

Sweet Cherry Harvest Systems and Efficiency



Matthew Whiting
Washington State University



Major challenges:



- Labor availability decreasing, costs increasing, demographics changing

Major challenge:



- Negative relationship between speed and quality

Not about harvest process



Not about harvest process



- Get fruit out of orchard quickly
- Minimize dumps/handling



Bin filling is important

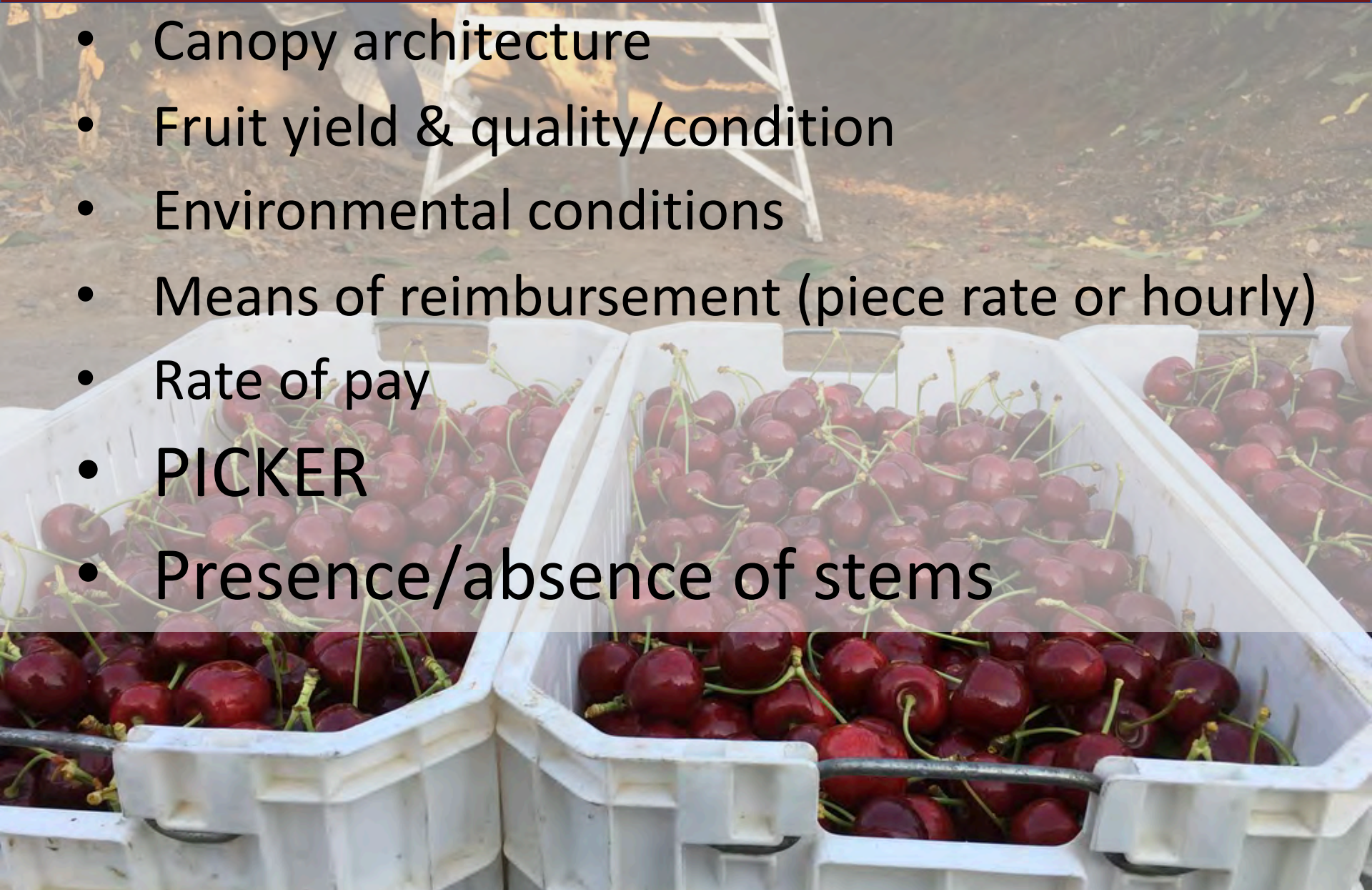


Factors affecting harvest efficiency:



