

Variety evaluations and stress mitigation strategies for small fruit crops in a changing climate.

*Gordon Johnson
Extension Fruit & Vegetable Specialist
University of Delaware*



Challenges With Day Neutral Strawberries



- Available varieties from areas with different climates
- Delaware not well adapted
 - **Summer heat**
 - Fall frost
- Unproductive periods
- Quality



- 2006. 'Albion' originated from the cross between 'Diamante' and the advanced selection Cal94.16-1 performed in 1997 at the University of California, Davis, USA. It was first fruited in 1998 at the University of California, Wolfskill Experimental Orchard near Winters, California.



'Seascape', named for a town near where tile Watsonville Strawberry Research Facility in California is. 'Seascape' originated at the U.C. Wolfskill Experimental Orchards, near Davis, as a cross between 'Selva' and 'Douglas', 1990

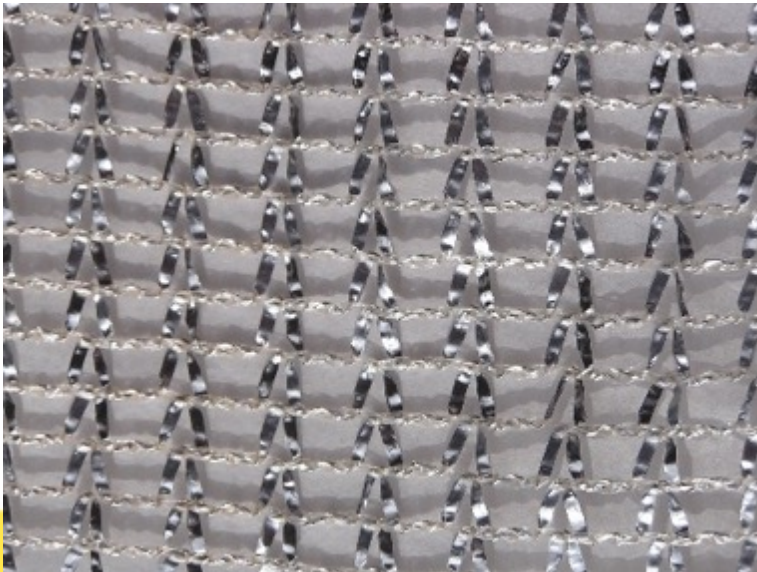
- 2001 'Evie 2' was the result of a strawberry breeding program started in 1986 by Mr. Peter Vinson of Edward Vinson Limited based in Kent, United Kingdom. 'Evie 2' originated from a cross made 'Everglade'(a day neutral type), and the male parent designated 'J92D12' (a short day type), known for passing on the traits of good fruit size and fruit shape



Our Approach



- Mulch
 - Black
 - White
 - Reflective
- Drip tape on top for surface cooling
- Shade cloth
 - White
 - Reflective
- Dormant plants
 - Greenhouse plugs

