the fresh berry market (Lobos and Hancock 2015), making earlier ripening rabbiteye cultivars more desirable. ‘USDA-Spiers’ is a new early ripening rabbiteye blueberry cultivar for the fresh berry market that has bloomed sufficiently late in southern Mississippi to avoid late-spring frost injury, but still develop berries as early as mid-May. It is also characterized by improved berry qualities relative to most other earlier ripening cultivars, including very firm, medium-to-large, light-blue berries with very good flavor. This new blueberry is productive when mature; however, plants grow more slowly than most other rabbiteye cultivars. Unlike most southern highbush blueberry cultivars, USDA-Spiers has exhibited very good adaptation and survival in the native soils and climatic conditions of the upper Gulf Coast.

Origin

‘USDA-Spiers’, tested as MS 794, is a new hexaploid rabbiteye blueberry (*V. virgatum* Aiton, $2n = 6x = 72$, syn. *Vaccinium ashei* Reade) derived from a series of hybridizations among rabbiteye blueberry cultivars and selections (Fig. 1). ‘USDA-Spiers’ came from a cross made in Poplarville, MS, in 1996 by A.D. Draper. Seedlings from the cross were established in field plots at Perkinston, MS (lat. $30^{\circ}46'56''$ N, long. $-89^{\circ}08'34''$ W), where ‘USDA-Spiers’ was selected by A.D. Draper in 1999.

Description

‘USDA-Spiers’ produces an abundance of medium-to-large (greater than 2.0 g), attractive, light-blue, and very firm berries with resistance to rain-induced splitting. Mature ‘USDA-Spiers’ bushes are moderately spreading with narrow crowns, and compared with most rabbiteye blueberry cultivars, grow more slowly, and require little pruning to manage excessive vegetative growth. Twelve-year-old ‘USDA-Spiers’ plants at Perkinston, MS, had

an average height and width of 1.82 and 1.56 m, respectively, and are significantly shorter than most other rabbiteye cultivars. Plants leaf normally in the spring, even after mild winters, and mature plants often develop berries on long racemes on the perimeter of the bush’s leaf canopy (Fig. 2). In southern Mississippi, ‘USDA-Spiers’ flowers in early- to mid-March and berries ripen in late May to mid-June. Comparisons of flowering dates with that of known cultivars suggest that ‘USDA-Spiers’ has a chilling requirement ~ 400 h below 7°C . ‘USDA-Spiers’ propagates readily from both softwood cuttings taken in late spring and the new growth of late summer, as well as hardwood cuttings in the winter. ‘USDA-Spiers’ should be planted with other rabbiteye blueberries having similar bloom periods to obtain optimum pollination and fruit set and is expected to perform well in hardiness zones 8a to 9a where rabbiteye blueberries are grown. ‘USDA-Spiers’ was named in honor of Dr. James M. Spiers who conducted blueberry research aiding in establishing the rabbiteye blueberry industry along the US Gulf Coast and who was the founding Research Leader at the USDA-ARS Small Fruits Research Station and the USDA-ARS Thad Cochran Southern Horticultural Laboratory in Poplarville, MS.

Performance

Plant and berry attributes of mature plants of ‘USDA-Spiers’ and three widely grown early to midseason rabbiteye blueberry cultivars, Brightwell, Climax, and Premier, were evaluated over seven seasons from 2015 to 2021 at Perkinston, MS, and at Poplarville, MS (lat. 30.8402°N , long. 89.5342°W). Plants were established and maintained at these sites beginning in 2002 and 2006, respectively, and grown following guidelines for Mississippi blueberries (Braswell et al. 2009). Plants of ‘USDA-Spiers’ were planted on raised beds in acidic soils (pH 5.2 and 4.9, respectively) amended with ~ 1 kg peatmoss in each 0.5×0.5 -m planting hole spaced at 1-m intervals. Raised beds were amended with 200 kg of pine bark per hectare. Mature plants were mulched with pine bark, watered ~ 12 h per week by drip irrigation, and fertilized with a total of 37.3 kg N, 13.1 kg P, and 13.1 kg K each season.