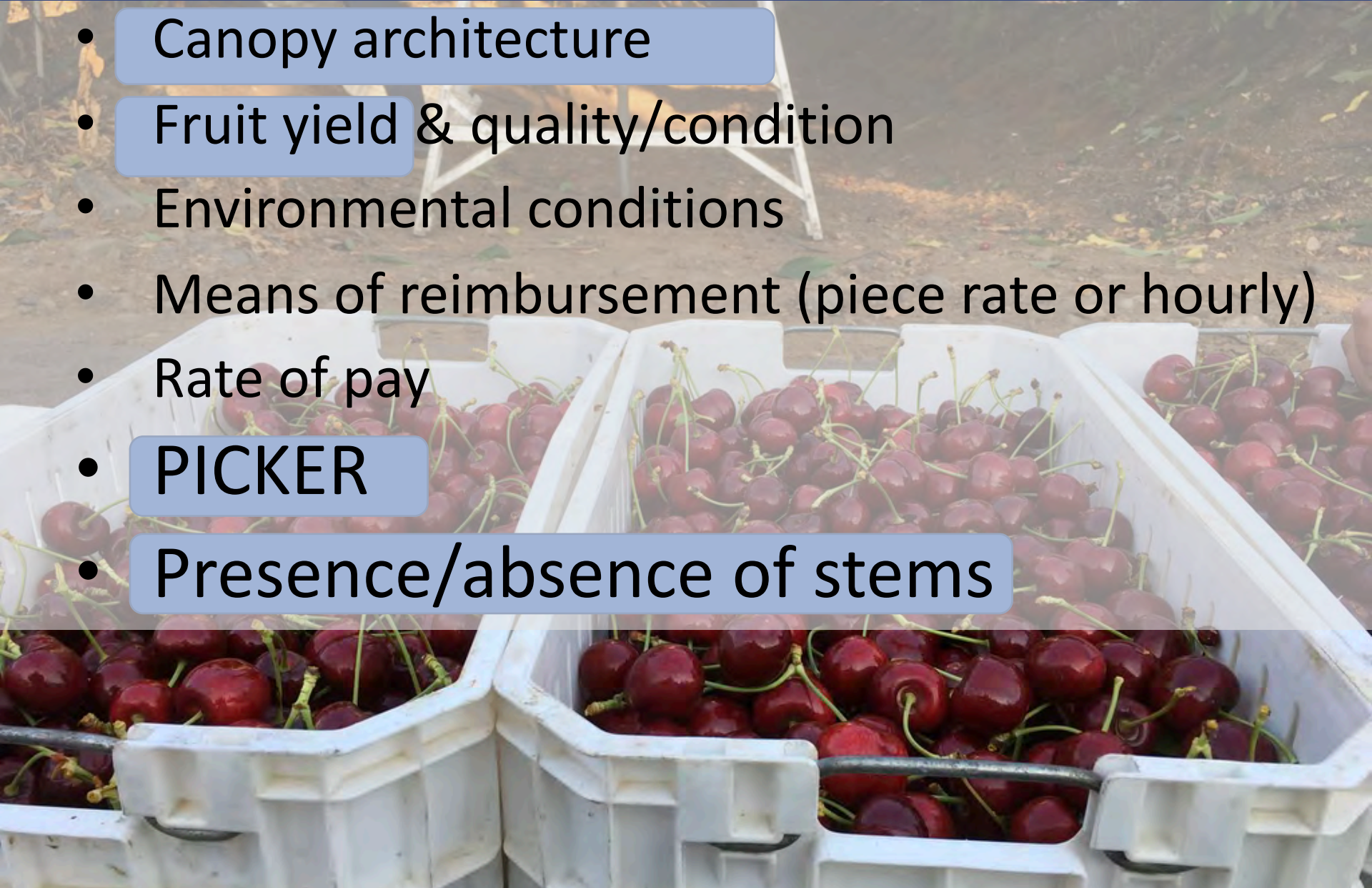
Factors affecting harvest efficiency:

- Canopy architecture
- Fruit yield & quality/condition
- Environmental conditions
- Means of reimbursement (piece rate or hourly)
