

Florida Blueberry Production Overview

Jeff Williamson
Extension Horticulturist
Horticultural Sciences Department
University of Florida

Blueberry industry in FL

- Based on *V. corymbosum* hybrids
- Hybrids are with wild species native to the southeastern U.S.
- *V. elliotii* / *V. darrowii* / *V. virgatum*



Low-chill blueberry production systems

- Traditional deciduous production system
 - Plants enter dormancy, growth (flowering and vegetative bud break) begins in late winter.
 - Timing of “spring” growth is dependent on many factors including winter temperatures.
 - Typically rely on dormancy-breaking compounds
- Evergreen or non-dormant production system (south-central Florida, or tunnel production)
 - May be combined with greenhouses or tunnels.
 - Plants retain foliage and are managed for dormancy avoidance.
 - Flowering and fruit harvest begin very early and may extend over a longer time.

Low-chill blueberry production challenges

- Challenges with traditional dormant production
 - Variable winter temperatures, low chill accumulation often accompanied by intermittent warm weather.
 - Bloom periods are variable and unpredictable which complicates application of dormancy-breaking compounds.
 - Flower buds may begin emergence from dormancy before significant chill accumulation occurs with symptoms of insufficient chilling (flowering before or without leaf bud emergence and protracted bloom periods).
 - Freezing temperatures are likely during and after bloom.

Weather conditions that routinely influence blueberry production in Florida

- Chill accumulation (traditional deciduous system)
 - A major concern, especially in central and south Florida.
- Late winter and early spring freezes
 - Blueberry bloom occurs in late January/early February before the threat of freezes is over. Killing freezes often occur in mid-to late February and early March after flowering and early leaf development.

Overhead irrigation – primarily used for freeze protection

Most fields require protection several times per year



Excessive soil moisture following freeze protection



Overhead irrigation for freeze protection can cause complications -

- Wet conditions encourage fertilizer leaching, root diseases, uprooted plants, and Botrytis flower blight.
- Ice loads can damage plants and fruit.

Chill accumulation in north and central Florida beginning November 1*

Date	Long-term Average		Winter 2010/2011		Winter 2011/2012	
	Alachua	Polk	Alachua	Polk	Alachua	Polk
Dec. 15	182	46	346	146	139	15
Dec. 31	283	85	520	254	195	22
Jan. 15	384	127	664	307	275	81

- Winter chill accumulation is highly variable by year. Chilling accumulated by December 31 is generally more effective than late winter chilling after hydrogen cyanamide applications are made and after the initiation of bud swell has occurred.
- Winter chilling was well above average during 2010/2011 and much below average in 2011/2012.

*Data taken from the AgroClimate website.

Winter chill accumulation at three locations in Florida - winter 2015/2016

Date	Long-term Average			Winter 2015/2016		
	Alachua	Lake Alfred	Jay	Alachua	Lake Alfred	Jay
Dec 15	182	46	301	24	0	98
Dec 31	283	85	399	47	0	135
Jan 15	384	127	507	127	5	283
Mar 1	532	210	785	327	49	532

Chill accumulation was extremely low during winter 2015/2016.

Dec. 31 is highlighted because hydrogen cyanamide is usually applied before the end of the year. Some pre-chilling is needed for hydrogen cyanamide to work effectively