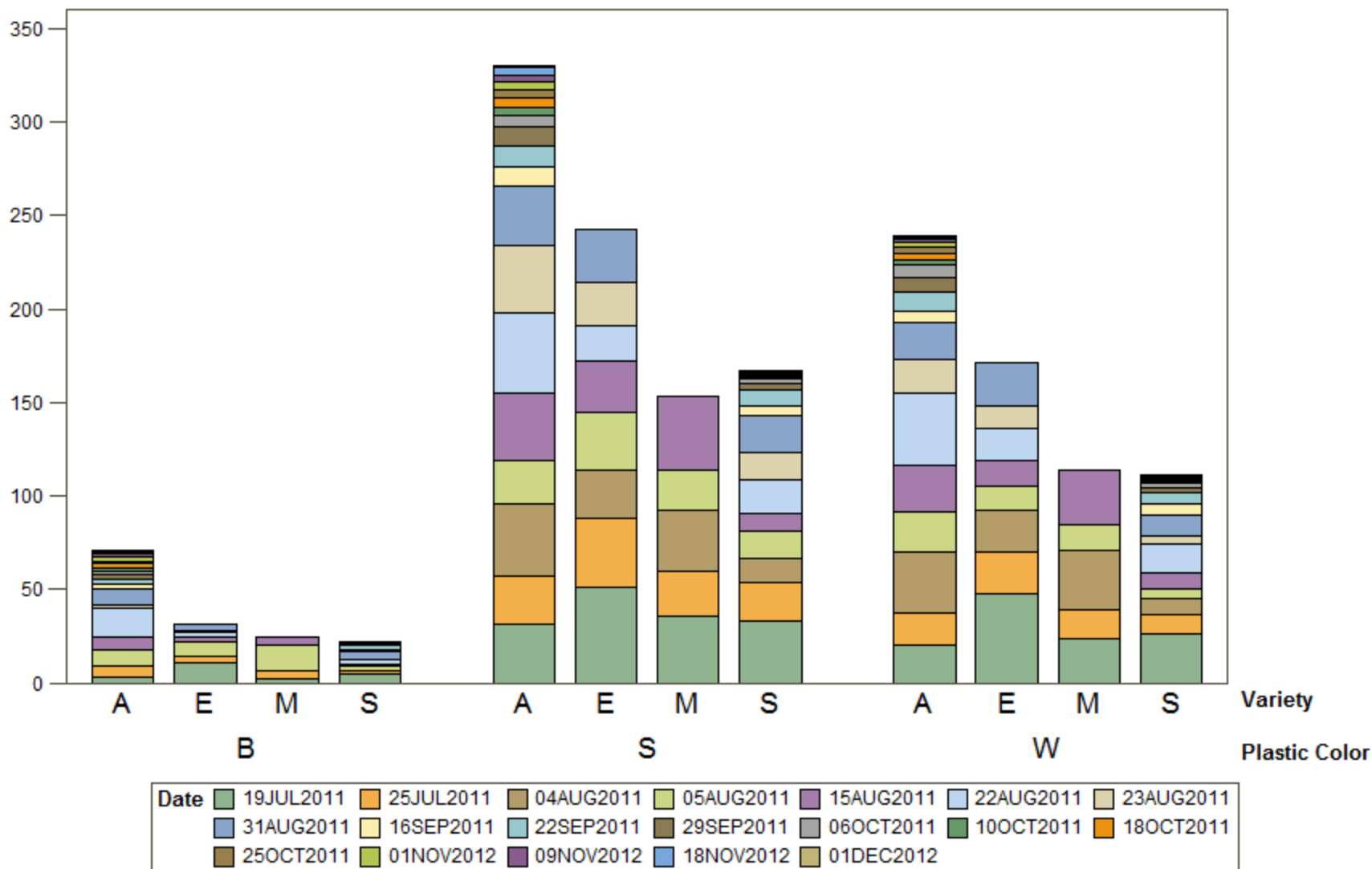


July 2011

Day	Avg Temp (°F)	Max (°F)
1	72.8	86.4
2	74.5	88.9
3	78.4	88.8
4	79.3	90.1
5	78.2	89.9
6	73.6	86.4
7	79.3	92.7
8	77.2	87.8
9	77.1	87.2
10	77.2	90.2
11	79.1	89.8
12	82.8	90.5
13	79.0	90.0
14	70.8	80.0
15	70.2	82.1
16	71.7	83.4
17	76.0	87.1
18	78.5	88.7
19	78.9	93.0
20	79.2	89.2
21	83.3	94.6
22	89.1	101.2
23	88.9	100.5
24	82.4	96.0
25	77.9	87.3
26	79.6	90.6
27	79.2	87.5
28	77.8	90.5
29	84.8	97.2
30	83.3	92.4
31	79.7	92.5