Observations on dates of 50% bloom and ripening of ‘USDA-Spiers’ and select rabbiteye blueberry cultivars were taken from two three-bush replications at both locations each year. As was widely demonstrated in southern Mississippi, early flowering times may predispose flowers and developing berries to late-spring frost injury, and typically bushes that bloom after mid-March are less likely to sustain such injury. At Perkinston, MS, ‘USDA-Spiers’ 50% bloom date was comparable to that of ‘Premier’ and ‘Climax’ but earlier than ‘Brightwell’ (Table 1). Ripening of ‘USDA-Spiers’ berries was intermediate between ‘Climax’ and ‘Premier’ but somewhat earlier than ‘Brightwell’. Both productivity and vigor of ‘USDA-Spiers’ were less than of Brightwell but equal to or

Received for publication 12 Dec 2022. Accepted for publication 16 Jan 2023.

Published online 16 Feb 2023.

A.D.D. is retired.

S.J.S. is the corresponding author. E-mail: stephen.stringer@usda.gov.

This is an open access article distributed under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by-nc-nd/4.0/>).

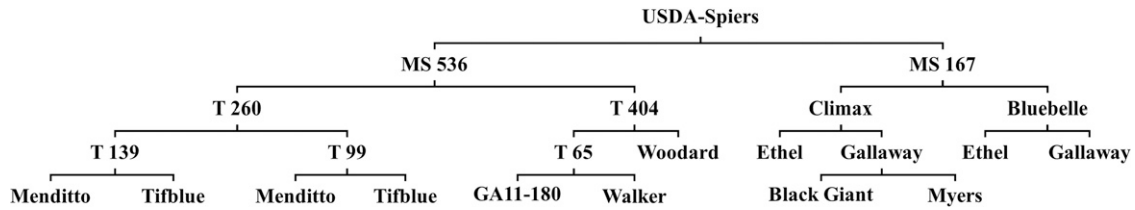


Fig. 1. Pedigree of 'USDA-Spiers' rabbiteye blueberry.



Fig. 2. Fruit of 'USDA-Spiers'.

Table 1. Observations on fruit and plant characteristics of 'USDA-Spiers' and selected rabbiteye blueberry cultivars at Perkinston, MS, 2015–22.

Cultivar	50% Date (\pm days)		Plant			Berry	
	Bloom	Ripening	Crop ⁱ	Vigor	Color	Scar	Flavor
USDA-Spiers	13 Mar \pm 3.4 ⁱⁱ	10 Jun \pm 3.3	8.1 \pm 0.1	7.4 \pm 0.2	8.1 \pm 0.1	7.4 \pm 0.2	8.1 \pm 0.1
Brightwell	17 Mar \pm 1.9	14 Jun \pm 3.0	8.2 \pm 0.1	7.9 \pm 0.01	7.8 \pm 0.2	7.8 \pm 0.2	7.9 \pm 0.1
Climax	14 Mar \pm 2.4	6 Jun \pm 2.6	7.1 \pm 0.1	7.3 \pm 0.1	7.9 \pm 0.1	7.9 \pm 0.1	7.9 \pm 0.1
Premier	13 Mar \pm 2.9	7 Jun \pm 4.9	7.3 \pm 0.1	7.4 \pm 0.2	7.8 \pm 0.2	7.8 \pm 0.2	7.9 \pm 0.1

ⁱ Ratings are based on subjective scores ranging from 1 to 10, with 1 being the least desirable and 10 being the most desirable. A value of 6 to 7 is considered the minimum acceptable rating for a commercial blueberry cultivar.

ⁱⁱ Values are means \pm SE with $n = 8$.

slightly greater than that of other cultivars. Observations on berry color and flavor showed that 'USDA-Spiers' was comparable to the other cultivars, and although picking scars were larger, they were acceptable.

