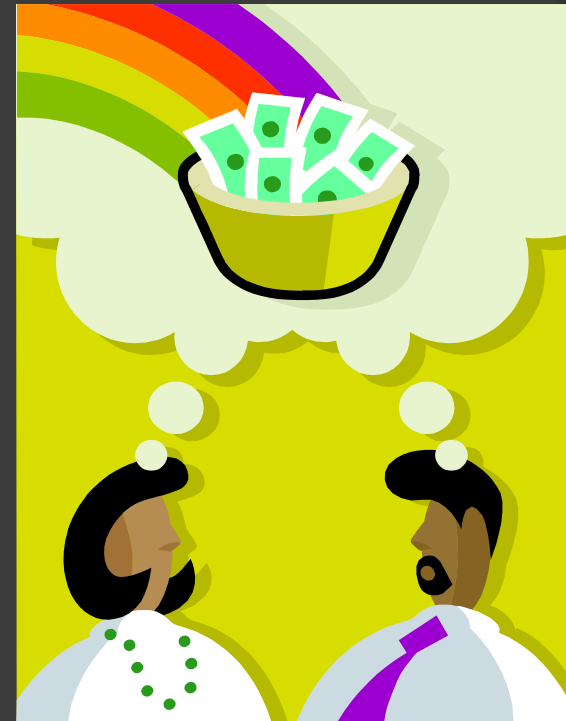


Evaluation and Demonstration of New Stone Fruit Systems



Goals of an “Ideal” System:

- ◎ Valuable Crop
 - Variety
 - Size and Quality
- ◎ Early yield & ROI
- ◎ Sustained High Marketable Yields
 - Light interception
 - Light distribution
- ◎ Labor efficient production
 - Minimal ladder use
 - Simple tasks



System Components

- ⦿ Genetic
 - Variety
 - Rootstock
- ⦿ Tree arrangement
- ⦿ Tree spacing
- ⦿ Training
- ⦿ Pruning

Missing Key: Dwarfing Rootstock

Vigor		
<u>Rootstock</u>	<u>(% of Lovell)</u>	<u>Issues</u>
Bailey	90%	Large tree
Empyrean®2 (Penta)	90%	Large tree
Empyrean®3 (Tetra)	90%	Large tree
Controller 9	90%	Large tree
Controller 6, 7, 8, 8.5	????	Too new
Controller 5	50%	Discontinued (anchorage)

Missing Key: Dwarfing Rootstock

<u>Rootstock</u>	Vigor	<u>Issues</u>
	(% of Lovell)	
American plum	70%	Rootsuckers
Fortuna	70%	Survival
Imperial California	90%	Survival
Ishtara	70%	Survival
Krymsk 1	75%	Survival
Krymsk 2	60%	Survival

Missing Key: Dwarfing Rootstock

Cumulative Mortality in Biglerville, 2013

Rootstock	Year of Planting	Mortality (%)
Fortuna	2009	38
Ishtara	2008	70
Krymsk 1	2008 & 2009	40 & 50
Krymsk 2	2008	40
Imperial California	2009	100

Missing Key: Dwarfing Rootstock

- ⦿ Dwarfing stocks remain a long-term goal
- ⦿ Many are interspecific hybrids
- ⦿ When size control is achieved:
 - Tree often appears stressed (incompatibility)
 - Fewer and/or small fruit
 - No increase in biological efficiency

Objectives:

- Evaluate
- 4 training systems: 172 - 484 trees / Acre
- 2 peach varieties:
 - Loring (conventional growth habit)
 - Sweet-N-Up (upright growth habit)



