

Choosing the Right Blackberry Cultivar in Subtropical Florida¹

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Introduction

Blackberry (*Rubus* spp.) is a deciduous berry crop that produces black, anthocyanin-rich aggregate fruits (Lee et al. 2012). All commercial blackberry cultivars belong to the genus *Rubus* in the family Rosaceae (Hummer 2017). Blackberry is the fourth most economically important berry crop in the United States, accounting for \$549 million in retail sales during 2016 (California Strawberry Commission 2017). Its retail sales increased by 15.3% from 2016 to 2017, supporting the rapid growth of the blackberry industry. Traditionally, blackberry production was concentrated in the western United States, including Oregon and California (Strik et al. 2007). Driven by the growing demand for blackberries, production recently expanded to the southeastern United States. In Florida, although there is increasing interest in growing blackberries, especially among strawberry and blueberry growers, commercial blackberry production is still limited primarily to small commercial U-pick operations (Andersen 2017). The main challenges include insufficient chill hours and poor fruit quality associated with the subtropical climate. This article will discuss important cultivar selection criteria and recommended blackberry cultivars in Florida, aiming to promote the development of blackberry production in Florida and other subtropical regions.

Blackberry Production in the United States

Blackberry originally grew wild and had long, thorny, and unmanageable canes. In Europe and North America, people used to pick wild blackberries in their backyards or along edges of forests and roadsides. In the United States, the earliest blackberry cultivar development could date back to the early 1900s (Finn and Clark 2017). Blackberry breeders have developed thornless cultivars with improved cane architecture, disease resistance, fruit quality, and adaptability to diverse climates, leading to successful commercialization of blackberry production (Clark and Finn 2011). Since the early 1900s, Oregon has been the predominant producer of processing blackberries in the United States. Around the 1990s, proprietary cultivars that were more adaptable to long-distance shipping with improved fruit firmness were developed (Finn and Clark 2017). Since the early 2000s, blackberry production of these new cultivars expanded rapidly in California, the current leading fresh-market producer in the United States. According to the Census of Agriculture, the blackberry production area in the United States (including dewberries and marionberries) increased from 14,874 acres in 2007 to 16,671 acres in 2017 (USDA 2017a).

In the southern United States, the major limitation in commercial blackberry production was the absence of resistance to the double blossom/rosette disease (Clark et al. 2005),

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which is a fungal disease caused by *Cercospora rubi*. This disease causes distortion of flowers and thus severely reduces fruit yields (Smith 2017). Since 1989, the breeding program at the University of Arkansas, directed by Dr. John Clark, has released new resistant cultivars, resulting in the expansion of commercial blackberry production in this area (Clark 2005). In 2017, Georgia, Arkansas, and North Carolina were the top three producers in the southeastern United States, producing blackberries on 880, 501, and 468 acres, respectively (USDA 2017b). Improved postharvest fruit quality also helped increase commercial plantings for shipping in these southeastern states and Mexico.

Blackberry Production in Florida

There has been a growing interest in blackberry production in the southeastern United States over the past decade. The southeastern blackberry production area increased from 2,145 acres in 2007 to 3,735 acres in 2017 (USDA 2017b). In Florida, the production area increased from 64 acres in 2007 to 173 acres in 2017, 70% of which is located in central Florida. In 2017, Alachua County was the top producer (45 acres) in Florida, followed by Marion County (25 acres), Lake County (16 acres), Escambia County (14 acres), and Hillsborough County (13 acres) (USDA 2017c).

Important Traits

Fruiting Type

Two types of canes coexist on a mature blackberry plant. The first-year canes that grow until a plant enters dormancy are called primocanes and only have vegetative growth. After they overwinter and dormancy is broken, the same canes are called floricanes, because they are able to develop racemes (flower laterals) and produce berries. During the time of fruiting on floricanes, new primocanes can emerge from the base of the crown in spring through summer. Floricanes senesce and die after fruiting is complete. Commercial blackberry cultivars are usually classified into floricanes- and primocane-fruiting cultivars. Floricanes-fruiting cultivars can only bear fruits on floricanes after dormancy, whereas primocane-fruiting cultivars can bear fruits on primocanes in late-summer and again on floricanes in the following early summer. Although primocane-fruiting cultivars can produce two crops in a year, yields and quality of fruits produced on primocanes in fall are poor in Florida, because excessive heat in summer damages developing flowers (Stanton et al. 2007).