Weather Information

Florida Automated Weather Network

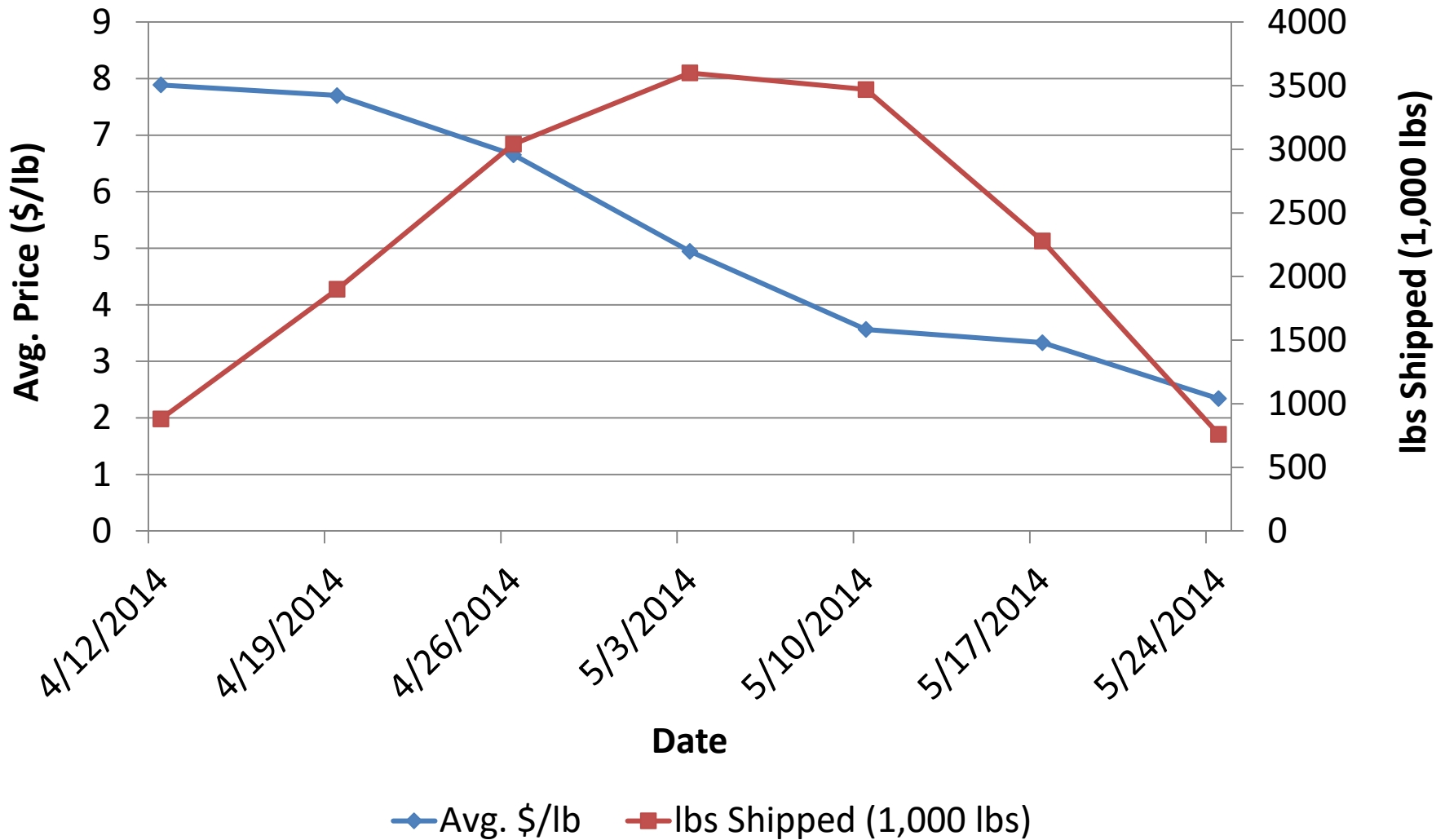
<http://fawn.ifas.ufl.edu/>

<http://fawn.ifas.ufl.edu/tools/>

Monitor thermometers or weather stations in several locations in your field.

Have access to reliable weather forecasts.

