

Blackberry Breeding Updates and Promising Cultivars

Hybrid IST 32388 "Advancing Blackberry Production in Florida"

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Outline

- Chill hours and their effects on blackberry plant growth, blooming, and fruiting
- Performance of some commercial varieties in central Florida
- Summary of blackberry breeding activities
- Yield and berry quality of experimental varieties



Blackberry Cultivars Grow and Fruit Very Differently in Central Florida

Arkansas (FRC, Clarksville)

Central FL (GCREC, Wimauma)



'Ponca', summer 2022



'Ponca', 2 years old, spring 2022



Explore Varietal Differences in Chilling Requirement

| Cultivars | Chilling requirements | References |
|---------------------|-------------------------------|---|
| Caddo | ~300, 300 ~ 400 | Clark et al. (2019) McWirth (2023) |
| Kiowa | 200 ~ 300 | Clark (2013), Yazzetti & Clark (2001) |
| Navaho | 800 ~ 900 | Drake & Clark (2000), Yazzetti & Clark (2001) |
| Natchez | 200 ~ 300, 300 | Clark & Salgado (2016), McWirth (2023) |
| Osage | 400 ~ 500, ~300, 350 ~ 450 | Clark (2013), Clark et al. (2019), McWirth (2023) |
| Ouachita | ~400, 400 ~ 500 | Clark & Salgado (2016), McWirth (2023) |
| Ponca | 300 ~ 400 | McWirth (2023) |
| Prime-Ark® 45 | 200 ~ 300, 300 | Clark & Salgado (2016), McWirth (2023) |
| Prime-Ark® Freedom | | |
| Prime-Ark® Horizon | ~300 | |
| Prime-Ark® Traveler | 300 ~ 400 | Clark & Salgado (2016) |



Low Chill Environment in Central Florida (Oct. 1 to Mar. 1)



- Blackberries need 200 to 900 chill units
- The 32°F to 45°F model
- From Oct. 1 to Mar. 1

http://agroclimate.org/tools/Chill-Hours-Calculator/ https://www.uaex.uada.edu/

https://products.climate.ncsu.edu/ag/chill-models/



Chilling Patterns in Central Florida

Chill Hours Hours, 12/18/22 to 1/18/23



Chill hours



Chilling and Warming Patterns in Central Florida



Chill hours Warm hours



Warm Temperatures Can Negate Chill Hours

- 32° to 45°F model
- 32° to 45°F model with first incidence of 28°F
- Yazetti and Clark model
- Modified Richardson model
- Warmund and Krumme model

| | Warmud & Krumme model | Modified Richardson Model | | |
|------------------------|--------------------------------------|---------------------------------|--|--|
| Initiation of chilling | 1 st incidence of 28°F | | | |
| 60.8°F to 64.4°F | Reduce chilling by 0.5 units | | | |
| >64.4°F | Reduce chilling by 1 unit | | | |



Blackberry Plant Growth, Blooming and Fruiting in Central Florida

| 10 Aspects | Major differences in central Florida |
|--------------------|--|
| Growth habit | Strong dominance, erect → softer canes, semi-erect, even trailing |
| Growing season | Mid February to late November, early to mid December \rightarrow 9 to 10 months |
| Dormancy | December to January? \rightarrow short dormancy |
| Budbreak | Much fewer, erratic (1% to 5% to 30%), depending on cultivars. |
| Fruiting laterals | Much shorter; much fewer flowers per lateral |
| Flowering | Much fewer flowers; prolonged flowering periods |
| Berries | Lower or much lower yields; prolonged harvest seasons; less sweet |
| Primocanes | Begin to emerge in March to April (even February); More in some cultivars, but fewer, even no primocanes in most cultivars |
| Primocane fruiting | Much weaker, or no. Often no commercial values |
| Floricanes | Don't die back in some cultivars ('Ponca'). Kept for 3 rd year fruiting? |



