

# ‘Ouachita’ Thornless Blackberry

John R. Clark<sup>1</sup> and James N. Moore<sup>2</sup>

Department of Horticulture, University of Arkansas, Fayetteville, AR 72701

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‘Ouachita’ is the eleventh release in a series of erect-growing, high-quality, productive, floricanne-fruited blackberry (*Rubus* L. subgenus *Rubus* Watson) cultivars developed by the University of Arkansas. It is the fourth thornless, erect cultivar released. ‘Ouachita’ ripens between the Arkansas thornless cultivars ‘Arapaho’ (Moore and Clark, 1993) and ‘Navaho’ (Moore and Clark, 1989), produces larger fruit than these cultivars, and yields as high as or higher than these cultivars and ‘Apache’ (Clark and Moore, 1999).

## Origin

‘Ouachita’ resulted from a cross of ‘Navaho’ × Ark.1506 made in 1990 (Fig. 1). The original plant was selected in 1993 from a seedling field at the University of Arkansas Fruit Substation, Clarksville, and tested as selection A-1905. The most thorough testing of ‘Ouachita’ has been at this location.

## Description and Performance

A single, 6.1-m plot was established at Clarksville [west-central Arkansas, lat. 35°31’58”N and long. 93°24’12”W; U.S. Dept. of Agriculture (USDA) hardiness zone 7a; soil type Linker fine sandy loam (Typic Hapludults)] in 1993 and observational data were taken on ‘Ouachita’ on this plot after fruiting began in 1995 and continued through 2002. Plots of comparative cultivars ‘Arapaho’, ‘Navaho’, and ‘Apache’ were also present in this planting and observational data were collected on these during this evaluation period. In all plantings, standard cultural practices for erect blackberry production were used including annual preemergence and postemergence herbicide applications, annual spring nitrogen fertilization (56 kg·ha<sup>-1</sup> N) using ammonium nitrate, summer tipping of primocanes at 1.1 m, and dormant pruning. All plantings received a single application of liquid lime sulfur (94 L·ha<sup>-1</sup>) at budbreak for control of anthracnose

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<sup>1</sup>Professor.

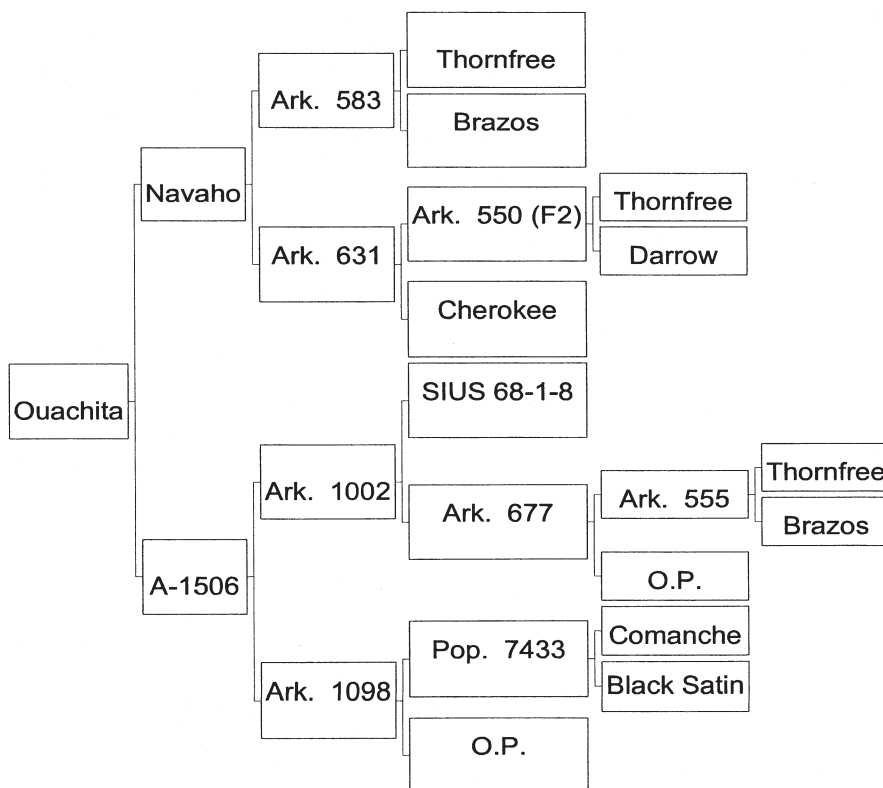
<sup>2</sup>Distinguished professor emeritus.