Upright Variety: Sweet N Up

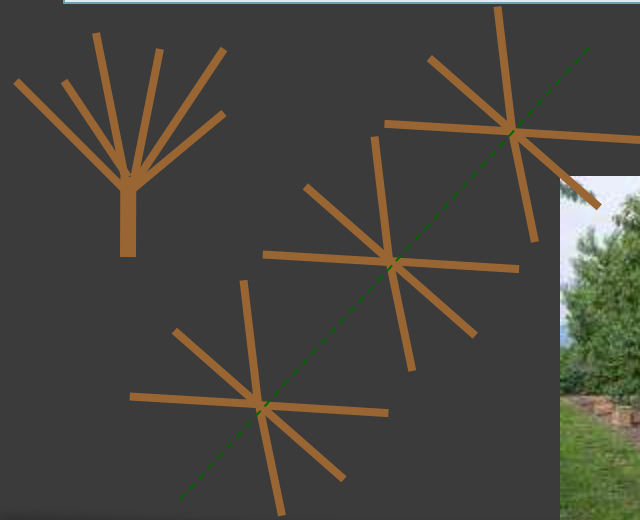


Peach Systems Trial

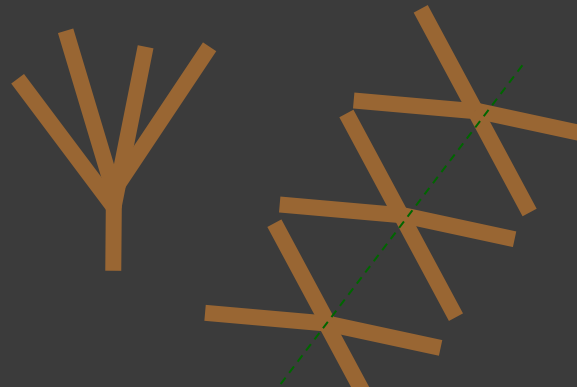
Perp V, 484 T/A



Hex V, 242 T/A



Bird's Eye View