- Rate of pay
- **PICKER**
- Presence/absence of stems



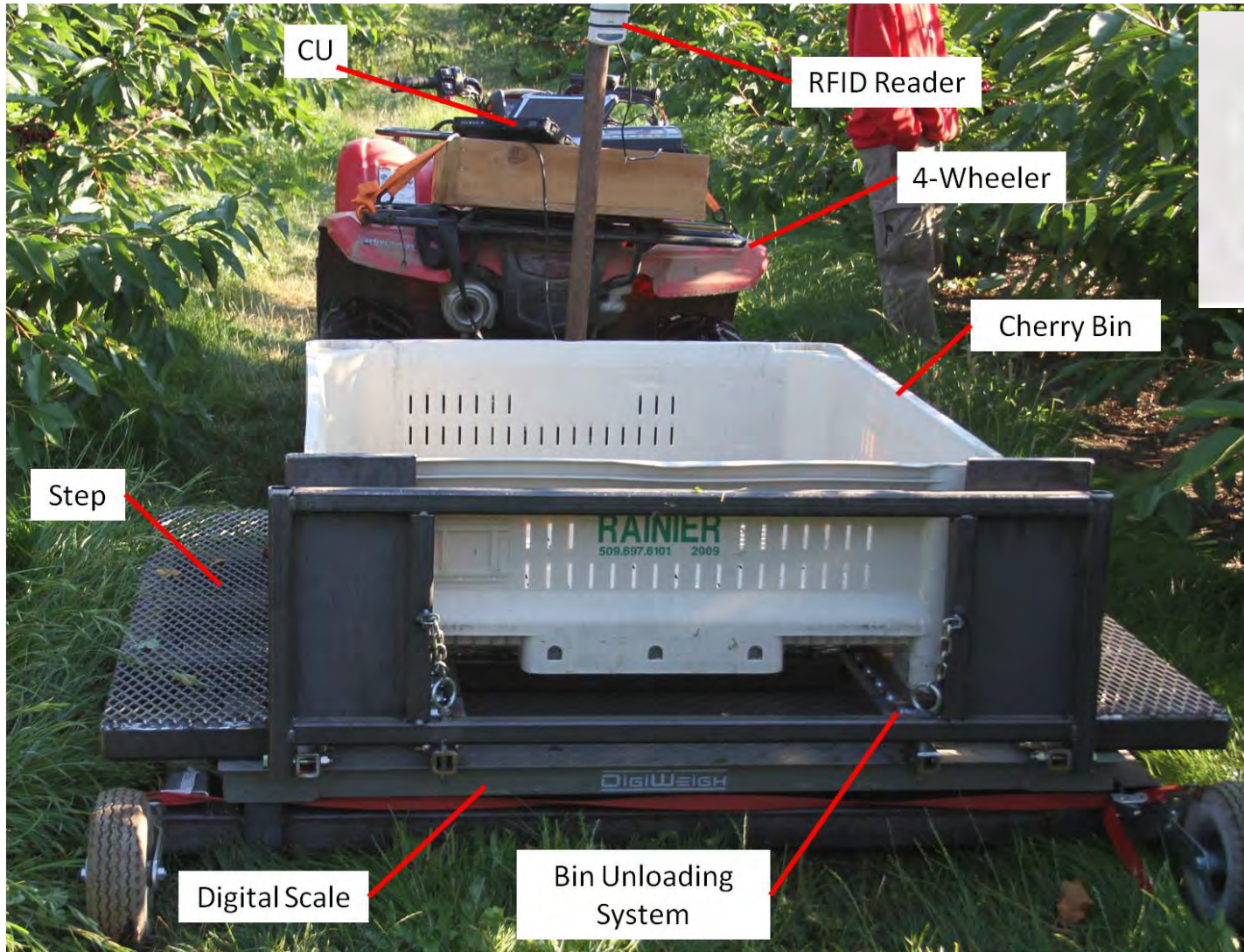
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'Labor Monitoring System' built in 2011