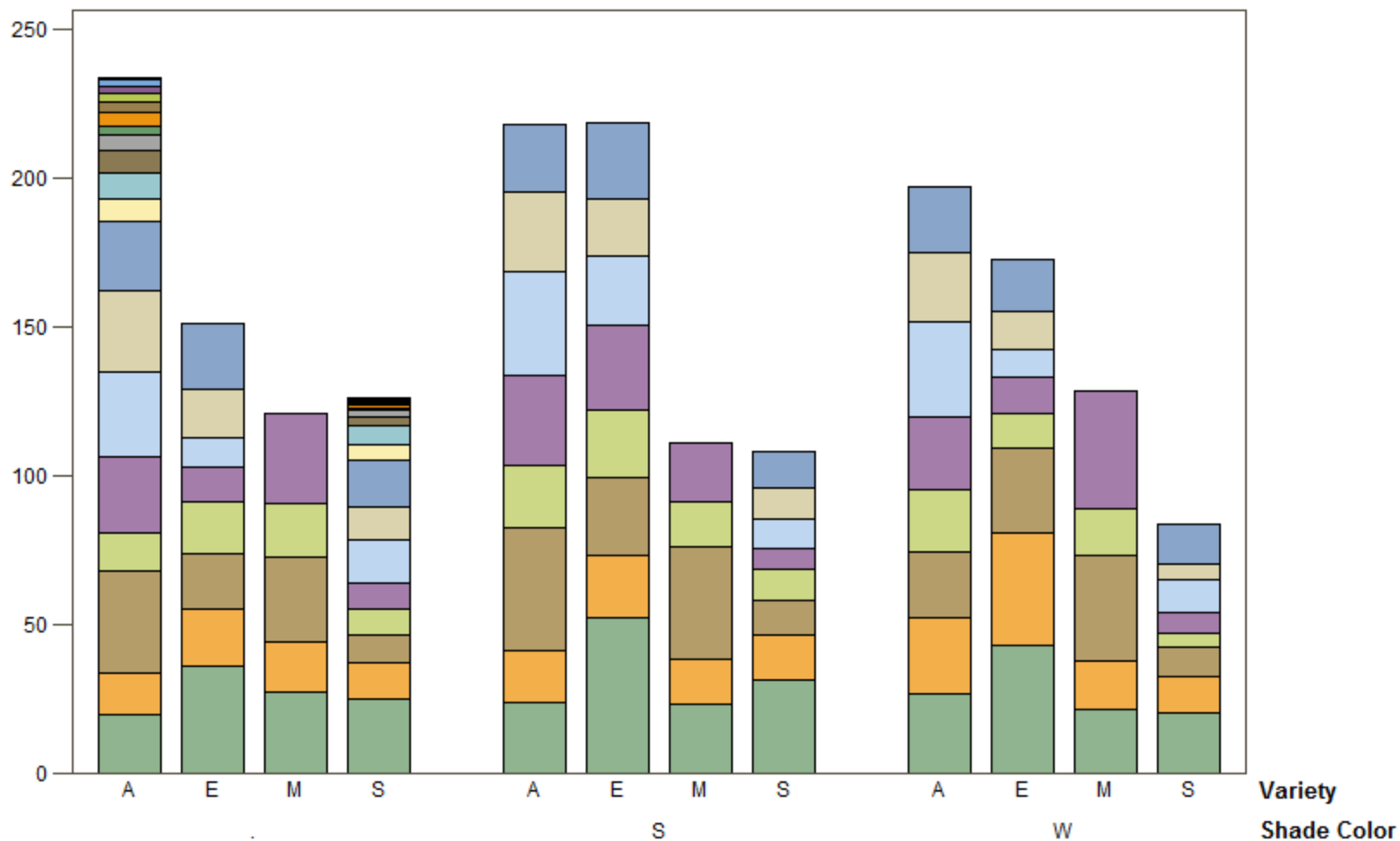
Plastic color effects

g/plant



Shade Color Effects

g/plant (Mean)



Date	19JUL2011	25JUL2011	04AUG2011	05AUG2011	15AUG2011	22AUG2011	23AUG2011	31AUG2011	16SEP2011	22SEP2011	29SEP2011	06OCT2011	10OCT2011	18OCT2011	25OCT2011	01NOV2012	09NOV2012	18NOV2012	01DEC2012
	[Green]	[Orange]	[Brown]	[Light Green]	[Purple]	[Light Blue]	[Tan]	[Dark Blue]	[Yellow]	[Cyan]	[Dark Brown]	[Grey]	[Dark Green]	[Dark Orange]	[Dark Brown]	[Light Green]	[Purple]	[Dark Blue]	[Tan]

Progress in Heat Tolerance Breeding in Blackberries

- It is a TOUGH proposition

APF-209T,
August 2008,
after 90+F
heat;
thornless



APF-77, July 2008
(postharvest quality
lacking)

The Current Potential Reality of PF? Does Much Better in Moderate Climates

- Fruit set is much better on individual flowers
- Crop potential is fabulous
- Quality much better also
- Where to achieve this in the East? Tunnels?





Two season fruiting of primocane blackberries, Vinifera grape winter injury

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 **Prime-Ark[®]**
Primocane-Fruiting **Blackberries**

Prime-Jan[®] Primocane-Fruiting Blackberry



 **Prime-Jan[®]**
Blackberry
(cultivar APF-8)

All photos are property of the University of Arkansas, Fayetteville, AR.

Prime-Jim[®] Primocane-Fruiting Blackberry



 **Prime-Jim[®]**
Blackberry
(cultivar APF-12)

All photos are property of the University of Arkansas, Fayetteville, AR.

Dr. John Clark, University of Arkansas

The New One : ARK-45

- Floricane crop ripens beginning early June, with Natchez or before
- Excellent flavor
- Comparable to Ouachita and Natchez in storage – should be shippable!
- Plants were available spring 2010



The First Thornless Primocane Release **'Prime-Ark[®] Freedom' Primocane- Fruiting Thornless Blackberry**

- Thornless and very erect
- Yield – Similar to Ark 45
- Berry size – Large (9 g)
- Earlier – first primocane harvest in late July (floricane in mid-June)
- Soluble solids 10.4
- Not suitable for shipping or longer term storage (less than 7 days)
- Mainly for local markets, U-pick



Breeding For Primocane Fruiting

- Improvement for important traits is being made
 - Heat tolerance screening ongoing
 - Early bloom and/or short bloom to ripening period getting attention
 - Fruit quality moving forward within PF types and from FF types
- A range of environments is now being used to test various new developments and more is being learned each year
- Cultural management development is **JUST** as important to get this trait in commercial use