[*Elsinoë veneta* (Burkh.) Jenkins] and this was the only fungicide applied to any plantings in any year.

Data collected included soluble solids concentration [based on a 25-berry sample collected once each season for 7 years (1995 and 1997–2002) using a hand-held refractometer]. Also, fruit ratings were taken based on a rating scale of 1 to 10, where 10= best, for 8 years for firmness (as measured subjectively by hand in the field on 8 to 10 berries, with rating of 10 indicating very firm) and flavor (subjectively rated by tasting berries in the field). Plant ratings for vigor (1 to 10 with a rating of 7 to 10 acceptable), health (1 to 10 with 10 = excellent health), and erectness (1 to 10 with 10 = very erect) were conducted one time each year for 8 years (1995–2002) during the fruiting season. All ratings were done by either J.R.C. or J.N.M. Winter injury was evaluated (seen as bud or cane injury) each year at the time of fruiting. Additionally, replicated trials were established at research stations in Clarksville (Fruit Substation), Hope (Southwest Research and Extension Center) [southwestern Arkansas, lat. 33°42’30” and long. 93°33’0”]; USDA hardiness zone 8a, soil type Bowie fine sandy loam (Fragic Paludults)] and Fayetteville (Arkansas Agricultural Research and Extension Center) [northwestern

Arkansas, lat. 36°5’47”N, long. 94°10’29”W, USDA hardiness zone 6b, soil type Captina silt loam (Typic Fragiudults)], Ark., in 1996 and 1999. These trials consisted of two or four replications in the 1996 planting (two replications for ‘Ouachita’ and four replications of the comparison cultivars), and four replications in the 1999 planting. Plots in both trials were 3.1 m in length containing five plants produced from root cuttings per replication spaced at 0.6-m intervals. ‘Apache’, ‘Arapaho’, and ‘Navaho’ were included for comparison in the 1996 trial and all but ‘Navaho’ were included in the 1999 trial. Data for 10% and 50% bloom, and first, peak, and last harvest dates were recorded for 1997–99 for the 1996 trial and for 2000–02 for the 1999 trial and averaged for each trial at Clarksville. Twenty five berries were collected from the two or four replications (depending on cultivar) at Clarksville on one harvest date in 1998. Seeds (endocarps) were extracted from the berries using a blender, and 100-seed samples were weighed (fresh weight after only surface drying of the seeds, and dry weights after heating at 70 °C for 24 h). Berry weight (average for 25 berries/replicate on each harvest date at each location, with the average for each replicate for the season being used in the analysis) and total yield data from the replicated plantings for 1997–99 and 2000–02 for all locations were analyzed as a randomized complete block separately by year and location by the GLM procedure of SAS (SAS Institute, 1989). Seed weight data from 1998 from Clarksville only were analyzed as a randomized complete block. All mean separation was by *t* test (*P* < 0.05).

Fig. 1. Pedigree of ‘Ouachita’ thornless blackberry.



'Ouachita' produced yields comparable to or higher than 'Apache' or 'Navaho' in 13 of 15 mean comparisons from the two replicated trials (Tables 1 and 2). It exceeded the yield of 'Arapaho' in most comparisons. 'Ouachita' performed well at all three locations in Arkansas; Hope, Clarksville, and Fayetteville.