Plant Architecture

Pruning, trellising, and training of blackberry canes are labor-intensive. The intensity of cane management is highly associated with plant architecture, especially in Florida, where long summers and warm winters direct plants to excessive vegetative growth (Lin and Agehara 2018). There are three types of blackberry according to cane growth habits: trailing, semi-erect, and erect (Strik et al. 2017). Trailing-type plants need to be trellised because they produce soft, long, and thin canes. Semi-erect-type plants produce erect primocanes, which still need to be trellised when they grow longer and branch. Erect-type plants produce stronger and upright canes, but trellising is still strongly recommended for making weeding, mulching, and harvesting easier.

Thorns

Because thorns increase difficulty in managing blackberry canes, thorny cultivars are not recommended, particularly for U-pick operations. Thanks to the efforts of breeders, many thornless cultivars are now available.

Chilling Requirement

Blackberry plants develop visible flower buds on primocanes in late fall (Figure 1). Buds stay dormant during winter, and bud break typically occurs in late February in central Florida. Current blackberry cultivars require 300 to 900 chill hours below 45°F (McWhirt 2016). When plants do not receive adequate chill hours, bud break becomes poor and erratic. In central Florida, chill hours average only about 250 hours. Choosing low-chill commercial cultivars is critical for successful subtropical blackberry production. For more information on the chill hours in your area, visit Agroclimate (<http://agroclimate.org/tools/Chill-Hours-Calculator/>) and select a FAWN (Florida Automated Weather Network) weather station near your orchard.

Ripening Season

Fruit earliness varies among cultivars. Select cultivars whose ripening period suits your farming schedule. Because of Florida's warm winters, plants rarely suffer from winter injury and spring frost, thereby improving fruit earliness. Selecting early-ripening cultivars could also minimize rain damage during the rainy season. In central Florida, some cultivars can be harvested as early as late April. Although there is currently no premium price for early-picked blackberries, the availability of pickers and potential rain damage during late harvest should be taken into consideration.

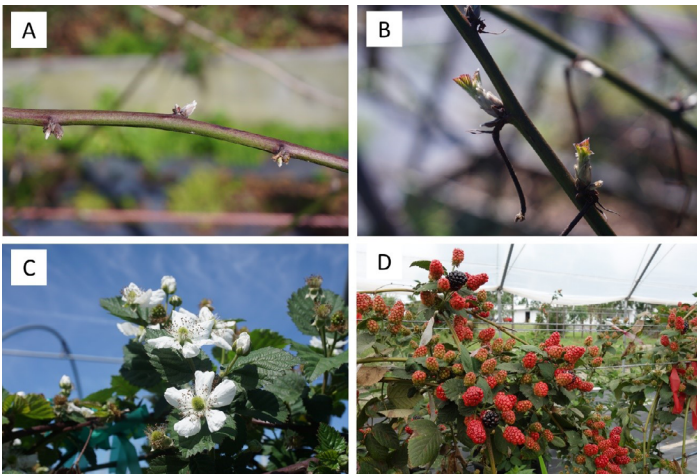


Figure 1. The phenology of 'Natchez' blackberry grown in central Florida: (A) Dormant buds in mid-January, (B) flower bud break in late February, (C) flowering in early March, and (D) fruits ripening in early May.

Credits: Shinsuke Agehara and Syuan-You Lin, UF/IFAS

Fruit Quality

Important fruit quality characteristics include fruit size, sweetness, acidity, firmness, and the susceptibility to red drupelet reversion and white drupelet disorder. Red drupelet reversion is a physiological disorder in which black drupelets revert to light reddish colors after fruits are picked. White drupelet disorder is another physiological disorder caused by excessive sun exposure (sunscald), and it is frequently observed under high temperature and low humidity conditions (USDA 2018). Both disorders can severely affect fruit appearance.