Research tool to study harvest efficiency



RFID bands



LMS Work Flow



Pickers
issued
unique
RFID band

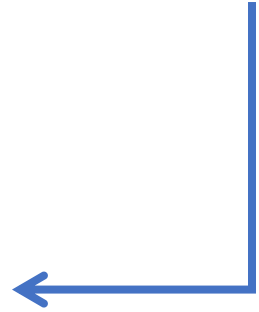
Pick fruit
normally

Weigh
fruit/identify
picker (LMS)

Transmit
data
wirelessly
to cloud
server

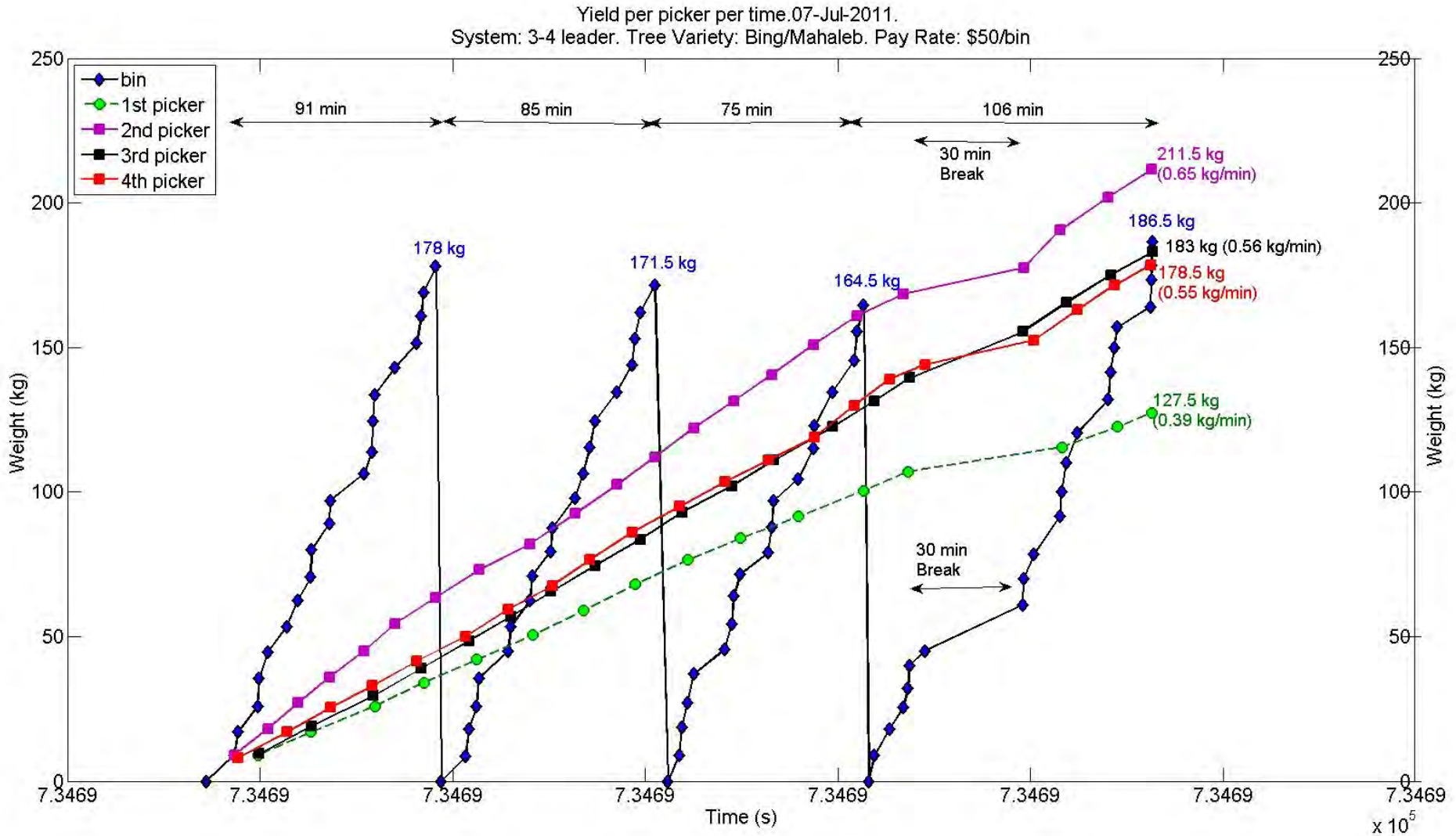
Visualize Harvest Data

- Analyze picking efficiency
- Generate payroll reports
- Improve fruit handling logistics



Picker efficiency

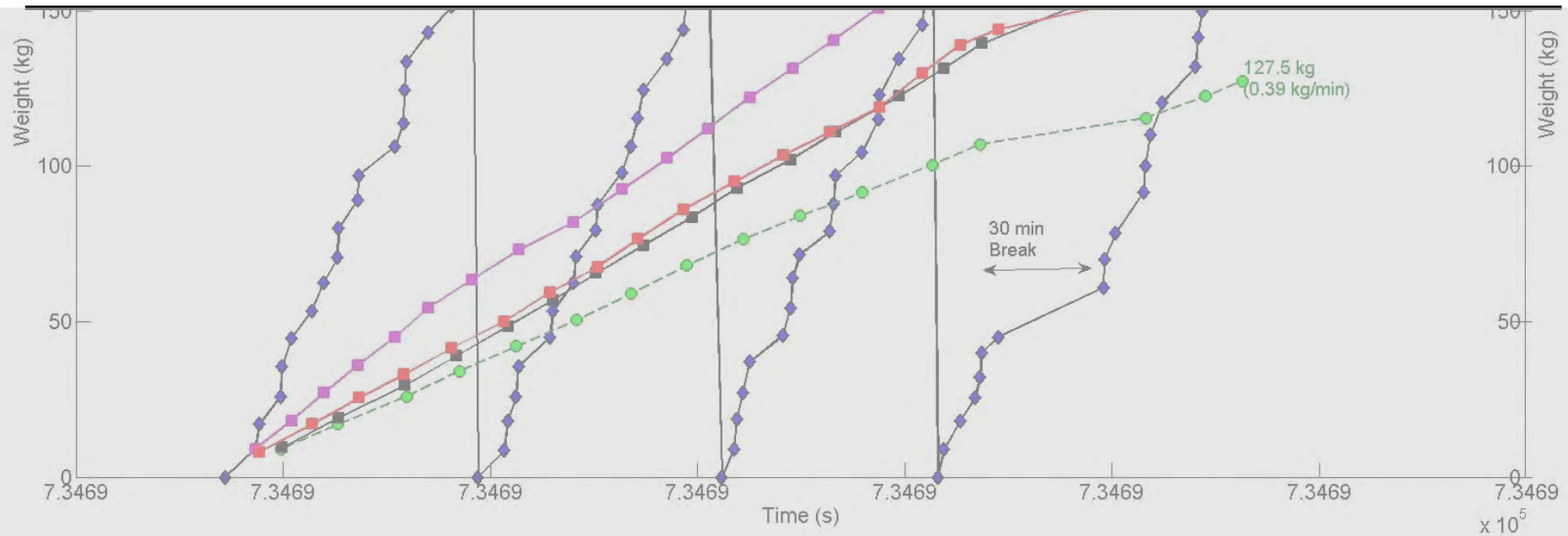
4 pickers – 4 bins



Picker efficiency

4 pickers – 4 bins

Picker	Total (lbs)	lbs/min	Buckets	lbs/bucket	Time fill bin	Time if 15 ppl	Ppl needed for 15 min
1	474	1.5	21	22.6	3 hr 53	15 mins	15.5
2	410	1.3	18	22.8	4 hr 30	18 mins	18
3	400	1.3	20	20.0			
4	286	0.9	15	19.1	6 hr 28	26 mins	26