Average berry weight of 'Ouachita' ranged from a high of 6.8 g to a low of 4.5 g (Table 2). Across all locations and years the average fruit weight for 'Ouachita' was 5.8 g compared to 4.7 g for 'Arapaho', 4.1 g for 'Navaho', and 8.1 g for 'Apache'. 'Ouachita' was also observed to retain its fruit weight later into the harvest season than 'Navaho' (data not shown).

Fruit of 'Ouachita' are blocky and conical and very attractive with an exceptional glossy, black finish. Fruit firmness rated in the field at maturity of 'Ouachita' was slightly less than that of 'Navaho' but comparable to that of 'Apache' and 'Arapaho' (Table 3). Soluble solids concentration over 7 years averaged 9.9% for 'Ouachita', 11.9% for 'Navaho', 11.1% for 'Apache' and 8.2% for 'Arapaho' (Table 3). Soluble solids values for 'Ouachita' for several years were 10% to 11%, 'Ouachita' soluble solids were higher in one year, 1997, compared to 'Navaho'. This is noteworthy in that 'Navaho' is considered the sweetest of the Arkansas cultivars. Flavor rating for 'Ouachita' averaged 8.4, near that of 'Apache' and 'Navaho', and exceeding that of 'Arapaho'. Postharvest evaluations indicated that 'Ouachita' stored comparably to 'Navaho' when held at 5 °C for 7 d (Penelope Perkins-Veazie, personal communication). This is noteworthy since 'Navaho' berries are considered to have exceptional shelf life berry (Perkins-Veazie et al., 1999). 'Ouachita' is expected to perform well in commercial shipping use also based on this comparison. Fresh seed weight of 'Ouachita' was significantly heavier than 'Arapaho', similar to 'Navaho', and less than that of 'Apache' (Table 3). Dry seed weights had similar trends. Seed weights are provided to give some reflection of seed size which is very important to some consumers in that smaller seeds are usually preferred.

'Ouachita' began bloom the same date as 'Apache', a day later than 'Arapaho', and 2 d earlier than 'Navaho' (Table 3). Fifty percent bloom was comparable to 'Navaho', 2 d later than 'Apache' and 0 to 3 d later than 'Arapaho' (Table 3). First harvest date for 'Ouachita' was June 12 or 13, 6 to 8 d after 'Arapaho', 7 d before 'Navaho', and 6 to 9 d before 'Apache'. Peak and last harvest dates had similar trends (Table 3). 'Arapaho' often has a shorter harvest period than the other cultivars, and this can result in a reduction in fruit available between 'Arapaho' and 'Navaho'. 'Ouachita' ripens between these two cultivars and should contribute to a more steady and continuous supply of fruit for harvest, a key issue for labor and marketing management.

Canes of 'Ouachita' are thornless, and are very erect. Average erectness ratings for 'Ouachita' surpassed those of 'Navaho' and 'Arapaho' but not 'Apache' (Table 3). If primocanes are tipped at 1.1 m to control length and encourage lateral branching, 'Ouachita'

can be grown in a hedgerow without trellis support. However, support of floricanes during fruiting is valuable; it can reduce canes from falling over due to wind or unusually heavy crop loads. Vigor rating of 'Ouachita' was higher than 'Arapaho' and 'Navaho' but not as high as 'Apache' (Table 3). Average health rating for 'Ouachita' was very good, surpassing that of 'Arapaho', but not 'Apache' nor 'Navaho'. In some years, health was rated lower due to upward leaf curling of primocane leaves. This was noted during several years. The concern was that this could be a symptom of susceptibility to powdery mildew [caused by *Sphaerotheca macularis* (Wallr.:Fr.) Lind]. However, no mycelia or stunting of leaf growth were observed on 'Ouachita', even when powdery mildew was present on other genotypes in the selection evaluation planting. Therefore, this concern appears unfounded and health ratings probably should have been higher for 'Ouachita'. No orange rust [caused by *Gymnoconia nitens* (Shwein.) F. Kern & H.W. Thurston] has been observed on 'Ouachita' in any evaluations, even though infected plants have been seen within 30 m of plots of 'Ouachita'. However, one of the parents of 'Ouachita', 'Navaho', is susceptible to orange rust, so evaluators or growers of 'Ouachita' should be aware of this relationship and possible susceptibility. 'Ouachita' is moderately resistant to anthracnose, as only a small amount of anthracnose was noted on berries in 2 of 8 years in the selection observation planting