Cultivars Evaluated in Central Florida

At the UF/IFAS Gulf Coast Research and Education Center (GCREC), four floricane-fruiting ('Navaho', 'Ouachita', 'Natchez', and 'Osage') and three primocane-fruiting cultivars ('Prime-Ark 45', 'Prime-Ark Freedom', and 'Prime-Ark Traveler') were evaluated in field trials for plant vigor, yields, fruit size, fruit acidity, and fruit sweetness (°Brix). Cultivar descriptions provided below and in Table 1 represent their general performance in central Florida.

'Navaho'

A thornless, erect, floricane-fruiting cultivar released by the University of Arkansas in 1989 (Moore and Clark 1989). It ripens between mid-May and late June and produces small, firm fruits. Yields are lowest among the tested cultivars, mainly because of poor bud break resulting from the high chilling requirement (Figure 2A). Primocanes are thicker and stronger than 'Natchez' and 'Ouachita'.

'Ouachita'

A thornless, erect, floricane-fruiting cultivar released by the University of Arkansas in 2006 (Clark 2005). It ripens between mid-May and late June and produces medium, firm fruits with high Brix and good flavors (Figure 2B). Because of the high fruit quality, 'Ouachita' is one of the most common cultivars grown at U-pick farms in Florida. Yields are moderate among the tested cultivars. Plants tend to produce a high number of primocanes.

'Natchez'

A thornless, erect, floricane-fruiting cultivar released by the University of Arkansas in 2010 (Clark and Moore 2008). In central Florida, it yields highest among the tested cultivars, ripens between early May and mid-June, and produces larger and softer fruits than other floricane-fruiting cultivars (Figure 2C). The fruits taste seedy and tart, but the fruits harvested in late season are sweeter and flavorful. 'Natchez' tends to overcrop, which can result in the decline of plant vigor year by year.

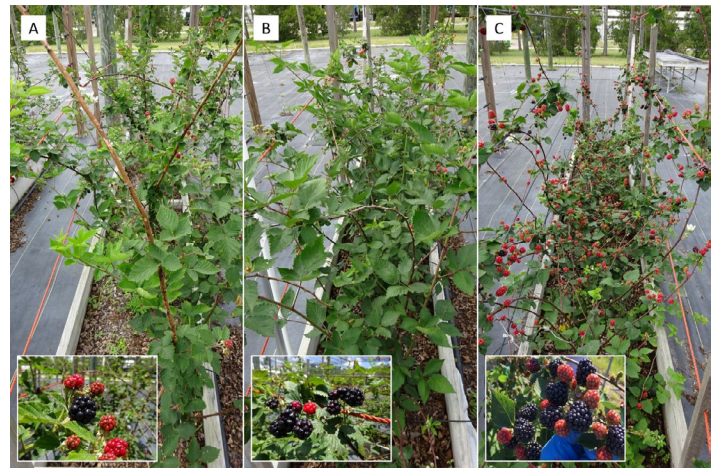


Figure 2. Growth performance and fruits of three blackberry cultivars grown at UF/IFAS GCREC: (A) 'Navaho', (B) 'Ouachita', and (C) 'Natchez'. Photos were taken in mid-May.

Credits: Shinsuke Agehara, UF/IFAS

'Osage'

A thornless, erect, floricane-fruiting cultivar released by the University of Arkansas in 2015 (Clark 2013). Plants are of moderate vigor and grow well in Florida. In central Florida, fruits ripen between mid-May and mid-June. Fruits are sweet and firm with good postharvest quality for shipping. Its fruit size is medium. The fruit flavor ratings for 'Osage' are comparable to or slightly higher than those for 'Ouachita'.

'Caddo'

A thornless, erect, floricane-fruiting cultivar released by the University of Arkansas in 2018 (Clark et al. 2019). Desirable

characteristics of ‘Caddo’ include medium to high yields, large berries, very good fruit flavor, excellent postharvest fruit-handling potential, and excellent plant health. Fruits are larger compared to ‘Osage’ and ‘Ouachita’ but smaller than ‘Natchez’. Tissue culture liners of this cultivar are available in Florida, and field trials have been initiated in Florida.