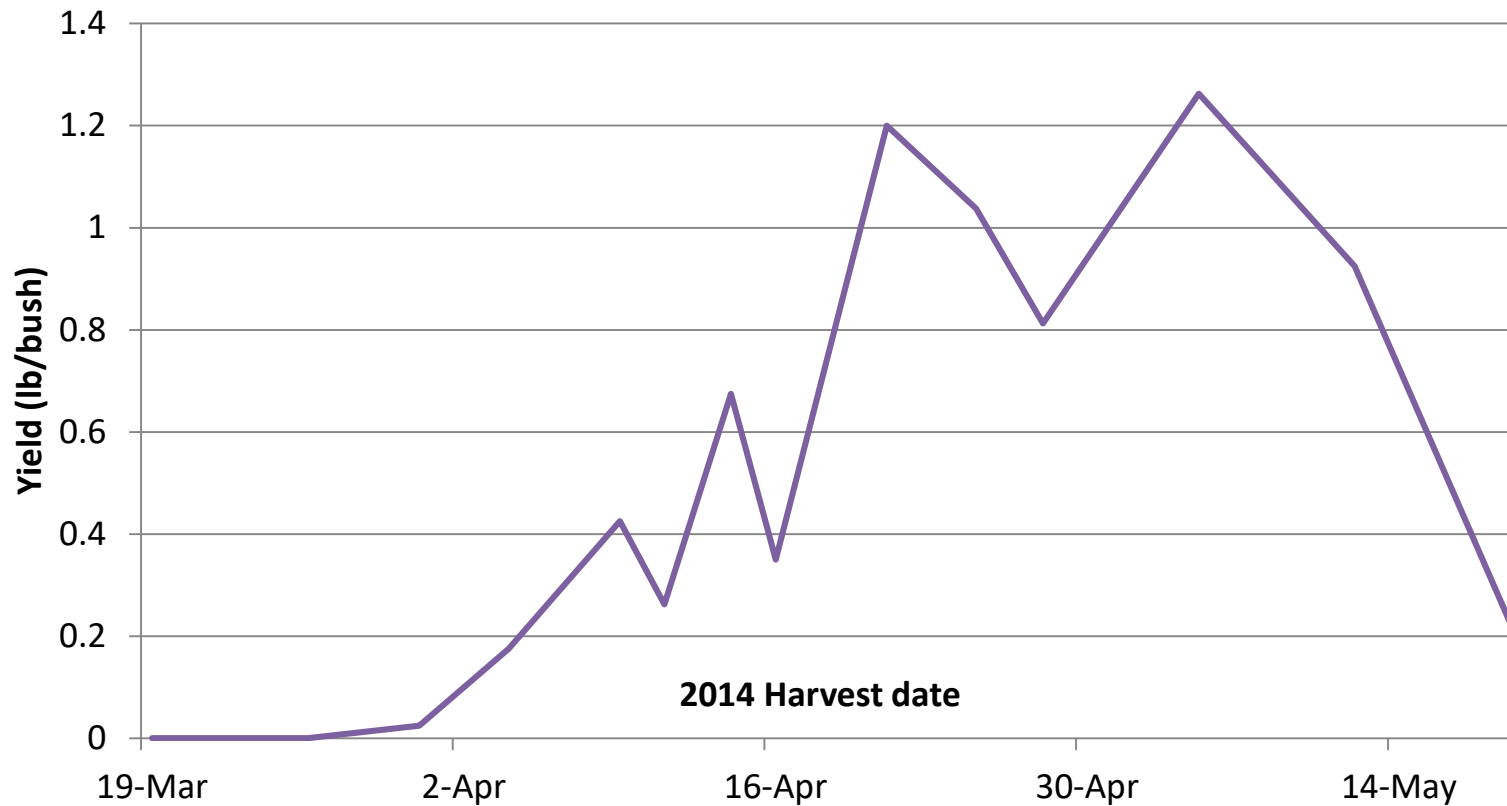
Florida's production is all about timing