in evaluations where a single spray of lime sulfur was applied. Fruit and cane anthracnose was observed only one time in the numerous replicated plantings. Reaction of 'Ouachita' to rosette/double blossom [*Cercospora rubi* (Wint.) Plakidas] was evaluated at the Calhoun Research Station of Louisiana State University, Calhoun, La. by Blair Buckley, in a planting where the disease pressure is very high. 'Ouachita', like 'Apache' and 'Navaho' had no incidence of this disease. By contrast, the disease incidence was 100% on canes of the thorny cultivars Shawnee and Kiowa (data not shown nor published). Therefore, 'Ouachita' holds promise for production in areas where this disease is limiting.

In recent years at test sites in Arkansas, white drupelets have been observed on some blackberry genotypes near or at fruit maturity, and has been most severe on 'Apache'. This damage has been attributed to eastern flower thrips (*Frankliniella tritici* Fitch), brown stink bug (*Euschistus servus* Say), green stink bug (*Acrosternum hilare* Say) (Donn Johnson, personal communication) and/or sunburn. In 2002, the incidence of this was quite severe. In repeated trials, 'Ouachita' was observed to have no white drupes while incidence of this was very high for 'Apache' (these could be observed at the same time due to partial overlap in fruiting season for these two cultivars). Additionally, uneven drupelet set has often been observed in 'Navaho' and has been attributed to some degree of sterility. 'Ouachita' has

Table 1. Yield and berry weight of four thornless blackberry cultivars in plantings established at three locations in Arkansas in 1996.

Cultivar	Yield (kg·ha <sup>-1</sup> )			Wt/berry (g)		
	2000	2001	2002	2000	2001	2002
Clarksville						
Ouachita	10,119 a <sup>z</sup>	10,086 a	9,568 a	6.7 b	6.7 b	5.8 b
Apache	10,100 a	7,683 a	9,560 a	10.0 a	9.5 a	7.7 a
Arapaho	4,940 b	4,974 a	4,981 b	5.4 c	5.2 c	5.0 c
Navaho	15,066 a	4,764 a	10,060 a	5.1 c	4.6 c	4.6 d
Hope						
Ouachita	4,292 a	16,994 a	9,866 a	6.8a	6.0 b	5.1 b
Apache	4,512 a	14,533 a	5,588 b	6.6 a	8.4 a	6.7 a
Arapaho	3,635 a	9,703 b	5,134 b	4.7 b	5.0 c	4.2 c
Navaho	3,024 a	11,115 ab	3,071 b	3.9 c	4.9 c	3.6 c
Fayetteville						
Ouachita	6,376 a	8,588 a	---	6.4 a	4.5 b	---
Apache	7,481 a	8,349 a	---	8.9 a	7.4 a	---
Arapaho	2,047 b	4,996 b	---	4.7 b	3.5 c	---
Navaho	2,711 b	4,785 b	---	3.2 b	3.1 c	---

<sup>z</sup>Mean separation within columns and locations by *t* test ( $P < 0.05$ ).

Table 2. Yield and berry weight of three thornless blackberry cultivars in plantings established at three locations in Arkansas in 1999.