Most bushes at the Poplarville location bloom earlier than those at Perkinston and 50% bloom dates of 'USDA-Spiers', 'Climax', and 'Premier' occurred in the first week of March, whereas the blooming of 'Brightwell' was nearly 2 weeks later (Table 2). 'USDA-Spiers' berries ripened a week earlier than 'Premier', and 2 to 3 weeks earlier than 'Climax' and

'Brightwell', respectively. Productivity and plant vigor were again comparable to that of 'Climax' and 'Premier', but less than 'Brightwell', whereas its color and flavor were consistently good and noticeably more acceptable.

Laboratory measurements of several berry quality attributes were also made from berry samples harvested from two three-plant replicates each season at Perkinston, MS, from 2015 through 2021. Berries were hand-harvested, chilled to remove field heat, and transported to the laboratory for quality evaluations the following day. Measurements of

Table 2. Observations on fruit and plant characteristics of USDA-Spiers and selected rabbiteye blueberry cultivars at Poplarville, MS, 2015–22.

Cultivar	50% Date (\pm days)		Plant			Berry	
	Bloom	Ripening	Crop ⁱ	Vigor	Color	Scar	Flavor
USDA-Spiers	5 Mar \pm 3.5 ⁱⁱ	27 May \pm 3.0	7.6 \pm 0.2	7.3 \pm 0.2	8.1 \pm 0.1	7.4 \pm 0.2	8.1 \pm 0.1
Brightwell	17 Mar \pm 1.9	13 Jun \pm 3.0	8.1 \pm 0.1	8.1 \pm 0.1	8 \pm 0.1	7.9 \pm 0.1	8.1 \pm 0.1
Climax	6 Mar \pm 2.6	10 Jun \pm 4.0	7.3 \pm 0.1	7.6 \pm 0.1	7.9 \pm 0.1	7.9 \pm 0.1	7.9 \pm 0.1
Premier	7 Mar \pm 3.1	2 Jun \pm 4.9	7.3 \pm 0.1	7.8 \pm 0.2	7.8 \pm 0.1	7.8 \pm 0.2	7.8 \pm 0.1

ⁱ Ratings are based on subjective scores ranging from 1 to 10, with 1 being the least desirable and 10 being the most desirable. A value of 6 to 7 is considered the minimum acceptable rating for a commercial blueberry cultivar.

ⁱⁱ Values are means \pm SE with $n = 8$.

several important fresh berry quality attributes, including berry weight, soluble solids content, pH, firmness, and physiological splitting tendencies, were made from samples from composites of three replications each year. Berry weight of 'USDA-Spiers', determined from averaging weight of 30 berries, was larger than each of the comparison rabbiteye cultivars (Table 3). Soluble solids content was determined from juice extracted from a 40-g berry sample placed into a commercial Waring® blender (Dynamics Corp. of America, Hartford, CT) and strained through cheesecloth. A hand-held temperature-compensating refractometer (Leica Microsystems AR 200, Wetzlar, Germany) was used to determine soluble solids content (Brix°), and pH was measured using an AR20pH/conductivity meter (Thermo Fisher Scientific Corp., Waltham, MA). Except for 'Climax', 'USDA-Spiers' had higher soluble solids content than the other two rabbiteye blueberries, and although pH and TA were lower, were well-balanced with sugars (Table 3). Firmness was measured from 20 berry samples placed onto a Firmtech II (Bio-Works Corp, Stillwater, OK), an apparatus that measures firmness in terms of grams per millimeter of deflection. 'USDA-Spiers' berries were substantially firmer than all other cultivars tested. Tendencies for berry splitting, measured by soaking 30 to 50 fully ripe berries from each sample in distilled water for 24 h and counting the number of split berries (Marshall et al. 2007), were substantially less for 'USDA-Spiers' than the other cultivars as well.