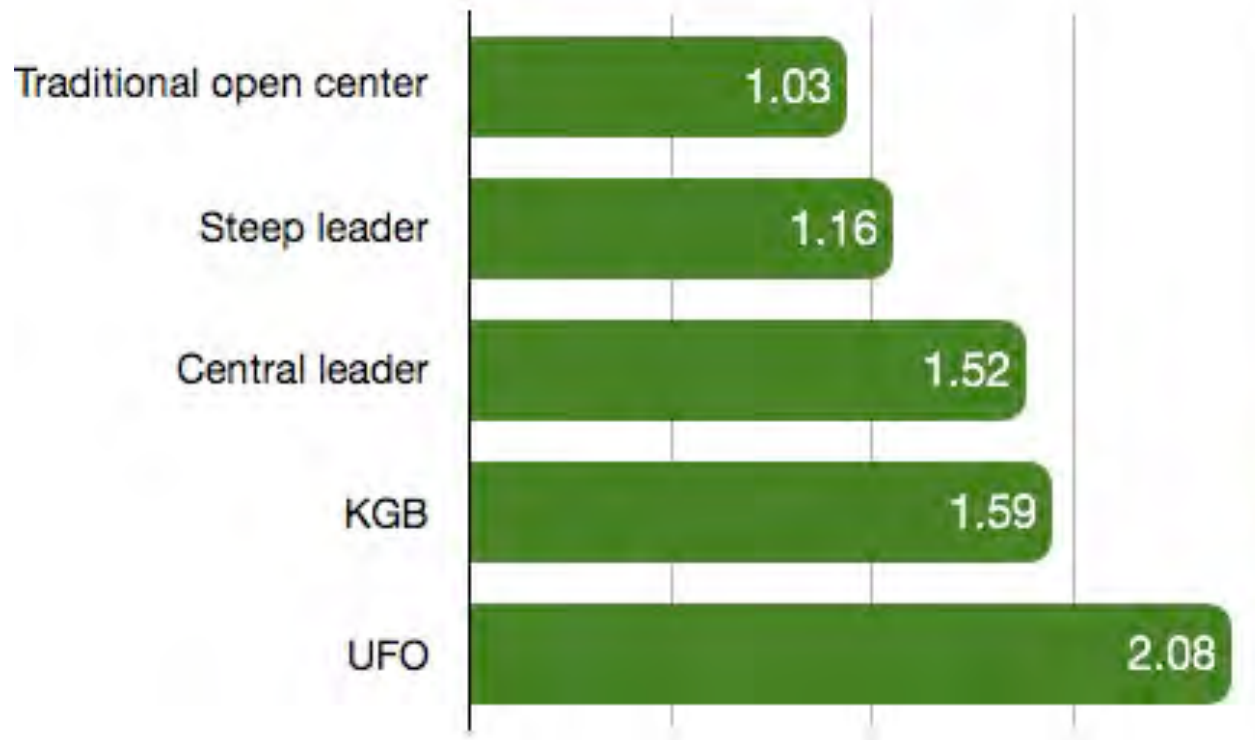
Canopy architecture: what difference does it make?



Harvest efficiency (lbs/min)

- Same 4 pickers harvesting in 5 different commercial orchards

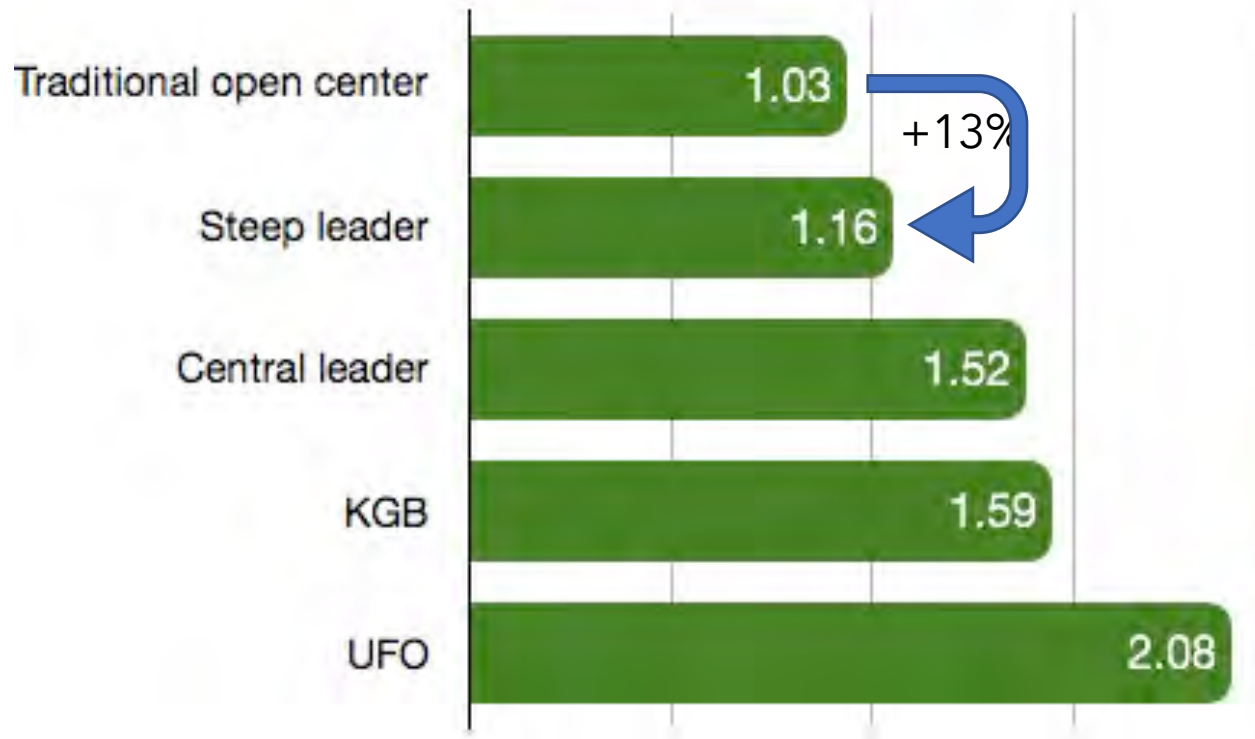
Ampatzidis Y. and M. Whiting, HortScience. 2013. 547-555.