Cultivar	Yield (kg·ha <sup>-1</sup> )			Wt/berry (g)		
	2000	2001	2002	2000	2001	2002
Clarksville						
Ouachita	5,886 a <sup>z</sup>	6,811 a	6,659 b	5.8 ab	6.4 b	4.7 b
Apache	3,859 ab	7,908 a	12,045 a	7.7 a	8.8 a	7.9 a
Arapaho	2,699 b	3,527 b	3,171 c	5.0 b	5.3 c	4.2 b
Hope						
Ouachita	9,915 a	11,184 a	10,931 a	5.9 b	5.5 b	5.0 b
Apache	4,941 b	5,336 c	6,178 b	7.5 a	8.9 a	7.0 a
Arapaho	7,227 ab	7,365 b	9,516 a	5.6 b	4.6 c	4.0 c
Fayetteville						
Ouachita	7,900 b	---	-----	---	---	---
Apache	14,900 a	---	---	---	---	---
Arapaho	4,178 c	---	---	---	---	---

<sup>z</sup>Mean separation within columns and locations by *t* test ( $P < 0.05$ ).

Table 3. Plant and fruit characteristics of four thornless blackberry cultivars at the University of Arkansas Fruit Substation, Clarksville.

Characteristic	Cultivar			
	Ouachita	Apache	Arapaho	Navaho
Bloom date <sup>z</sup>				
10% Bloom	29 Apr.	29 Apr.	28 Apr.	1 May
50% Bloom	7 May	5 May	4 May	7 May
Bloom date <sup>y</sup>				
10% Bloom	26 Apr.	26 Apr.	25 Apr.	---
50% Bloom	2 May	30 Apr.	2 May	---
Harvest date (1996–99) <sup>z</sup>				
First	12 June	21 June	6 June	19 June
Peak	19 June	30 June	11 June	1 July
Last	20 July	26 July	7 July	27 July
Harvest date (2000–02) <sup>y</sup>				
First	13 June	19 June	5 June	---
Peak	24 June	29 June	16 June	---
Last	16 July	25 July	2 July	---
Fruit				
Firmness <sup>s,w</sup>	8.1 (±0.4)	8.0 (±0.5)	8.1 (±0.4)	8.6 (±0.7)
Flavor <sup>s,w</sup>	8.4 (±0.7)	8.3 (±0.7)	7.8 (±0.5)	8.5 (±0.8)
Seed fresh weight <sup>v</sup> (mg/seed)	11.4 b <sup>v</sup>	12.5 a	8.4 c	10.6 b
Seed dry weight <sup>v</sup> (mg/seed)	4.5 ab <sup>v</sup>	4.8 a	3.3 c	4.2 b
Soluble solids (%) <sup>u</sup>	9.9 (±1.3)	11.1 (±1.8)	8.2 (±1.6)	11.9 (±3.0)
Plant <sup>s,w</sup>				
Vigor	8.4 (±0.5)	9.1 (±0.6)	7.3 (±1.0)	7.4 (±0.5)
Health	8.5 (±0.8)	9.4 (±0.5)	7.8 (±1.0)	8.9 (±0.4)
Erectness	8.5 (±0.5)	8.9 (±0.6)	8.0 (±0.9)	7.9 (±0.4)

<sup>z</sup>Means of 3 years, 1997–98, with data collected from the 1996-established replicated plots.

<sup>y</sup>Means of 3 years, 2000–02, with data collected from the 1999-established replicated plots.

<sup>x</sup>Means of 8 years, 1995–2002, with data collected from the observational plots; ± the standard deviation.

<sup>v</sup>Rating scale of 1 to 10 where 10 = best.

<sup>w</sup>Mean separation within rows by *t* test ( $P < 0.05$ ); seeds were collected and weighed in 1998.

<sup>u</sup>Means of 7 years, 1995 and 1997 through 2002, with data collected from the observational plots.

excellent fruit fertility and full drupelet set (data not shown).