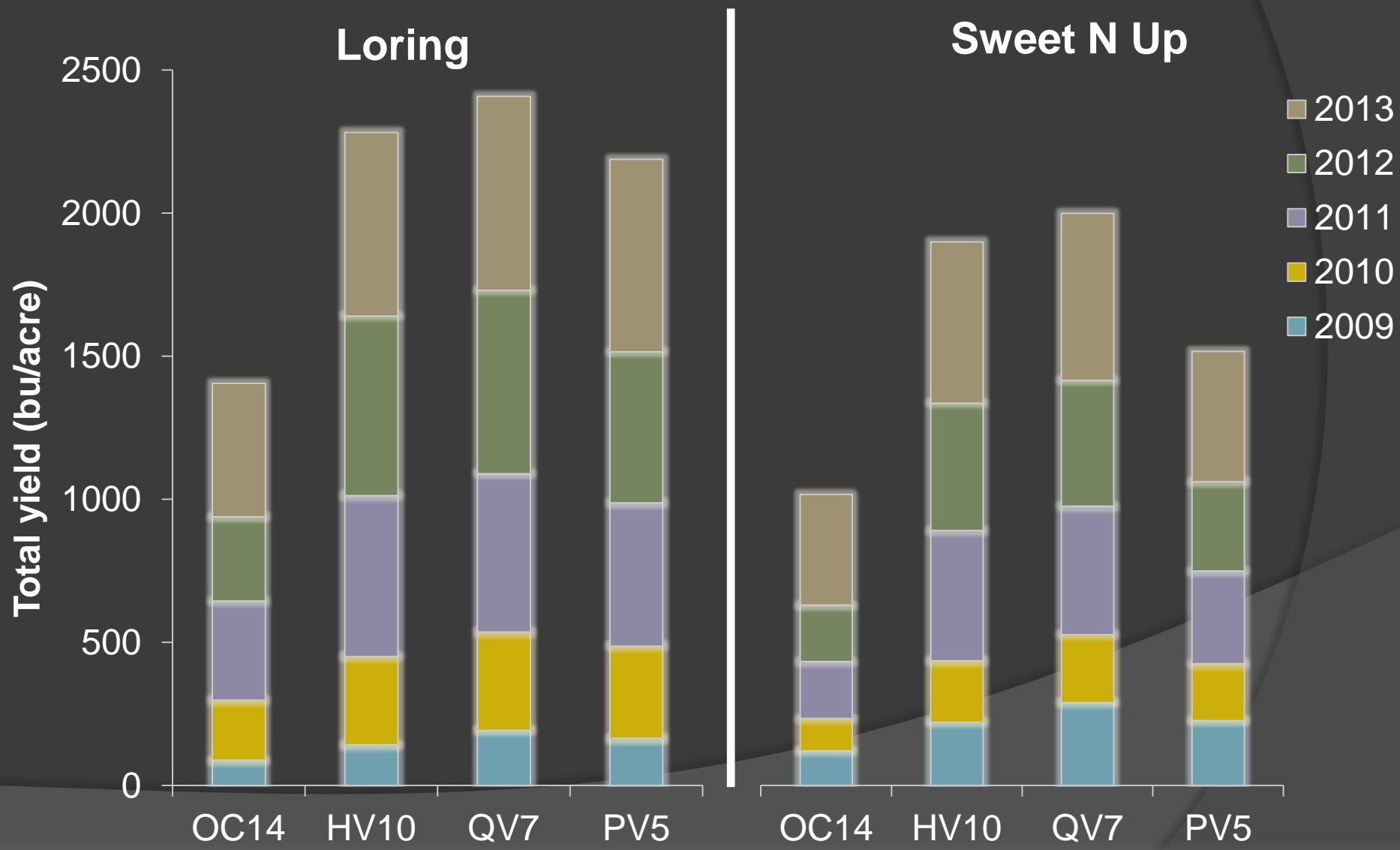
Bird's Eye View

Quad V, 346 T/A

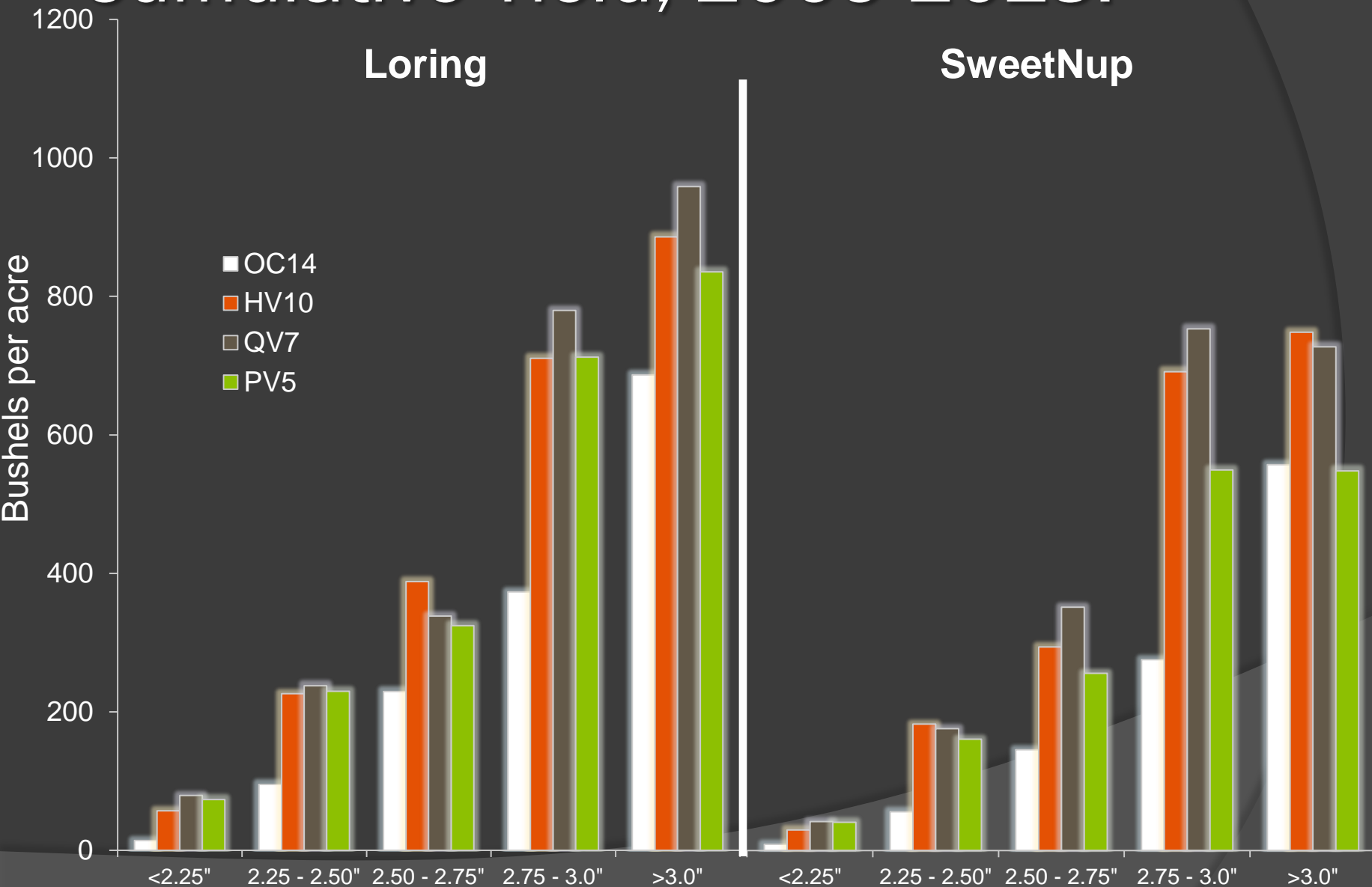


Open Center, 173 T/A

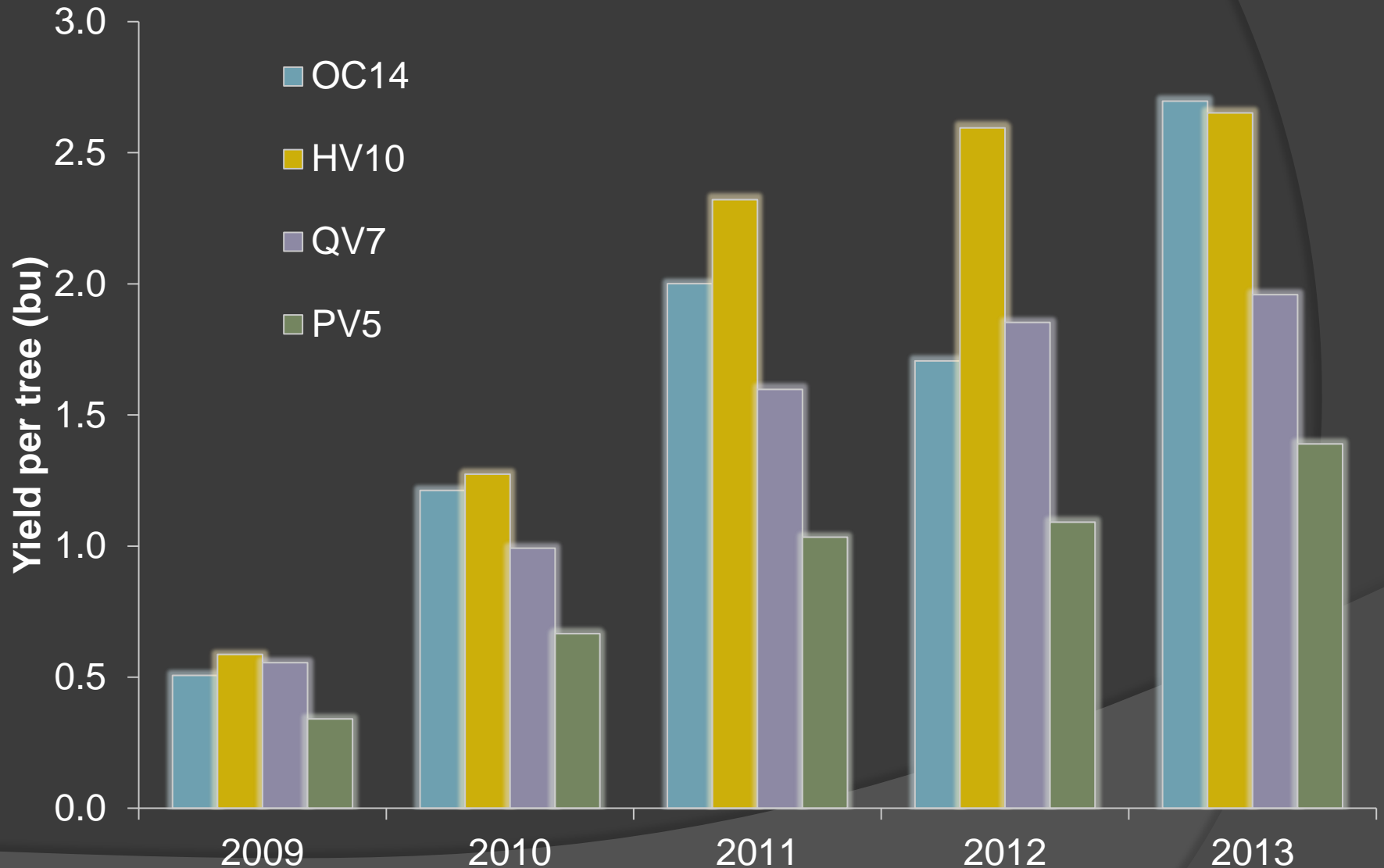
Cumulative Yield, 2009-2013:



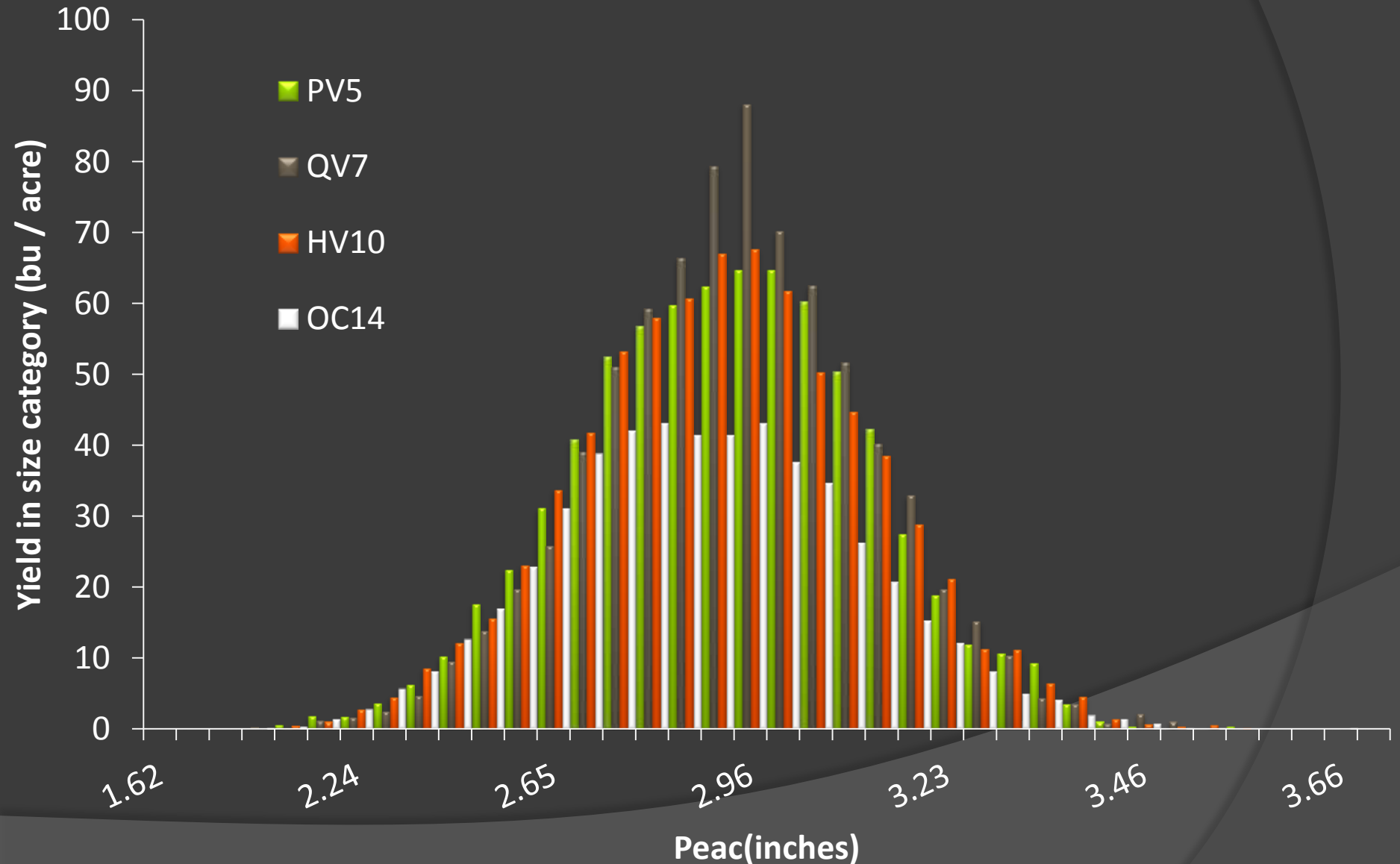
Cumulative Yield, 2009-2013:



Yield per tree by year, Loring



2013 Fruit Size Distribution, Loring



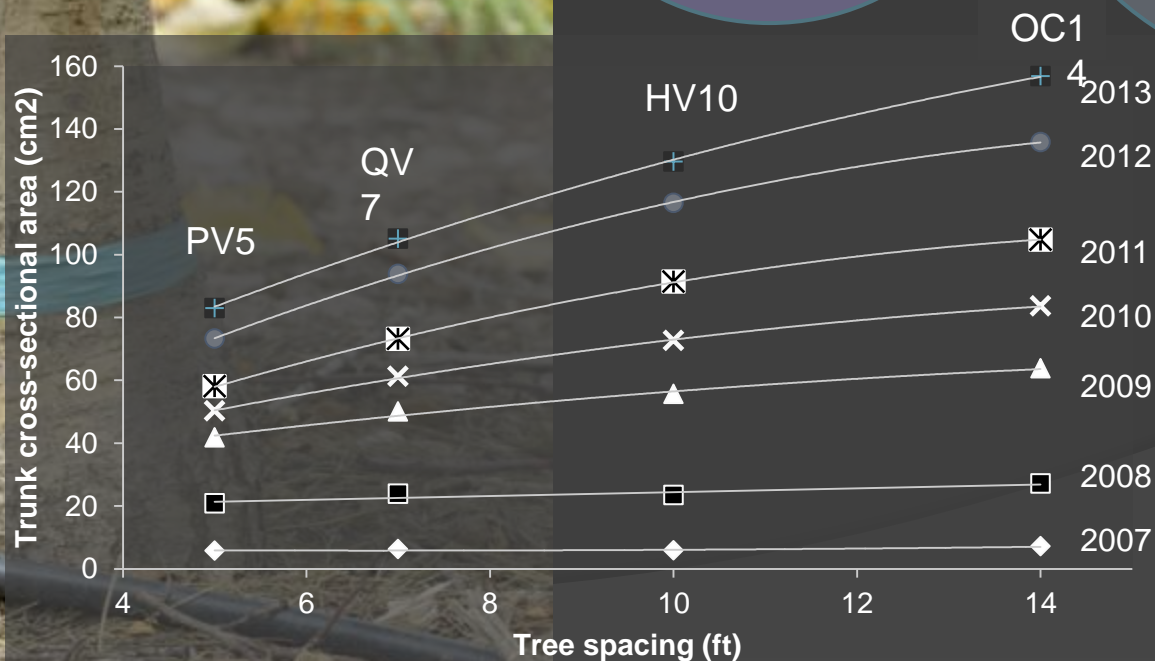
Cumulative trunk growth, 2007-13

Perp. V
(483 t/A)
83 cm²

Quad V
(346 t/A)
105 cm²

Hex V
(242 t/A)
130 cm²

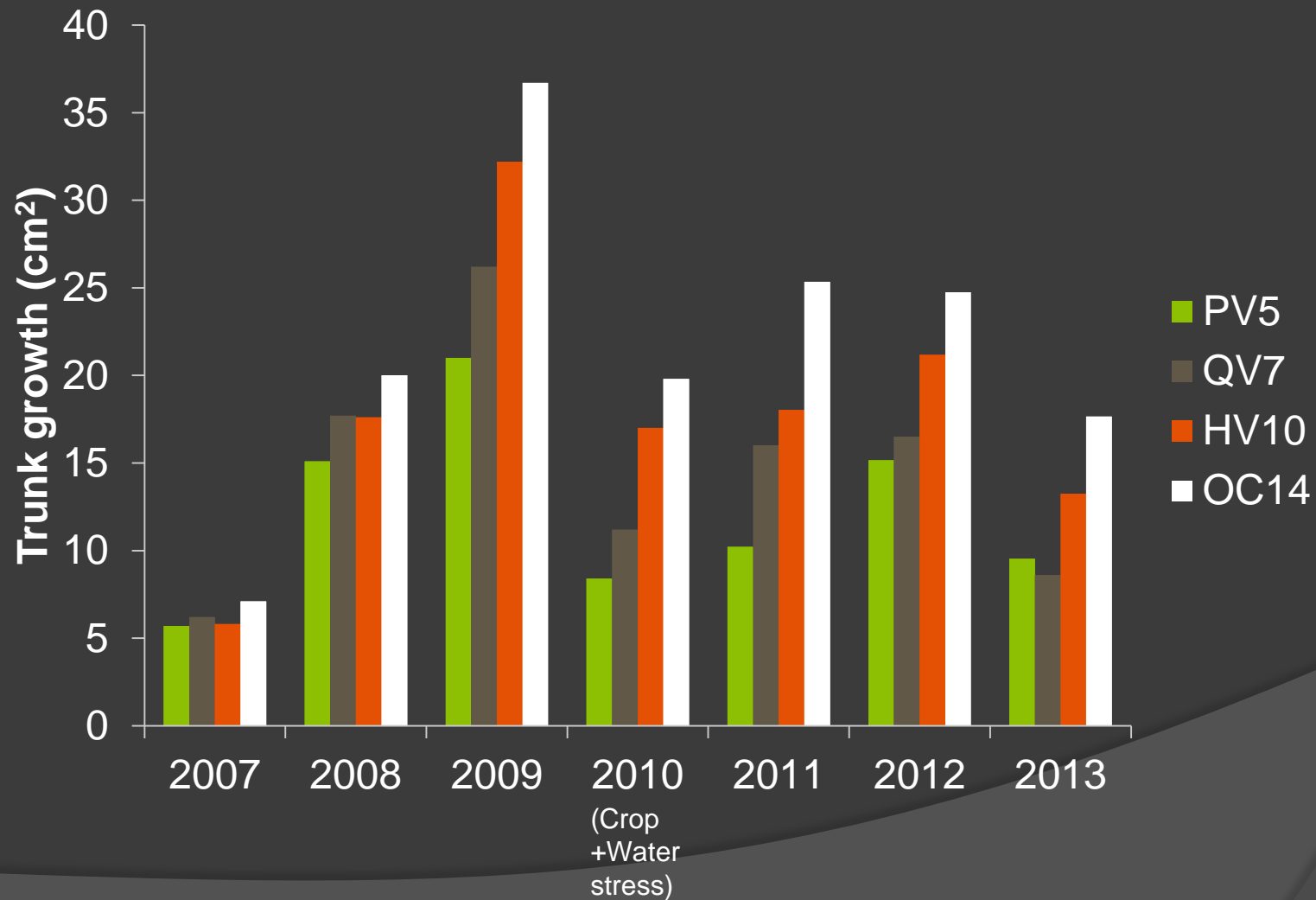
Open Center
(173 t/A)