Chile – Weekly Shipments

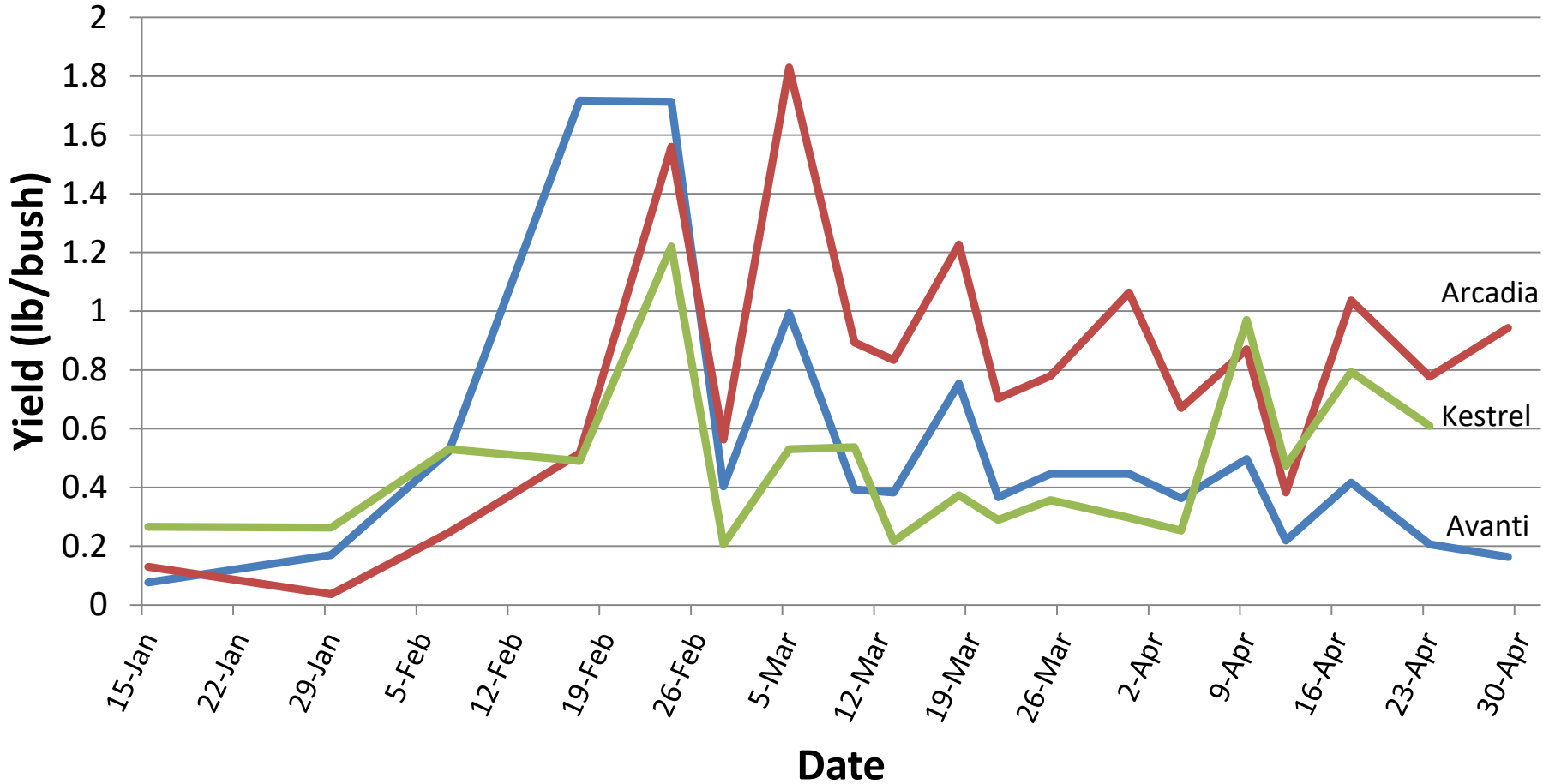


'Emerald' yield, typical production window in central Florida



Jim Olmstead, Horticultural Sciences Dept., IFAS, UF.

2014 seasonal yield (evergreen) – Arcadia, FL



Jim Olmstead, Horticultural Sciences Dept., IFAS, UF.

Blueberry cultivars

- Generally rabbiteye cultivars (top) are more vigorous and easier to grow than southern highbush (SHB) cultivars (bottom).
- SHB cultivars ripen early and are the bases for the commercial industry in Florida.