Plant hardiness was observed to be good on 'Ouachita' in that it has performed well compared to other cultivars and has shown no to little injury to canes and buds. Minimum winter low temperatures at Clarksville during evaluation ranged from  $-7.8$  °C (1999–2000) to  $-17.4$  °C (1996–97 and 1997–98). In 1996, a late winter/early spring freeze ( $-12.3$  °C) occurred near budbreak on 10 Mar. and probably damaged the plants as budbreak was reduced. In this year the crop was greatly reduced for 'Ouachita' (rating of 3 on a 1 to 10 scale with 10 = full crop). Crop ratings for comparison cultivars were: Navaho 7, Apache 4, and Arapaho 3. From these comparisons it appears 'Ouachita' may be less hardy than 'Navaho' for this incidence of a late winter freeze. A second occurrence of late winter freeze occurred in 2002, with a low of  $-13.4$  °C on 3 Mar. In this year crop ratings recorded were 7 for 'Ouachita', 8 for both 'Apache' and 'Navaho', and 5 for 'Arapaho', and this is further supported by replicated yield data for 2002 for Clarksville for three of these four cultivars (Table 2). In conclusion, the data generally

support the idea that 'Ouachita' is likely more hardy than 'Arapaho', comparable to 'Apache', and slightly less hardy than 'Navaho'. This will ultimately be determined by testing in a broad range of environments.

Root cutting sprouting of 'Ouachita' has consistently been about 60% on roots forced in a heated greenhouse in commercial potting soil. This compares with 'Apache' which had sprouting of 50% to 100%, 'Arapaho' 40% to 80%, and 'Shawnee' 80% to 100% (data not shown). Therefore, growers using root cuttings for establishment must be aware that a complete stand will likely not be achieved due to this sprouting percentage.

The chilling requirement for 'Ouachita' has not been measured. However, two occurrences of less than adequate chill (hours below 7 °C) were experienced at Hope during its testing. In 1999, about 600 h of chilling were attained, both 'Ouachita' and 'Arapaho' were observed to have full budbreak, while 'Apache' and 'Navaho' had poor budbreak. This likely accounted for the higher yields of 'Ouachita' over those for 'Apache' and 'Navaho' at Hope for 1999 (Table 1). In 2001 a similar level of chill occurred, and a range of cultivars were rated

for budbreak. The ratings were on a scale of 1 to 5 with 5 = full budbreak. 'Ouachita' had a rating of 5.0, while other cultivars were as follows: 'Arapaho' 4.5, 'Apache' 3.3, 'Shawnee' 4.0, 'Kiowa' 5.0. Yields for that year at Hope corresponded to these budbreak ratings (Table 2). The observations in these two years indicate that 'Ouachita' may have a chilling requirement similar to that of 'Arapaho', and lower than the other two thornless cultivars.

Additional testing of 'Ouachita' was conducted at Aurora, Ore. (North Willamette Research and Extension Center of Oregon State Univ.), West Lafayette, Ind. (Purdue University), Griffin, Ga. (Georgia Experiment Station, Univ. of Georgia), Calhoun, La. (Calhoun Research Station of the Louisiana State Univ. Ag. Center), Benton Harbor, Mich. (Southwest Michigan Research and Extension Center, Michigan State, Univ.), and Jackson, Ky. (Univ. of Kentucky Robinson Station). In all tests 'Ouachita' fruited well and comments by the cooperative testers indicated quality berries were produced (data not shown).

Outstanding characteristics of 'Ouachita' include high fruit quality, consistent high yields, good fruit size, and excellent postharvest fruit-handling potential. Superior plant characteristics include thornless, erect canes, and good vigor and health. 'Ouachita' should be popular as a commercial cultivar with good potential for shipping, as well as an option for home gardens. 'Ouachita' is expected to perform well in areas where 'Apache', 'Arapaho', or 'Navaho' are adapted, including all areas of the South and into the Midwest, in addition to the West and Pacific Northwest.

### Availability

An application for a U.S. plant patent has been filed for 'Ouachita'. A list of nurseries licensed to propagate and sell 'Ouachita' can be obtained from J.R.C., 316 Plant Science, Dept. of Horticulture, Univ. of Arkansas, Fayetteville, AR 72701; e-mail jrclark@uark.edu.

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