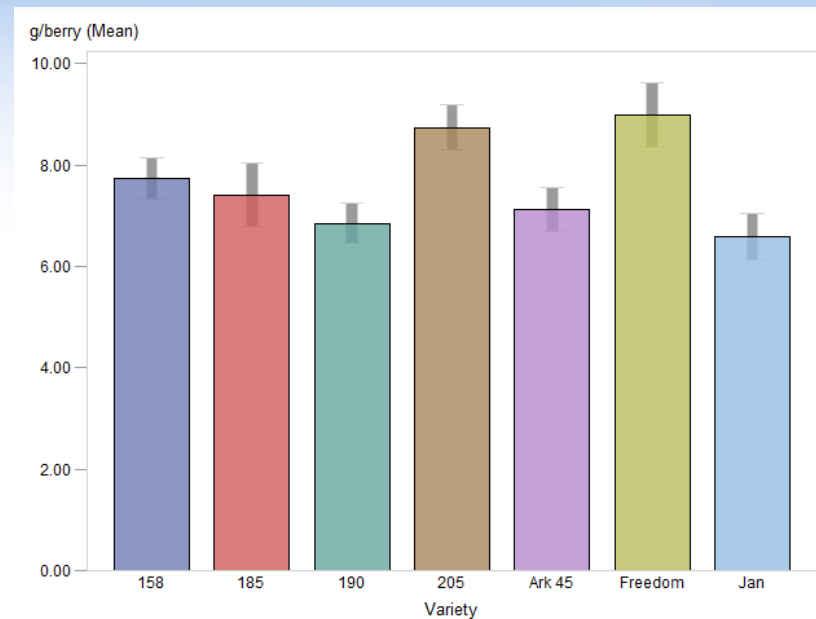
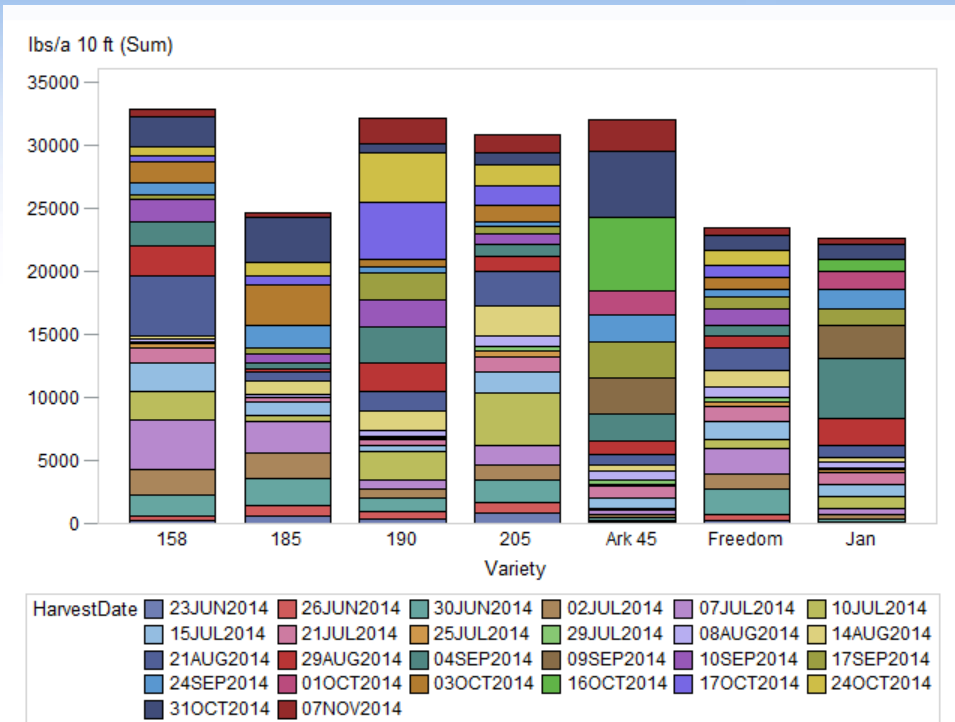
Delaware Trials

- 2 year old planting
- Carvel Center, T. Adams Farm, Georgetown, DE
- Trial 1 – Ark 45 and Jan, 10 plants/plot, 3' between plants, 5 reps
- Trial 2 – UAK Breeder selections, 4 reps, 5 plants per rep
 - 153 (Freedom) thornless
 - 158 thorny
 - 185 thornless
 - 190 thornless
 - 205 thornless
- 2013 some double fruited, floricanne and primocane, 2014 double fruited
- Untipped 2013, tipped 2014