*All patented UF blueberry varieties are
licensed by Florida Foundation seed
Producers, Inc. (FFSP)*

*Anyone propagating plants for personal
use or sale is required to be licensed by
FFSP.*

*Licenses are available to any nursery in
Florida by contacting FFSP
<http://ffsp.net>, (352) 392-9446*

‘Jewel’ (USPP # 11,807)



- Low chill (Gainesville-south)
- Blooms early
- Ripens mid-season
- Excellent fruit quality, but berries are tart until fully ripe
- High yield potential
- Often paired with ‘Emerald’
- Very susceptible to leaf diseases
- Not suited for “evergreen” system

‘Emerald’ (USPP # 12,165)



- Low chill requirement
- High yield potential
- Vigorous, spreading bush
- Large fruit size, good quality, tight clusters
- Blooms early
- Long harvest period
- Often planted with ‘Jewel’
- Evergreen tendencies.

‘Farthing’ (USPP # 19,341)



- Vigorous, compact growth habit, good survival
- Blooms later than ‘Emerald’
- High yield potential, long picking season
- Very firm fruit, potential for mechanical harvest
- Color?
- Evergreen potential.
- Algal stem blotch has become a problem.

algal stem canker

Cephaleuros virescens

More common in central and southwest Florida than in north Florida.

Prune out diseased Wood.

Seen on Farthing and Emerald





Emerald

Meadowlark



Meadowlark™

'FL01-173' – (USPP # 21,553)

- Part sparkleberry
- Early bloom and ripening
- Very upright growth
- Very open fruit clusters
- Good yield potential
- High mechanical harvest potential?
- Flavor, color?

Courtesy Jim Olmstead



Bacterial leaf scorch -
Meadowlark





Kestrel™

'FL02-40' – (USPP # 21,719)

- Low chill requirement – evergreen production
- Medium to large berry, excellent flavor
- Vigorous plant, good survival so far
- Low detachment force when ripe – pick often
- Appears to have evergreen potential



Evergreen Kestrel –
Arcadia, FL (1/16/14)

Chickadee™

'FL04-235' – (USPP # 21,376)

- Low chill requirement – south central Florida
- Upright growth habit
- Very firm, great flavor, darker fruit color
- Susceptible to blueberry necrotic ring blotch virus
- Appears to have evergreen potential



Courtesy Jim Olmstead

Newer Blueberry Variety Options

Arcadia™

'FL07-399' (USPPAF)



Courtesy Jim Olmstead

FL07-399 (Arcadia)

FL07-399 is a low chill (< 200 chill hours 0 to 7°C), mid-season maturing genotype adapted to production regions in central and south-central Florida. The key attributes for FL07-399 are:



- High yield when grown in an evergreen management system.
- Peak production in central and south central Florida during high value market window.
- Large fruit size, sweet flavor.
- Excellent survival and leaf disease tolerance.



- Low yield in northern areas of Florida.
- Very long harvest season when grown as an evergreen plant.
- Fruit firmness just above program minimum (but no apparent packing/postharvest problems).
- Vigorous, spreading growth habit may make machine harvest for fresh market difficult.

Courtesy Jim Olmstead

Avanti™

'FL06-203' (USPPAF)



Courtesy Jim Olmstead

FL06-203 (Avanti)

FL06-203 is a very low chill (100 chill hours 0 to 7°C), early maturing genotype adapted to production regions in central and south-central Florida. The key attributes for FL06-203 are:



- Early production (late January/February in south central FL)
- Produces well under evergreen management systems
- Can be grown using hydrogen cyanamide with some yield loss
- Firm, high quality fruit
- Small dry picking scar



- Smaller fruit size, particularly later in the season.
- Susceptible to Botrytis fruit rot that can cause fruit deformation.
- Susceptible to gall midge damage on flowers.
- Early bloom requires much longer periods of freeze protection when grown in northern FL production regions.
- Almost too early for current market window.

Endura

'FL06-377'



Courtesy Jim Olmstead

FL06-377 (Endura)

FL06-377 is a very low chill (150 chill hours 0 to 7°C), mid-to-late maturing genotype adapted to production regions in central Florida. The key attributes for FL06-377 are:



- Very low chill requirement.
- Produces well under both evergreen and hydrogen cyanamide management systems.
- Firm, large fruit.
- Excellent, persistent blue color
- High season-long yield.