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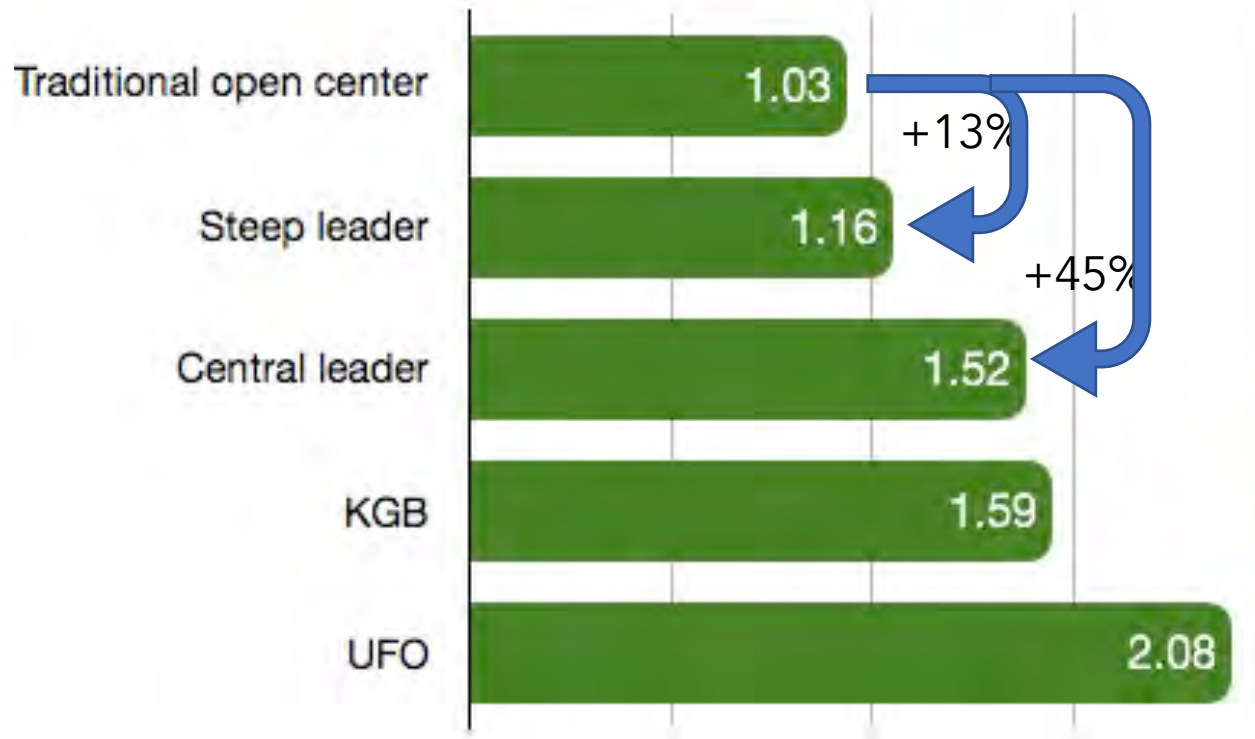
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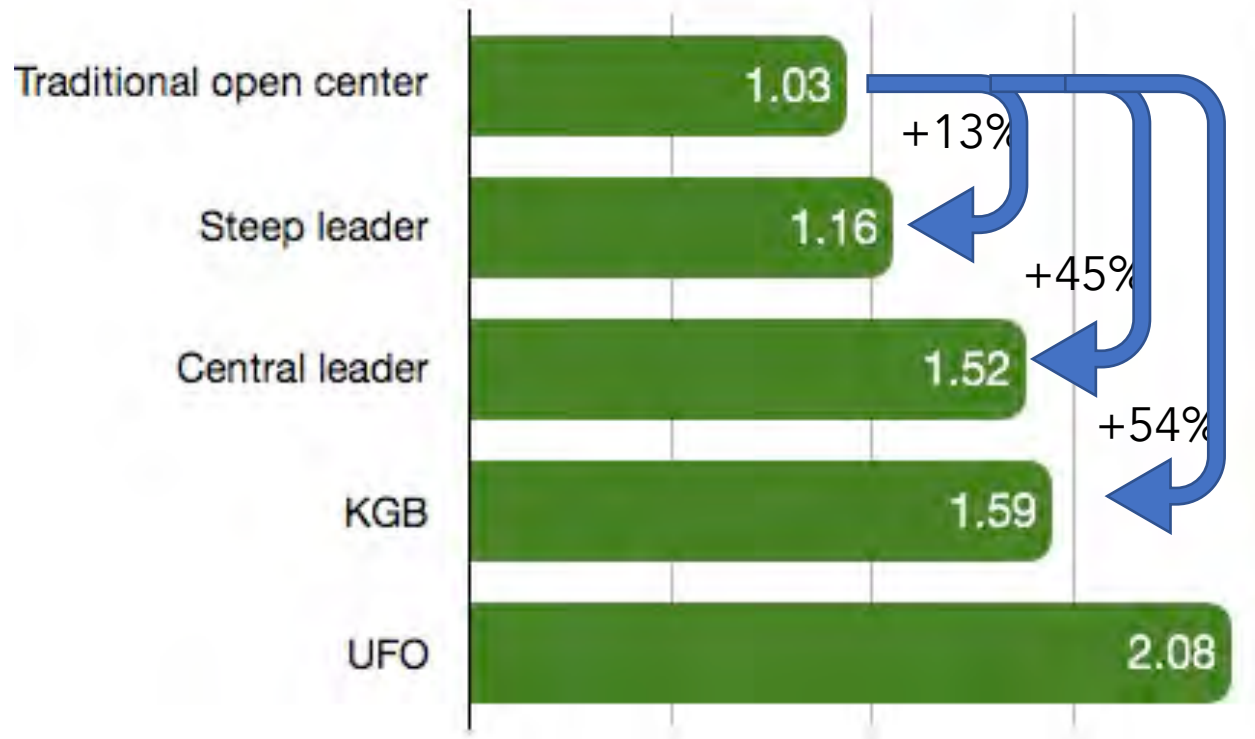
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