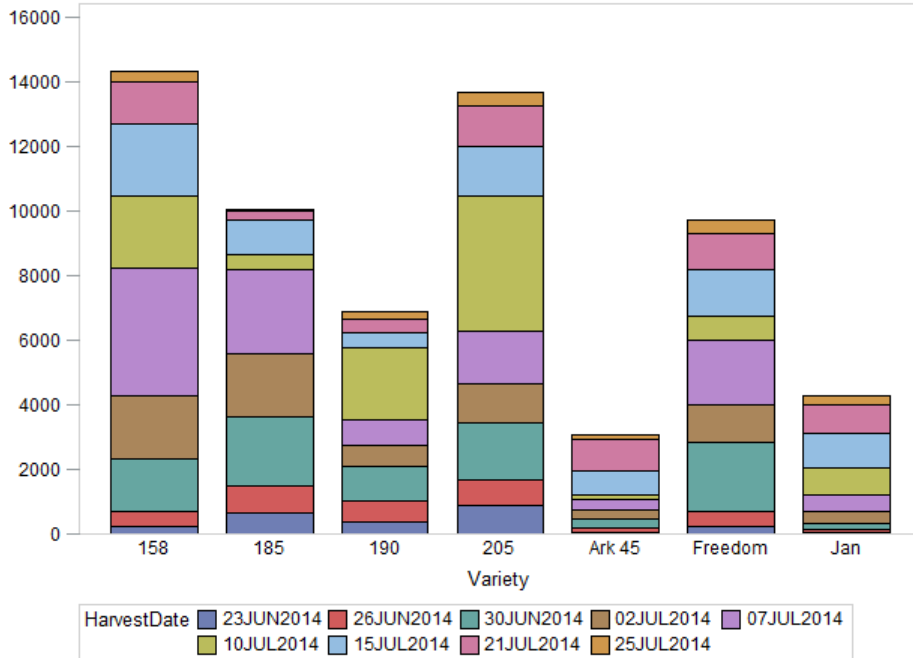


2014 Floricane + Primocane Yields

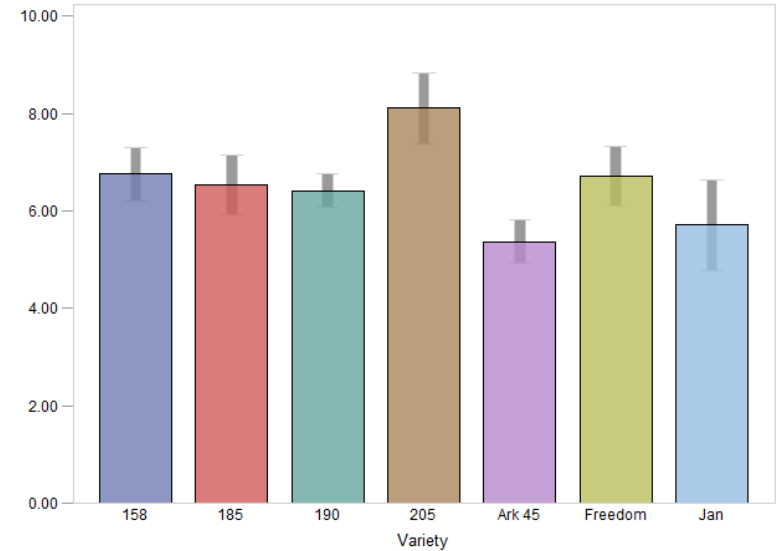


2014 Floricane Yields

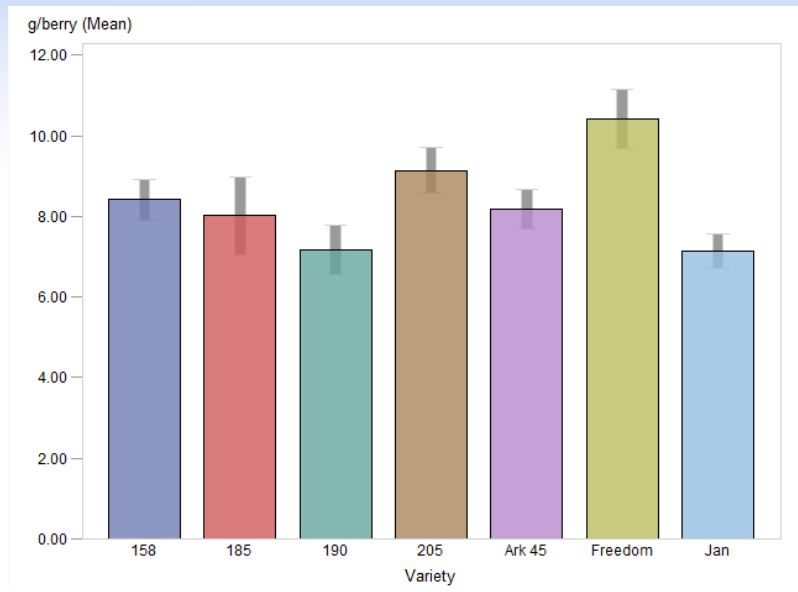
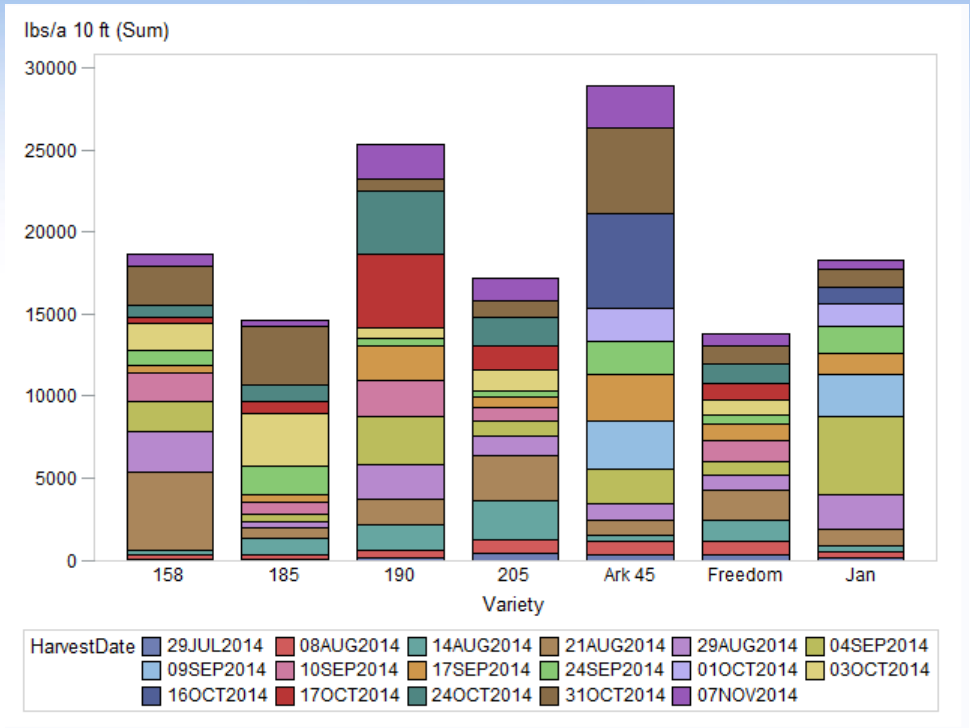
lbs/a 10 ft (Sum)



g/berry (Mean)