- Fruit is tart very early in the season and when not fully ripe.
- Very long harvest season when grown as an evergreen plant.
- Susceptible to leaf rust (but no leaf drop).
- Susceptible to *Phytophthora* root rot.
- Later peak harvest window.

Properly designed beds and pruning to a narrow crown will reduce ground drops if mechanical harvesting is done.



Adaptation of mineral soils (sands) for blueberry production in Florida

- Ideal blueberry soils are coarse, acidic, and high in organic matter.
- Few soils in Florida are naturally suited for blueberry production.
- Good blueberry soils in Florida tend to be in frost pockets.
- Most commercial blueberry production in Florida is on highly amended sandy soils.
- Pine bark as a soil amendment is a significant establishment cost.

Soil managementc for SHB

- SHB soil requirements
 - Soil pH 4.5 - 5.5
 - High organic matter
 - Well aerated soil
 - Available NH_4



Examples of three common SHB production systems



Pine bark beds



Pine bark incorporated into soil -
uses less pine bark



Incorporated pine bark with ground cloth – uses less pine bark

Pine bark increases organic matter, decreases soil pH, maintains N in NH_4 form,
and greatly increases establishment costs of SHB plantings.

Pine bark bed system - pine bark is laid out in beds on top of soil. Requires large amounts of pine bark.



Pine bark incorporated system – pine bark is incorporated into the top layer of soil.
Uses less pine bark



Pine bark incorporated beds with woven fabric ground cover.



Incorporated bark



Bark Bed



No difference in canopy size or yield for incorporated and bark beds for first three years after planting.