157 cm²



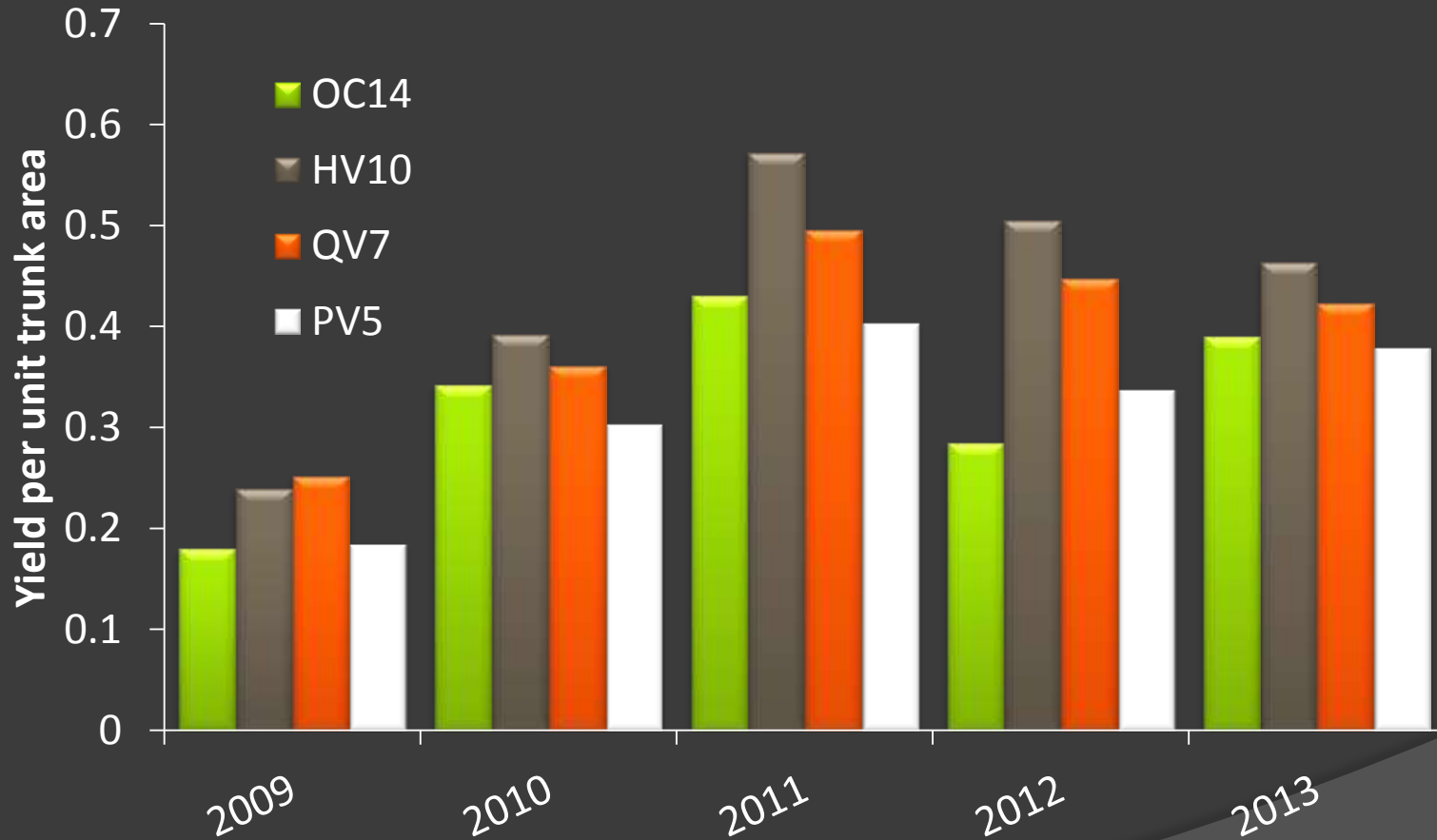
Trunk size correlates to tree spacing

Year	R ² value
2013	0.999
2012	0.999
2011	0.999
2010	0.999
2009	0.989
2008	0.856
2007	0.792

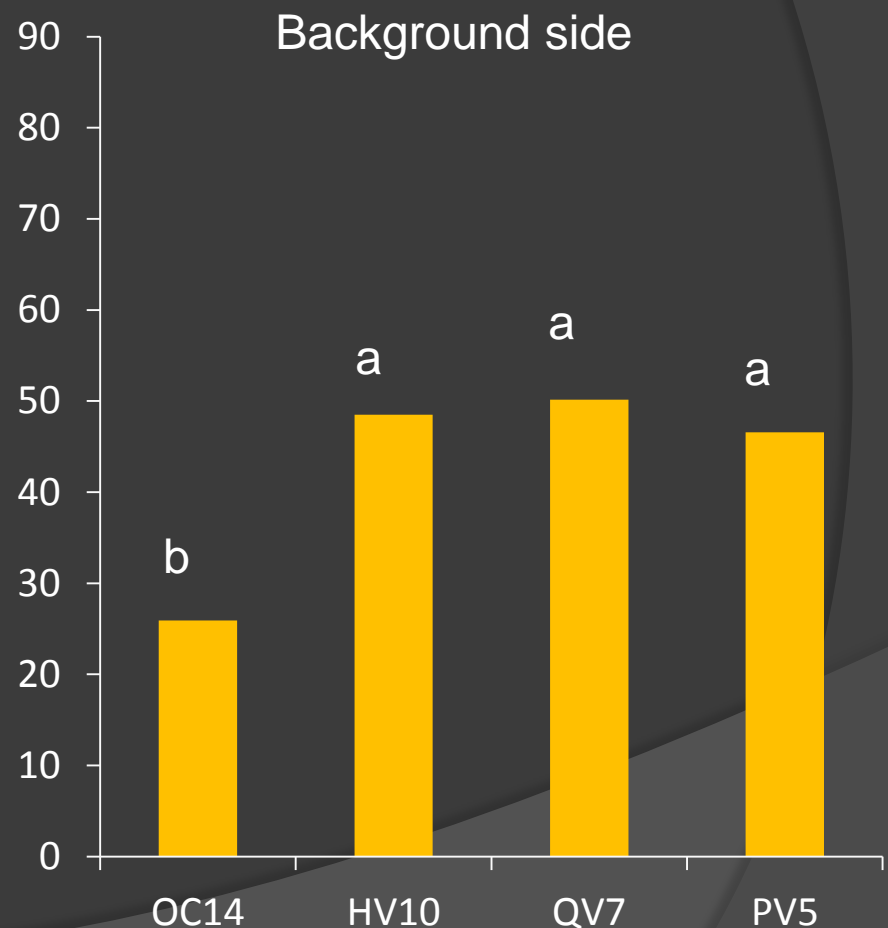
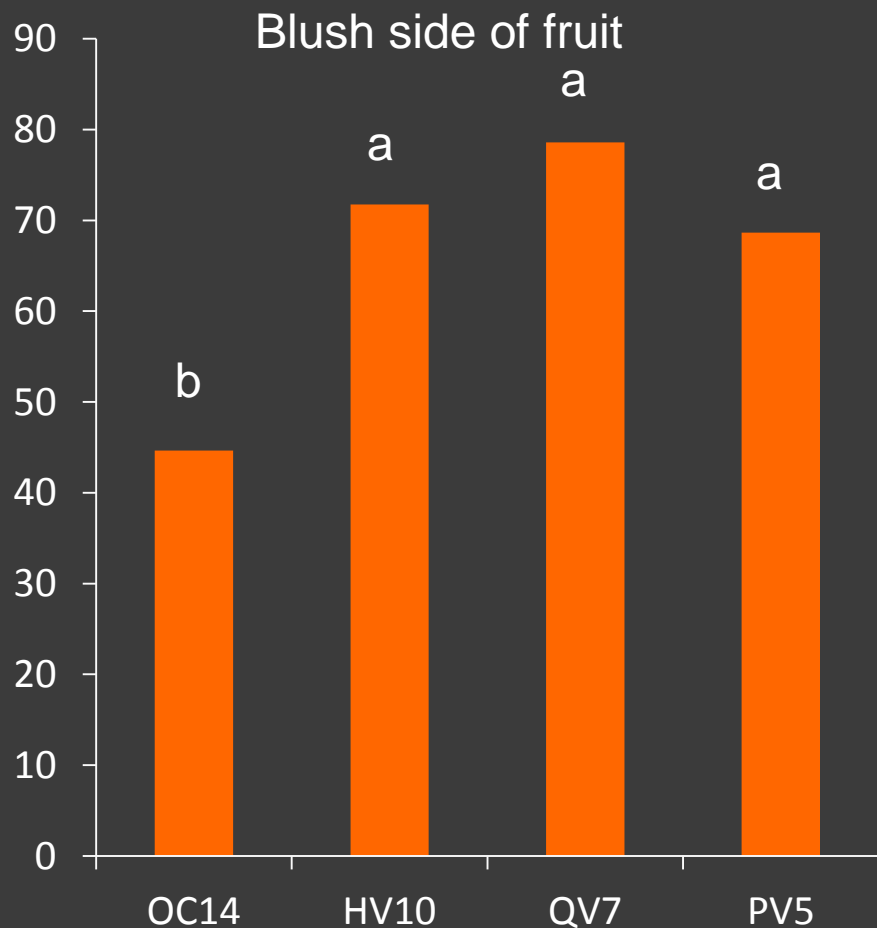
Trunk Growth by Year