2014 Primocane Yields



Winter Damage Grapes – Vinifera Normal Growth

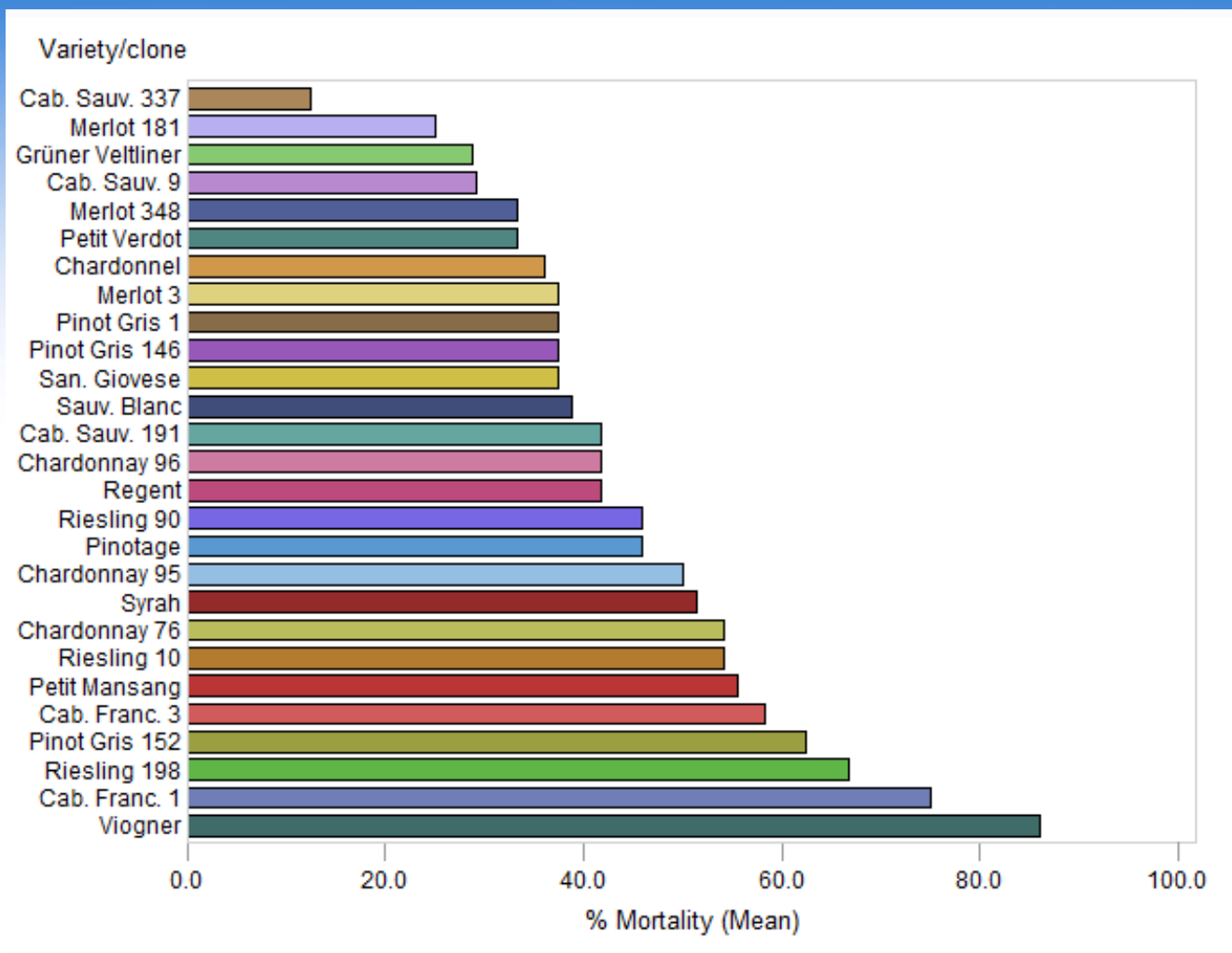


Vinifera – Dead canes



Hybrid comparison – no winter injury





Blueberry Project and Blueberry Research Updates

Emmalea Ernest, Gordon Johnson

University of Delaware Cooperative Extension

Hail Bennett

Bennett Orchards

Project History

Early Production Year Yield Studies funded by Specialty Crop Block Grant obtained by UD