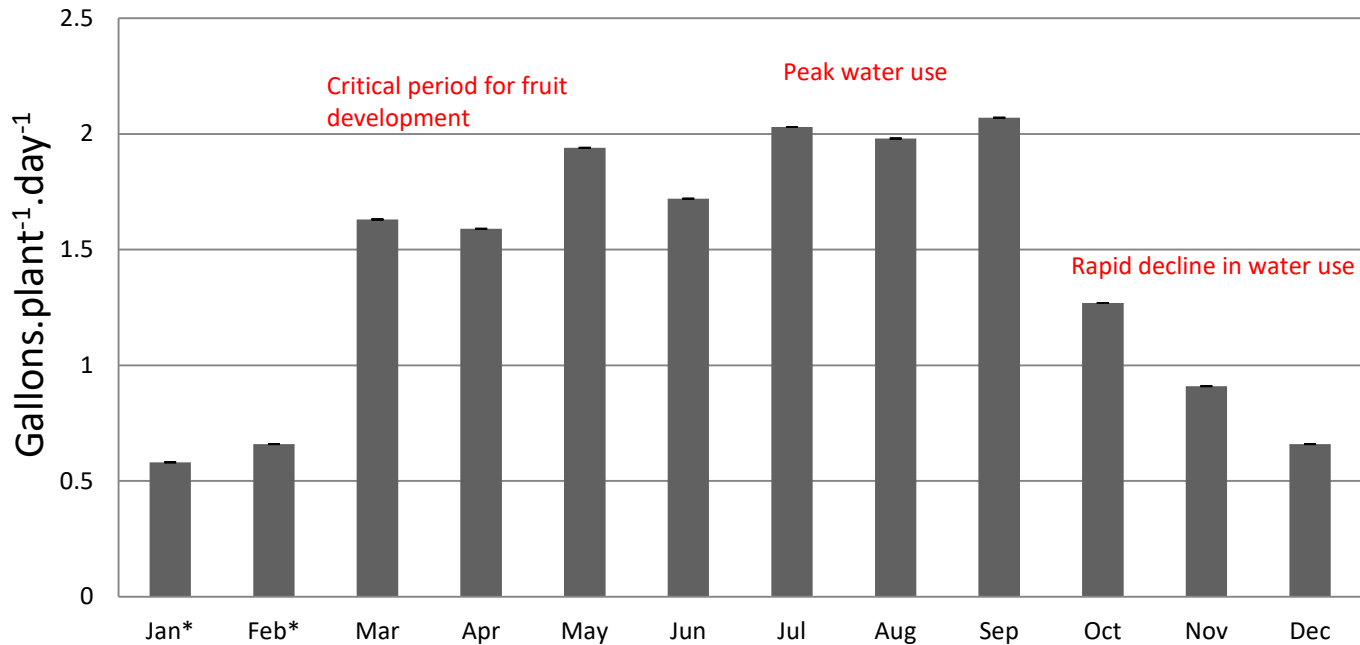
Excavated Blueberry Plant

Root system was only a few inches deep





Daily plant water use of mature 'Emerald' blueberry plants by month averaged across treatments and years.



Monthly means of daily water use of mature 'Emerald' southern highbush blueberry plants averaged across treatments and years from April, 2010 to Sept. 2012.

*Means for one year due to complications from overhead irrigation for freeze protection.

Blueberry irrigation

- Most blueberry fields have overhead irrigation for freeze protection and low volume irrigation (usually drip) for daily water requirements. Overhead irrigation is used during extended droughts to supplement low-volume irrigation.
- In bark beds , and in bark amended sandy soils, water from drippers moves vertically with little lateral spread. Two drip lines per row usually increases root zone wetting from drip irrigation. Decomposed bark, and bark incorporated into the soil, has better lateral spread from drippers than new bark, but the wetted zone can still be limited.
- During periods of high water demand, multiple, short, irrigation cycles per day are needed since long irrigation cycles push water below the shallow root zone.

Some factors that can affect irrigation requirements and scheduling

- Plant size
- Planting density (plant and row spacing)
- Rooting depth
- Soil type and water holding capacity
- Stage of growth and development of the crop
- Crop load
- Cultivation, mulching, weeds

Machine harvesting for fresh markets

- There is high interest in machine harvesting blueberries for fresh markets to reduce labor costs associated with hand harvesting.
- However, machine harvesting for fresh markets presents numerous challenges.



Mechanical harvesting for fresh markets presents challenges

- Marketable yield can be reduced by –
 - Fruit dropped on ground during harvest
 - Harvest of immature fruit
 - Mature fruit left on the bush
 - Fruit drop between harvest intervals
 - Fruit bruising from harvester
 - Plant injury from harvester



Fruit can fall to the ground between the crown and the catch plates.



Fruit dropped during machine harvesting.



Properly designed beds and pruning to a narrow crown will reduce ground drops if mechanical harvesting is done.



‘Meadowlark’ harvested by machine. Note the number of immature berries.



'Farthing' harvested by machine.