2013 Yield Efficiency



Blush coverage (%), Loring 2012



Income over specified costs / A

Sweet N Up						
	2009	2010	2011	2012	2013	Cumulative
OC14	\$ 1,741	\$ 633	\$ 2,014	\$ 4,575	\$ 6,953	\$ 15,916
HV10	\$ 2,938	\$ 2,283	\$ 4,534	\$ 9,930	\$ 8,241	\$ 27,927
QV7	\$ 2,556	\$ 240	\$ 4,255	\$ 9,628	\$ 9,551	\$ 26,231
PV5	\$ 2,809	\$ (162)	\$ 2,169	\$ 5,871	\$ 6,072	\$ 16,795

Income over specified costs / A

Loring						
	2009	2010	2011	2012	2013	Cumulative
OC14	\$ 1,246	\$ 1,764	\$ 3,880	\$ 7,455	\$ 6,625	\$ 20,970
HV10	\$ 1,647	\$ 3,311	\$ 6,277	\$ 15,886	\$10,218	\$ 37,338
QV7	\$ 3,911	\$ 436	\$ 5,861	\$ 15,677	\$11,095	\$ 36,981
PV5	\$ 1,855	\$ 226	\$ 4,546	\$ 11,952	\$ 9,304	\$ 28,077

Why do V systems perform better?

- More linear bearing surface per acre
- Better light interception
- Training compatible with natural growth
- Less aggressive, 'retaliatory' growth
- They don't shade themselves excessively

Summary - Variety

- ◎ Similar tree size for both
 - Sweet N Up trees were taller (con)
 - Loring Trees were wider (pro)
- ◎ Loring pulling away on cumulative yield
 - Sweet n Up had highest yield in 2009
 - Loring has been yielding more since 2010
- ◎ **Advantage: standard spreading habit**

Future Missing Key?

- Who will test future peach varieties?
- Trend to private breeding programs
- Trend to California varieties
- Loss of Extension personnel
- Answer: YOU WILL!

Summary

⊙ V systems

- Higher yield / A
- Redder fruit color
- More economic value
- More efficient use of land
- More bearing surface per acre
- More large fruit, more small fruit, more fruit

⊙ Open center systems

- Very slight savings on labor
- Larger average fruit size
- Less fruit, also less large fruit (per acre)
- More wood

Take Home Message.

~~2012 & 2013~~ 2014:

- ⦿ Hex V at 10 x 18 & Quad V at 7 x 18
- ⦿ Quad:
 - Easier to get 4 good scaffolds
 - Earlier Bu. / A = best system for high value crops
- ⦿ Hex:
 - Similar performance to Quad V with less initial investment
 - Scheduled replacement of declining peach blocks

Questions Remain (2013/ 2014)

- ⦿ Can we maintain higher yields in V systems as trees become mature?
 - Especially in lower canopy?
- ⦿ Yields of all systems have continued to increase through 2013
 - PV5 is “catching up” to QV7 and HV10
 - Shoot vigor has migrated up in all systems,
 - Shoots in lower canopy of V trees still Ok.

Questions Remain (2013/ 2014)

- Can we achieve an optimal balance between high yield and fruit size?
- Yes! 2013 V system Loring yields > 600 BPA and large fruit size (with irrigation for final swell)