2013-2015

Georgetown Research Farm

Mulch Material Study
Soil Amendment Study
Variety Trial

Bennett Orchards

Variety Trial



Blueberry Variety Trials

Georgetown Research Farm

25 varieties

RCBD with 4 replications, 3 plants/plot

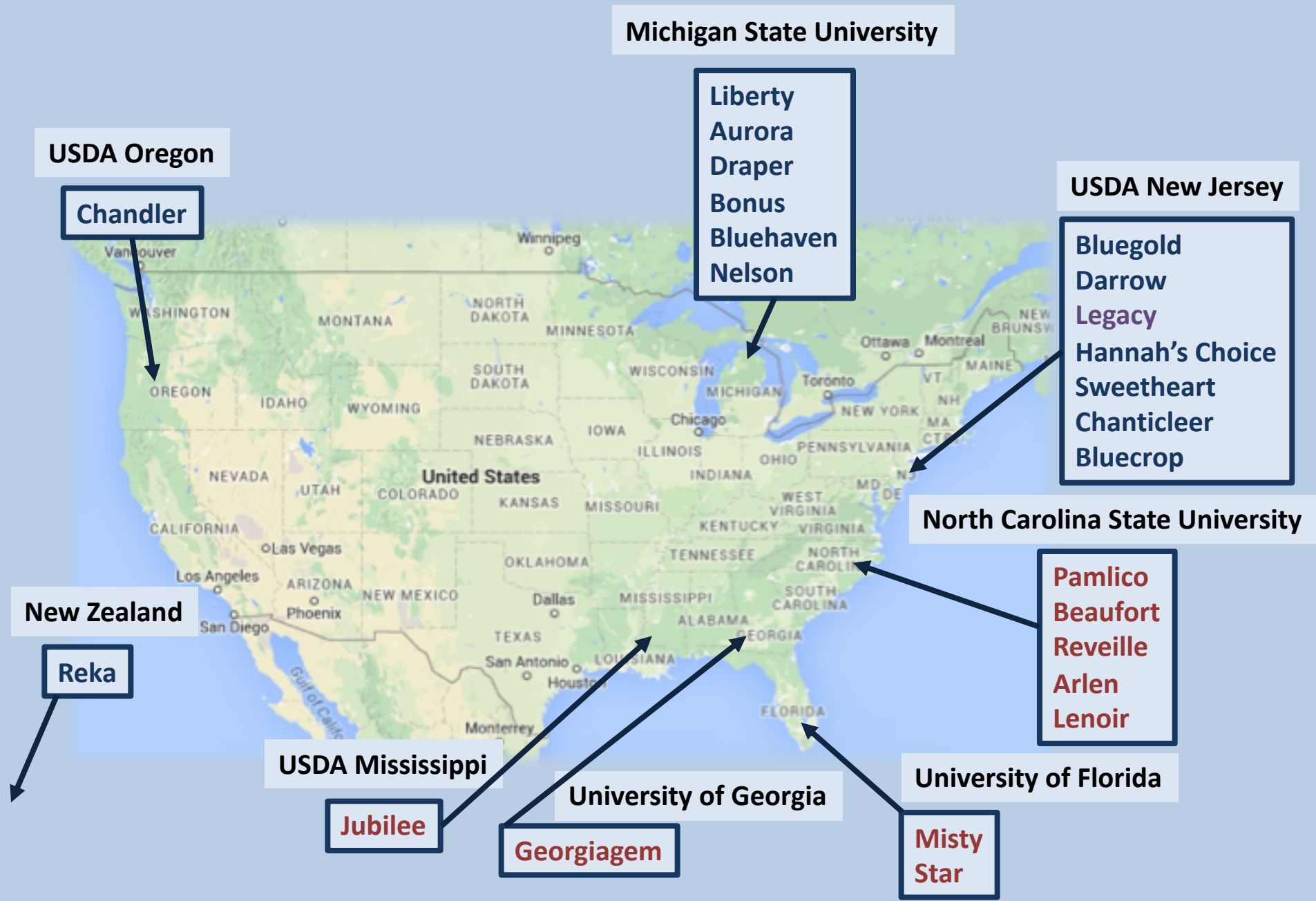
Bennett Orchards

10 varieties

10 plants of each variety

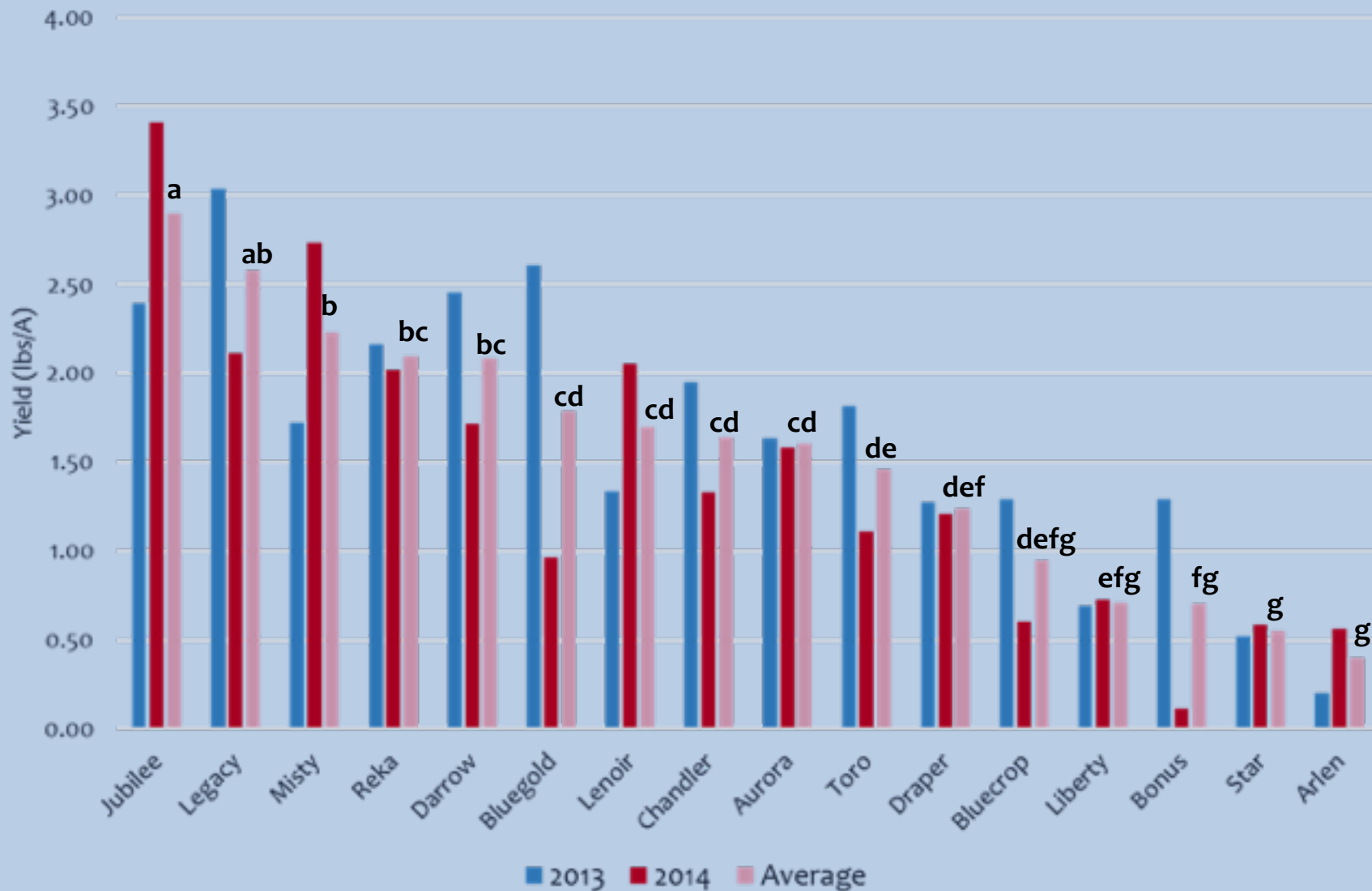
Variety	Reported Ripening
1 - Reka*	Early-Mid
2 - Toro*	Mid
3 - Bluegold*	Mid
4 - Chandler*	Late-Mid
5 - Darrow*	Late-Mid
6 - Liberty*	Late
7 - Aurora*	Late
8 - Draper	Early-Mid
9 - Legacy*	Mid
10 - Bonus	Late-Mid
11 - Bluecrop	Mid
12 - Misty	?
13 - Jubilee	?
14 - Star	?
15 - New Hanover	?
16 - Pamlico	?
17 - Beaufort	?
18 - Reville	?
19 - Georgiagem	?
20 - Hannah's Choice	Early
21 - Sweetheart	Early
22 - Arlen	?
23 - Lenoir	?
24 - Chanticleer	Early
25 - O'Neal	Early
26 - Bluehaven*	Mid
27 - Nelson*	Mid-Late

Varieties in the Trial



Variety Trial at Georgetown Research Farm

Yield of Blueberry Varieties at Georgetown Farm 2013 & 2014