Blackberry Varieties Trialed in Central Florida

| Floricane | UA | Apache, Arapaho, Kiowa, Natchez, Navaho, Osage , Ouachita, Caddo, Ponca | 9 |
|-----------|-------------|---|----|
| | NCSU | Von | 1 |
| | UF (1950's) | Flordagrand, Oklawaha | 2 |
| | Others | Brazo, Brizon, Chester, Red Quito, Rosborough, Snowbank, Triple Crown, Tupi (Tupy) | 8 |
| Primocane | UA | Prime-Ark [®] 45, Freedom, Horizon, Traveler | 4 |
| | USDA/OSU | Thunderhead | 1 |
| | | | 25 |



Chemical Defoliation and Budbreak Induction

(Dr. Shinsuke Agehara)



'Prime-Ark® Freedom'

- 8 trials conducted in central Florida
- Thick, strong canes; emerge early; may be brittle
- Strong vigor, large canopy; large leaves on primocanes
- Earliest ripening (Mid April to late May)
- Highest yields among tested commercial cultivars
- Largest berries, very attractive; acceptable flavor
- Severe color reversion after storage
- Better tolerance to major diseases
- Susceptible to cane blight
- Weak primocane fruiting (June to January)



| Harvest | Yield per plant (lb) | Yield per acre (lb) | % marketable weight | Berry size (g) | Average Brix | Berry qualities |
|-------------------------|-------------------------|------------------------|---------------------------|-------------------|--------------|---|
| Mid April ~ late May | Up to 13 | Up to 19,000 | 70% ~ 72% | 5.9 ~ 8.0 | 8.2 ~ 10.1 | Large, attractive, <mark>soft/ok, color reversion</mark> |



'Osage' without and with Chemical Budbreak Induction

Planted 3/2021; Photo 5/2022 (Year 2), un-treated



Planted 10/2020; Photo 5/2022, treated



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| Harvest | Yield per | Yield per acre | % marketable | Berry size | Average | Berry qualities |
|------------|--------------|----------------|--------------|------------|------------|------------------------|
| (2021) | plant (lb) | (lb) | weight | (g) | Brix | |
| 5/3 ~ 6/28 | Up to 7.2 | Up to 10,500 | 77% | 3.6 ~ 6.3 | 8.6 ~ 11.7 | Firm, sweet/sweet tart |

'Prime-Ark® Horizon'

- Two trials done in central Florida
- Planted in July 2021, 2023
- Soft canes, dense laterals
- Large fruiting laterals, tons of flowers and berries
- 1st harvest: May 5, 2022; very easy to harvest
- Up to 10,000 lbs per acre, or higher
- 89% marketable weight,
- Medium to large, firm, sweet, flavorful, taste better than 'Freedom' and 'Traveler'
- Short thorns, but may not be a major problem

Too late?

| Harvest (2022, 2024) | Yield per plant (lbs) | Yield per acre (lbs) | % marketable weight | Berry size (g) | Average Brix | Berry qualities |
|----------------------------|-----------------------------|-------------------------|------------------------|-------------------|-----------------|------------------------|
| 5/3 ~ 6/28? | Up to 6.9 | Up to 10,100 | 77% ~ 89% | 5.8 ~ 8.2 | 10.0 ~ 11.2 | Firm, sweet/sweet tart |



'PrimeArk® Traveler'



- Good cane development and branching
- Good berry crop and yield
- Firmer, store and ship well
- Berries tend to be small to medium
- Highly susceptible to cane blight, spur blight
- Plants decline rapidly

| | Harvest | Yield per plant (lb) | Yield per acre (lb) | % marketable weight | Berry size (g) | Average Brix |
|----------|-----------|-------------------------|---------------------|------------------------|-------------------|--------------|
| Traveler | 5/5 ~ 6/9 | | Up to 9,150 | 50% ~ 71% | 4.5 ~ 5.8 | 7.3 ~ 9.8 |