Peach Facts

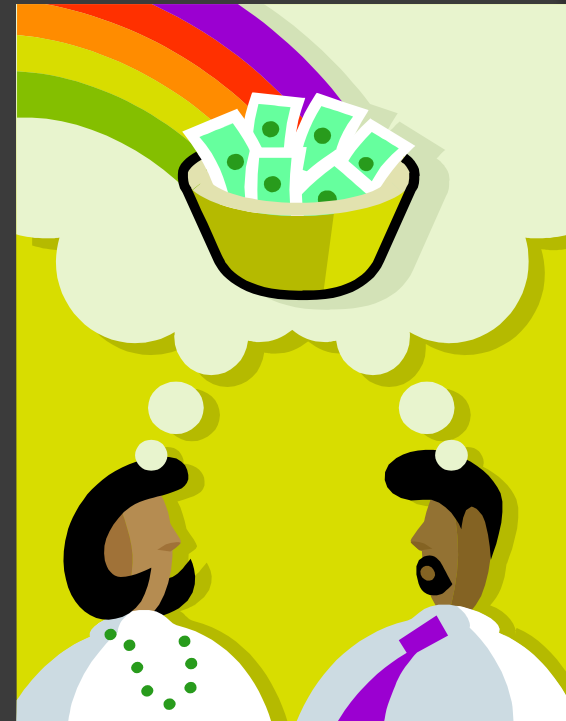
- An peach fruit is ~89% water by weight
- ~10% by weight is carbohydrate
$$6\text{CO}_2 + \underline{12\text{H}_2\text{O}} + \text{light} = \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$$
- ~1% is mineral moved to the fruit by water
- Fruit growth occurs by water pressure (turgor)
- Deficits during final swell reduce size
- Irrigation is water insurance!

Questions Remain (2013/ 2014)

- Do Open Vase trees ever catch up, if so when?
- OC14 yield per tree = to HV10 in 2013
- No evidence that OC14 yield / acre will ever catch up as of 2013, 7th yr/ 5th crop
- Do we still care?

Goals of an “Ideal” System:

- ◎ Valuable Crop
 - Variety
 - Size and Quality. Edge: HV / QV
- ◎ Early yield & ROI. Edge: HV / QV
- ◎ Sustained High Marketable Yields
 - Edge: HV / QV
- ◎ Labor efficient production
 - Minimal ladder use. Edge: OC
 - Simple tasks. Edge: V systems



Thanks For Your Support!



- Hoffman Foundation
- Pennsylvania Peach & Nectarine Board
- SHAP



Feedback From Growers

- “I liked your talk, and I’m going to plant Hex V, but I’m going to keep them short”

Peach Trees Want to Be Trees!

- ◎ Natural growth habit: Acrotonic
 - Vigorous growth is at the periphery
 - Secondary buds near base of limbs are weak
- ◎ Species is INTOLERANT of shade
 - Shaded apple limbs will limp along for years
 - Shaded peach limbs DIE!

Other Methods of Restricting Tree Height

“Dilute” vigor between multiple scaffolds

- Two scaffold V:14.4 ft;
- Six scaffold V 13.9 ft. (3.5%)
- Not effective in peach



Pruning for Restricting V Tree Height

Heading of V-systems:

- in the upper half of a vigorous scaffold,
- upright branching angle,
- favorable light environment...

Severing apical dominance stimulates regrowth

- Result: Shorter tree with more branches and worse shading than if it had been left tall

Summer shearing/ Dormant heading cuts no help

A Common Challenge:

Bearing surface migrates up



Loss of Productivity in Lower Canopy

- ◎ Bearing surface migrates up
 - Shading partly responsible
 - Summer pruning/shearing to prevent shading?
- ◎ Renewal pruning not as successful as apple
 - Peach growth habit: acrotonic
 - Secondary buds at base of lateral are weak/unlikely to grow out as new shoots

Pruning Goals: Fruit Size and Quality

Sunlight and quality of Fruiting Laterals

- ⦿ Eliminate excess fruiting laterals
 - Reduce crop density and shading
- ⦿ Space fruiting laterals evenly up / down & radially on scaffold
 - Eliminate shade from limb crowding
- ⦿ Eliminate long fruiting laterals
 - Reduce shading
- ⦿ Eliminate small fruiting laterals
 - Promote higher Leaf : Fruit ratio

Std. Open Vase Peach System

Open Vase Canopy

- ⦿ Short height for ease of labor access
- ⦿ Heavy pruning stimulates branch renewal
- ⦿ Well-understood
- ⦿ Creates challenges:
 - Reduced yield and fruit color (low light interception / penetration)
 - Less compatible with mechanization

Intensive Peach Systems

Tall Narrow V Canopy

- ⦿ Canopy split into 2 narrow tree walls
- ⦿ Increased yield and fruit color
- ⦿ Facilitates mechanization
- ⦿ Creates challenges:
 - Tall tree + labor-intensive crop
 - Renewal pruning not as successful as apple

Pruning for Peach Crop Goals

Open Vase orchard

350 bushel / A of large (3") fruit

= 35,000 peaches per A

140 trees/A = 250 peaches/ tree

5 scaffolds / tree = 50 peaches/ scaffold

At 3 peaches per fruiting lateral = 17
laterals

20% "safety margin" =

20 fruiting laterals / scaffold

Pruning for Peach Crop Goals

Perpendicular V orchard

600 bushel / A of large (3") fruit

= 60,000 peaches per A

400 trees/A = 150 peaches/ tree

2 scaffolds / tree = 75 peaches/ scaffold

At 3 peaches per fruiting lateral = 25
laterals

20% "safety margin" =

30 fruiting laterals / scaffold

Open Vase Pruning



Thin out Upright & Pendant Secondary Limbs



Bench Cuts & Thin Laterals



Heading Cut in Open Vase: The Bench Cut

Essential to low headed open vase system

Slows ascent of canopy (+)

Contributes to a loss in productivity (+)

Increases risk of canker infection (-)

Stimulates vigorous regrowth in canopy

- Stimulates renewal shoots (+)

- Shades lower canopy, with loss in productivity/
quality (-)

Pruning Perpendicular V



Reduce / Thin Out Secondary Limbs



Renewal: 2ndary Limbs Cut Back to 1st Strong Fruiting Lateral



Pruning Fruiting Laterals

- ⦿ Dormant heading releases lateral buds from apical dominance
- ⦿ Dormant heading leaves basal buds to set crop (not the best).
- ⦿ Summer shearing = many heading cuts

Peach Pruning Demo

- 6 Feb (Next Thursday)
- Rich Marini
- Jim Schupp
- V and OC systems
- Hands on!