Growers and nurserymen should consider that bushes of 'USDA-Spiers' grow more slowly than other cultivars. Softwood cuttings taken in spring and late summer, as well as hardwood cuttings taken in winter, propagate readily. 'USDA-Spiers' has shown good longevity in fields in southern Mississippi and no diseases have been observed. This new early ripening fresh market blueberry cultivar should be considered for trial plantings where rabbiteye blueberries have been successfully grown, but commercial growers should be prepared to periodically protect blooms and developing berries from early spring frost injury. Because rabbiteye blueberries are not self-fertile, 'USDA-Spiers' should be interplanted with other rabbiteye blueberry cultivars to optimize cross-pollination and fruit set. Although 'USDA-Spiers' matures slower than many rabbiteye cultivars, when mature it is productive with high-quality fruit. It is intended for use by

Table 3. Berry quality attributes of USDA-Spiers and selected rabbiteye blueberry cultivars at Perkinston, MS, 2015–21.

Cultivar	Berry weight (g) ⁱ	pH	Soluble solids (Brix°)	Firmness ⁱⁱ	Split berries (%) ⁱⁱⁱ
USDA-Spiers	2.1 ± 0.1 ^{iv}	3.1 ± 0.1	13.9 ± 0.4	255.9 ± 10.9	0.8 ± 0.7
Brightwell	1.9 ± 0.1	3.4 ± 0.1	13.1 ± 0.5	206.5 ± 11.7	8.3 ± 2.8
Climax	1.7 ± 0.1	3.4 ± 0.1	14.3 ± 1.1	225.0 ± 12.5	9.2 ± 3.3
Premier	1.8 ± 0.1	3.4 ± 0.7	13.2 ± 0.5	198.6 ± 14.4	6.7 ± 5.01

ⁱ Average weight of 30 berries.

ⁱⁱ Rate (g/mm) at which force required to compress berries increases.

ⁱⁱⁱ Percentage of split berries following 24 h distilled water soaking.

^{iv} Values are means ± SE with n = 7.

gardeners and commercial growers in the Gulf Coast region of the United States who desire an early ripening blueberry for the fresh market.

Availability

‘USDA-Spiers’ is a public domain blueberry cultivar. A limited supply of rooted cuttings and cutting wood is available to certified nurserymen. Written requests for plant materials should be sent to either Dr. Stephen Stringer or Dr. Ebrahiem Babiker, USDA-

ARS Thad Cochran Southern Horticultural Laboratory, P.O. Box 287, Poplarville, MS 39470. Genetic materials of this release are deposited in the National Plant Germplasm Repository at Corvallis, OR, where they are available for research and commercial development.

References Cited

Ballington JR. 2001. Collection, utilization, and preservation of genetic resources in *Vaccinium*. *HortScience*. 36(2):206–213. <https://doi.org/10.21273/HORTSCI.36.2.206>.

Braswell J, Stringer SJ, Sampson BJ, Ingram DM. 2009. Establishment and maintenance of blueberries. MS State Coop. Ext. Ser. Pub. 1758.

Draper AD. 1997. Blueberry breeding for the southern United States. *HortScience*. 32(4):597B. <https://doi.org/10.21273/HORTSCI.32.4.597B>.

Ehlenfeldt MK, Martin RB, Rowland JK. 2015. ‘Nocturne’ hybrid blueberry, a winter hardy, mixed species hexaploidy with ornamental landscape and novel fruit quality. *HortScience*. 50(12):1825–1827. <https://doi.org/10.21273/HORTSCI.50.12.1825>.

Hancock JF. 2006. Highbush blueberry breeders. *HortScience*. 41(1):20–21. <https://doi.org/10.21273/HORTSCI.41.1.20>.

Lobos GA, Hancock JF. 2015. Breeding blueberries for a changing global environment: A review. *Front Plant Sci*. 6:782. <https://doi.org/10.3389/fpls.2015.00782>.

Marshall DA, Spiers JM, Stringer SJ, Kurry KJ. 2007. Laboratory method to estimate rain-induced splitting in cultivated blueberries. *HortScience*. 42(7):1551–1553. <https://doi.org/10.21273/HORTSCI.42.7.1551>.

US Department of Agriculture, National Agricultural Statistics Service. 2019. Blueberry report 2019. https://www.nass.usda.gov/Statistics_by_State/New_Jersey/Publications/Blueberry_Statistics/. [accessed 12 Sep 2022].