2013 Freeze Damage to Flower Buds



2013 Freeze Damage to Flower Buds



Variety Trial at Georgetown Research Farm

Variety	2013 -14 Yield (lbs/plant)	Freeze Damage		
		2012	2013	2014
Jubilee	2.90 a	none	moderate	none
Legacy	2.57 ab	none	minor	none
Misty	2.23 b	moderate	moderate	moderate
Reka	2.09 bc	minor	none	none
Darrow	2.08 bc	none	none	none
Bluegold	1.78 cd	none	none	none
Lenior	1.69 cd	none	none	none
Chandler	1.64 cd	none	none	none
Aurora	1.60 cd	none	none	none
Toro	1.46 de	none	none	none
Draper	1.24 def	none	none	none
Bluecrop	0.94 defg	none	none	none
Liberty	0.71 efg	none	none	none
Bonus	0.70 fg	none	none	none
Star	0.55 g	moderate	moderate	moderate
Arlen	0.40 g	none	moderate	moderate

Blueberry Variety Trial

Legacy



Blueberry Variety Trial

Lenoir



Blueberry Variety Trial

Jubilee



Acknowledgements

- DDA Specialty Crop Block Grants (USDA)
 - Season Extension
 - New Crop Evaluations
 - Blueberry
- Emmalea Ernest
- Many students and interns