‘Prime Ark 45’

A thorny, erect, primocane-fruiting cultivar released by the University of Arkansas in 2012 (Clark and Perkins-Veazie 2011). Plants grow well in Florida, produce many canes, and yield well. Fruits are moderately sweet and firm, and they ripen between early May and mid-June, with good flavor and postharvest potential. Thorns on the canes can be a major challenge to harvesting and cane management.

‘Prime-Ark Freedom’

The world’s first commercial thornless primocane-fruiting cultivar, released by the University of Arkansas in 2013 (Clark 2014). Plants of this cultivar are vigorous and produce strong, thick canes. Fruits ripen in late April to early June. Fruits are very large, elongated, and attractive. Although it has the potential to produce fruits in both fall and spring, high yields are expected only in spring.

‘Prime-Ark Traveler’

A thornless, erect, primocane-fruiting cultivar released by the University of Arkansas in 2014 (Clark and Salgado 2016). Plants of this cultivar produce multiple canes of moderate vigor and generally one crop on the floricanes in Florida. Fruits are medium in size, have fair flavor, ripen between early May and mid-June, and have good potential for shipping and postharvest storage. Compared to other primocane-fruiting cultivars, the plants are less vigorous, with canes prone to chlorosis.

Recommendations and Precautions

Although blackberry plants can thrive in Florida’s climate, inadequate chill hours cause poor and erratic bud break, limiting the productivity of many cultivars. Therefore, chilling requirements are among the most important criteria in cultivar selection. Other important cultivar selection criteria include disease tolerance, fruit earliness, fruit size, firmness, sweetness, and flavor. In terms of crop management, it is also important to take into account plant vigor, because excessive primocane growth makes cane management laborious and time-consuming. Recommendations

and precautions in selecting cultivars provided below are based on trial data and observations in central Florida.

- For medium- to large-scale commercial production, ‘Prime-Ark Freedom’ is recommended because of high yields, earliness, large fruit size, and good fruit quality. ‘Prime-Ark Freedom’ is a primocane-fruiting cultivar with vigorous canes, so cane management is more laborious than with floricanes-fruiting cultivars.
- Although ‘Natchez’ is the highest-yielding cultivar, overall fruit quality is poor. Declines in cane vigor and productivity after three growing seasons have also been observed at multiple orchards. Therefore, we currently do not recommend this cultivar, especially for U-pick operations.
- For U-pick operations, ‘Ouachita’ or ‘Osage’ are good options that have superior fruit quality with moderate yields and medium-size fruits.

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Table 1. Characteristics and general performance of commercial blackberry cultivars grown in central Florida.

Cultivars	Year released ¹	Required chill hours ²	Ripening period	Yield (lb/plant) ³	Fruit size	°Brix
Floricanne-fruiting						
'Navaho'	1989	800–900	Mid-May–late June	Low (< 1 lb)	Small	9–14
'Ouachita'	2006	400–500	Mid-May–late June	Moderate (1–3 lb)	Medium	11–13
'Natchez'	2010	300	Early May–mid-June	High (4–6 lb)	Large	9–12
'Osage'	2015	400–500	Mid-May–mid-June	Moderate (2–4 lb)	Medium	8–11
'Caddo'	2018	300	n/a	n/a	n/a	n/a
Primocane-fruiting						
'Prime-Ark 45'	2012	300	Early May–mid-June	Moderate (2–3 lb)	Medium	11–13
'Prime-Ark Freedom'	2013	300	Late April–early June	High (2–6 lb)	Large	8–10
'Prime-Ark Traveler'	2014	300	Early May–mid-June	Moderate (2–3 lb)	Medium	6–8

n/a = data not available.

¹ Reference: Fin and Clark 2017.

² References: Clark 2014; Clark and Salgado 2016; McWhirt 2016.

³ Yield data were collected from field trials at UF/IFAS GCREC and on-farm trials in central Florida.