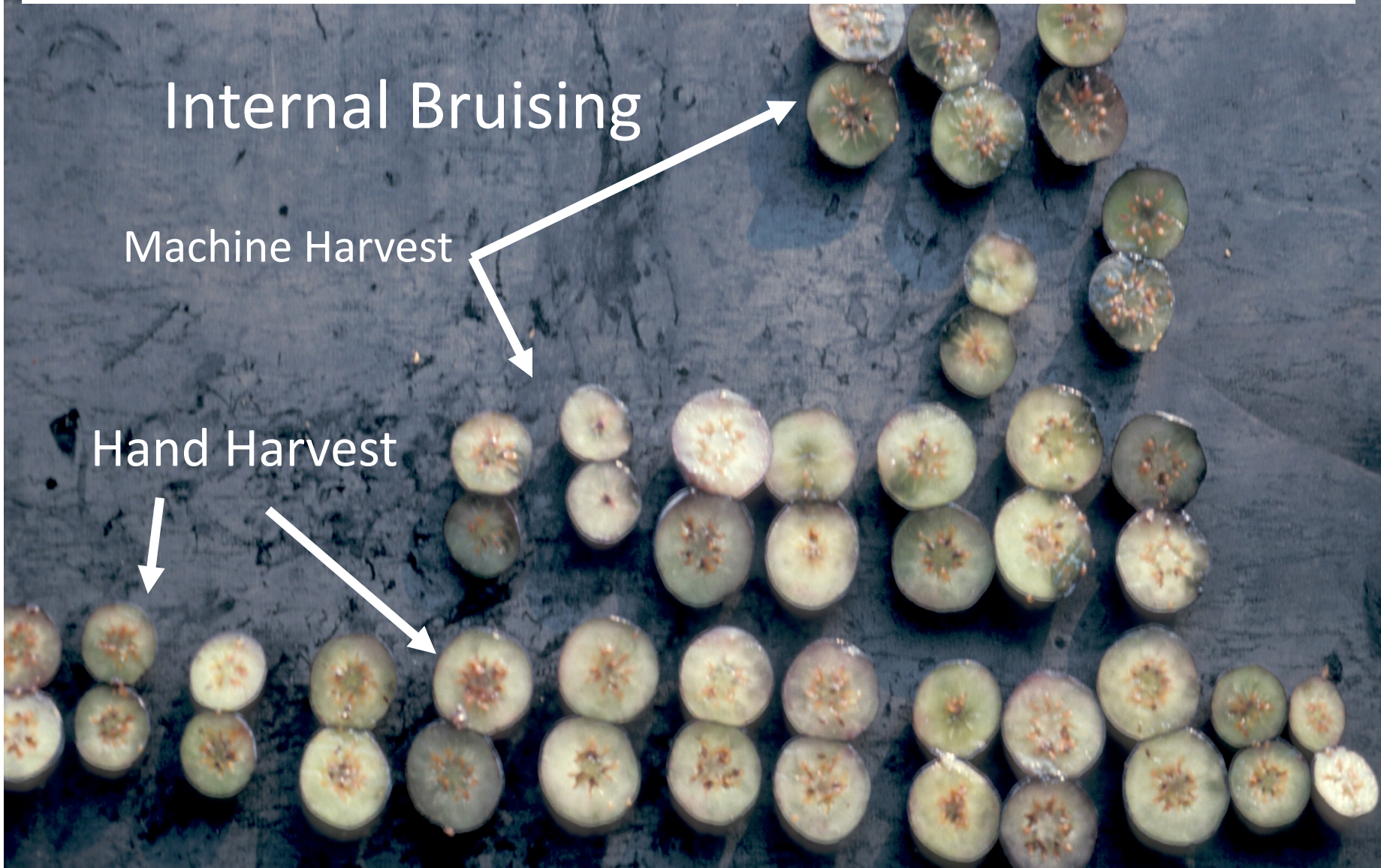


Example of bruising from mechanical harvest. Note the higher incidence of dark, water-soaked, areas in the machine harvested fruit compared with hand harvested fruit.

Internal Bruising

Machine Harvest

Hand Harvest



Challenges to machine picking

- Bruising/quality
- Tight clusters
- Leakers
- Ground loss
- Green loss
- Pack loss
- Rain/wet handling leading to decay
- Hand first?
- Hand supplemental?
- Hand between machine picks?
- More frequent passes with machine?
- Pickers leave?

Hybrid hand/machine picking system

- Prime the field by hand to get early \$ and break tight clusters. Hope it doesn't rain.
- Machine-pick DRY, frequently, gently as possible, padded machine, right cultivars
- If blue fruit left behind, clean-up by hand between machine trips to avoid “leakers” caused by overripe fruit remaining on the bush
- Immediate forced air cooling followed by color- and soft- sorting in controlled climate

Summary – Key Points

- New blueberry plantings continue to be established in Florida and production continues to increase.
- Establishment costs are high.
- FL berry prices have declined compared to previous years (early 2010's) but remain higher than other US production regions.
- The optimum commercial production window appears to be from late March through April.
- Weather remains a major challenge for Florida blueberry growers.
 - Evergreen production?
- Berry imports from other regions such as Mexico during the traditional Florida window has increased during 2016 and 2017 and may continue to increase.
- Concerns about labor availability has increased interest in mechanical harvest for fresh fruit. This is an active area of research in Florida and elsewhere.
- Larger growers may find it easier than small growers to remain competitive in the future.