Sweet-Ark[™] 'Caddo' without & with Chemical Budbreak Induction

Planted 3/2021; Photo 5/2022 (Year 2), un-treated



Planted 10/2020; Photo 5/2022, treated



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| | Harvest (2021) | Yield per plant (lb) | Yield per acre (lb) | % marketable weight | Berry size (g) | Average Brix | Berry qualities |
|-------|--------------------------|-------------------------|------------------------|------------------------|-------------------|-----------------|-------------------------|
| Caddo | <mark>5/19 ~ 7/18</mark> | <mark>0.9 ~ 1.2</mark> | Will be much higher | 75% | 6.7 ~ 9.1 | 9.3 ~ 11.0 | Large, firm, sweet tart |
| | | | nigner | | | | |

Sweet-Ark[™] 'Ponca' without & with Chemical Budbreak Induction

Planted 3/2021; Photo 5/2022 (Year 2), un-treated

Planted 10/2020; Photo 5/2022, treated







Sweet-Ark[™] 'Ponca'

- Good cane development; timely tipping may increase the number of canes
- Very low budbreak in central Florida; Need more chill hours than 'Caddo' and 'Osage'
- Do much better in north Florida
- Longer fruiting laterals and fruit clusters
- Sweet berries, medium to small sizes, firm; high marketable weight
- Store and ship well, minimal color reversion
- Harvesting extended into the raining season \rightarrow Lost berries
- 3rd year plants had much lower yield due to fewer canes and low budbreak

| | Harvest (2021, 2024) | Yield per plant (lb) | Yield per acre (lb) | % marketable weight | Berry size (g) | Average Brix | Berry qualities |
|-------|----------------------------|-------------------------|---------------------|---------------------------|-------------------|-----------------|---------------------------|
| Ponca | 5/13 ~ 7/18 | Up to 7.5 | Up to 11,000 | 80% | 4.8 ~ 6.1 | 9.0 ~ 13.1 | Firm, sweet, flavorful |



UF/IFAS Blackberry Breeding: Objectives

- Better adaptation to Florida's growing environment (warm winter, hot May and Fall, hot, humid and rainy summer) (low chill varieties)
- Improved eating qualities (medium to large, firm, flavorful berries, small seeds, no bitterness, etc.)
- Improved shipping qualities (ship well, minimal leakage, reduced color reversion, etc.)
- Increased yield
- Improved tolerance/resistance to major diseases (orange felt/orange cane blotch, cane blight, etc.)
- Desirable berry ripening & harvest season (early April to mid June)
- Strong primocane-fruiting



Summary of Major Blackberry Breeding Activities

| Breeding activities | |
|--|------------------|
| Seedlings grown & evaluated | Nearly 25,000 |
| Seedlings grown in field | More than 16,000 |
| New selections | ~250 |
| Selections established in tissue culture | 65 |
| Young plants produced for trials | Nearly 9,000 |
| Advanced selections in TC companies | 7 |
| Advanced selections in growers' trials | 65 |
| Grower trials in Florida | 4 |
| Grower trials outside Florida | 6 |



Elite Selection #1

0 days

7 days

14 days

- Large, shiny, attractive
- Firm
- Excl. flavor
- Seeds acceptable
- High Brix, 10 12, up to 15
- Low acids
- Sweet, flavorful
- Store very well
- Up to 12,000 lb/A



Photos: T. Gardner



Elite Selection #2

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•

•

•

good



Photos: T. Gardner



Low-chill, High-yielding Selections

18,000 to 32,000 lb per acre in research plots



Yield from Single-plot Trials (2024)





Other Promising Selections

- Strong primocane-fruiting
- High Brix, sweet flavors
- Crispy texture, small seeds, etc.





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Our Aim:

Make Commercial Blackberry Production Profitable and Sustainable in Florida



Blackberries in North Carolina & South Carolina (2016)

We are getting very close to this yield



Acknowledgements



USDA

AMS



UF IFAS

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