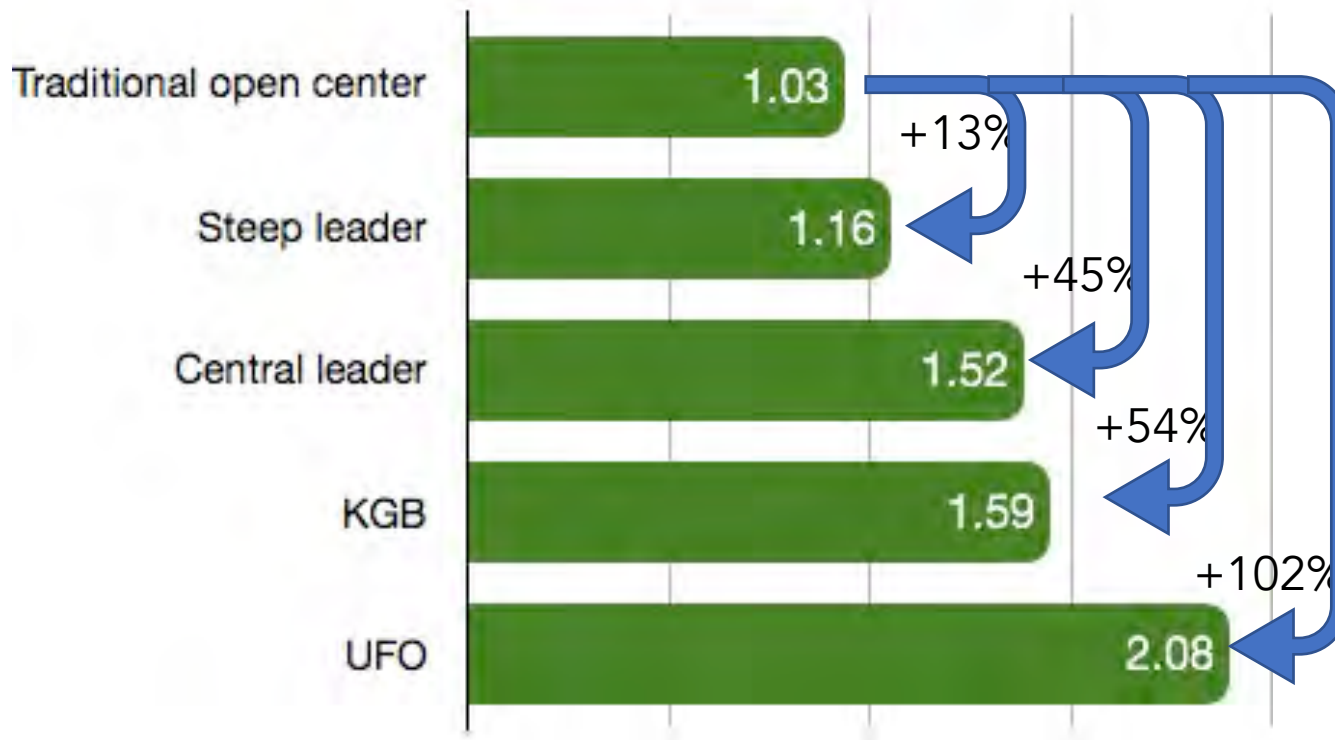
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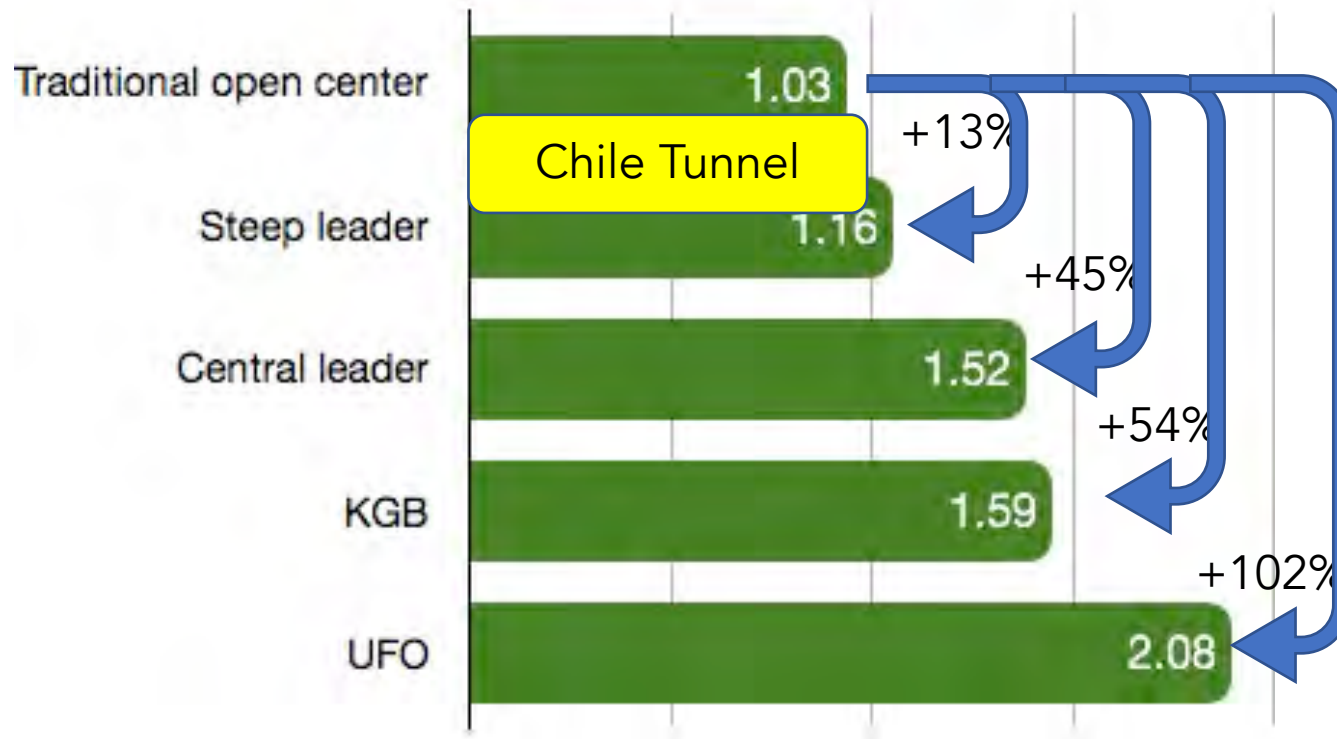
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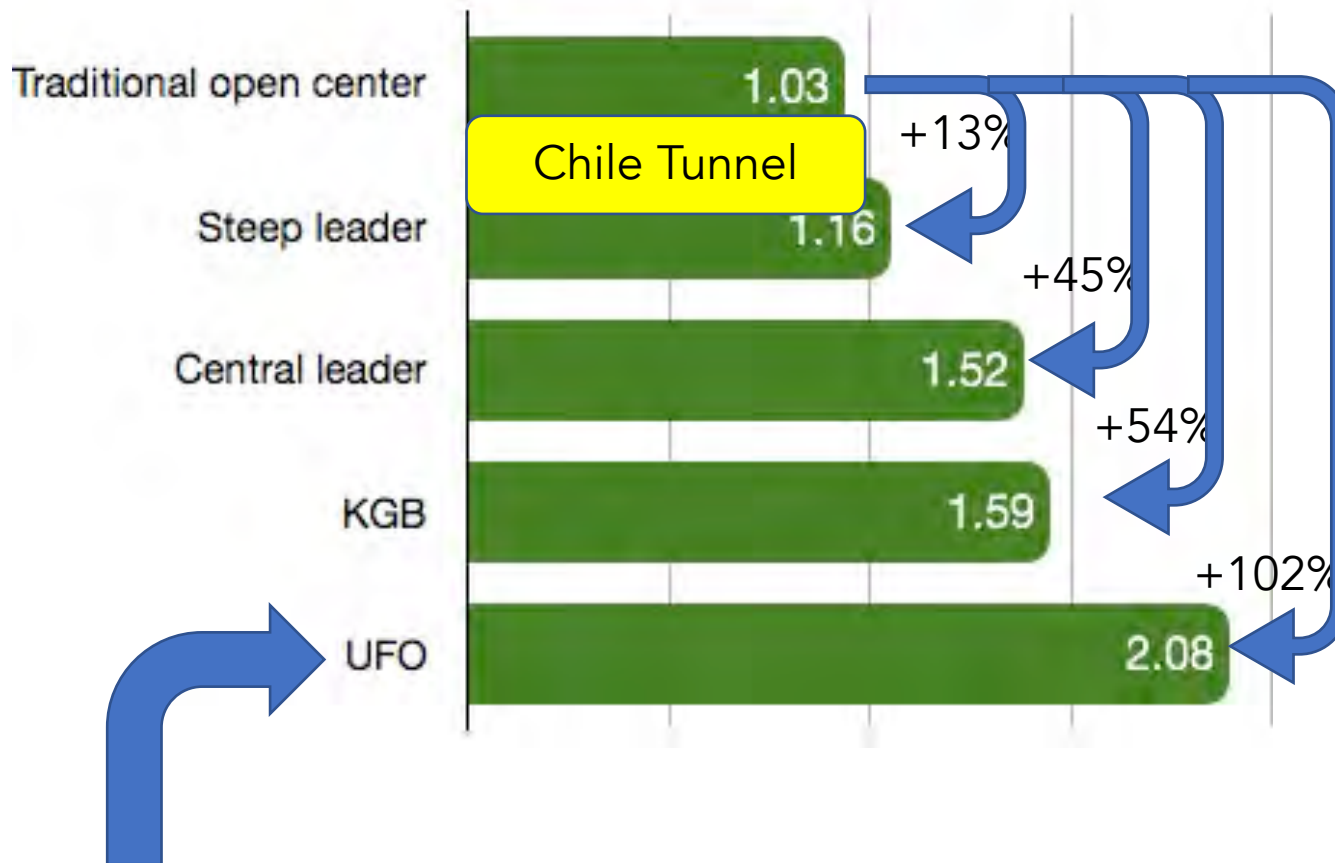
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Harvest efficiency (lbs/min)

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Same acreage – half the pickers or twice as fast

Steep leader

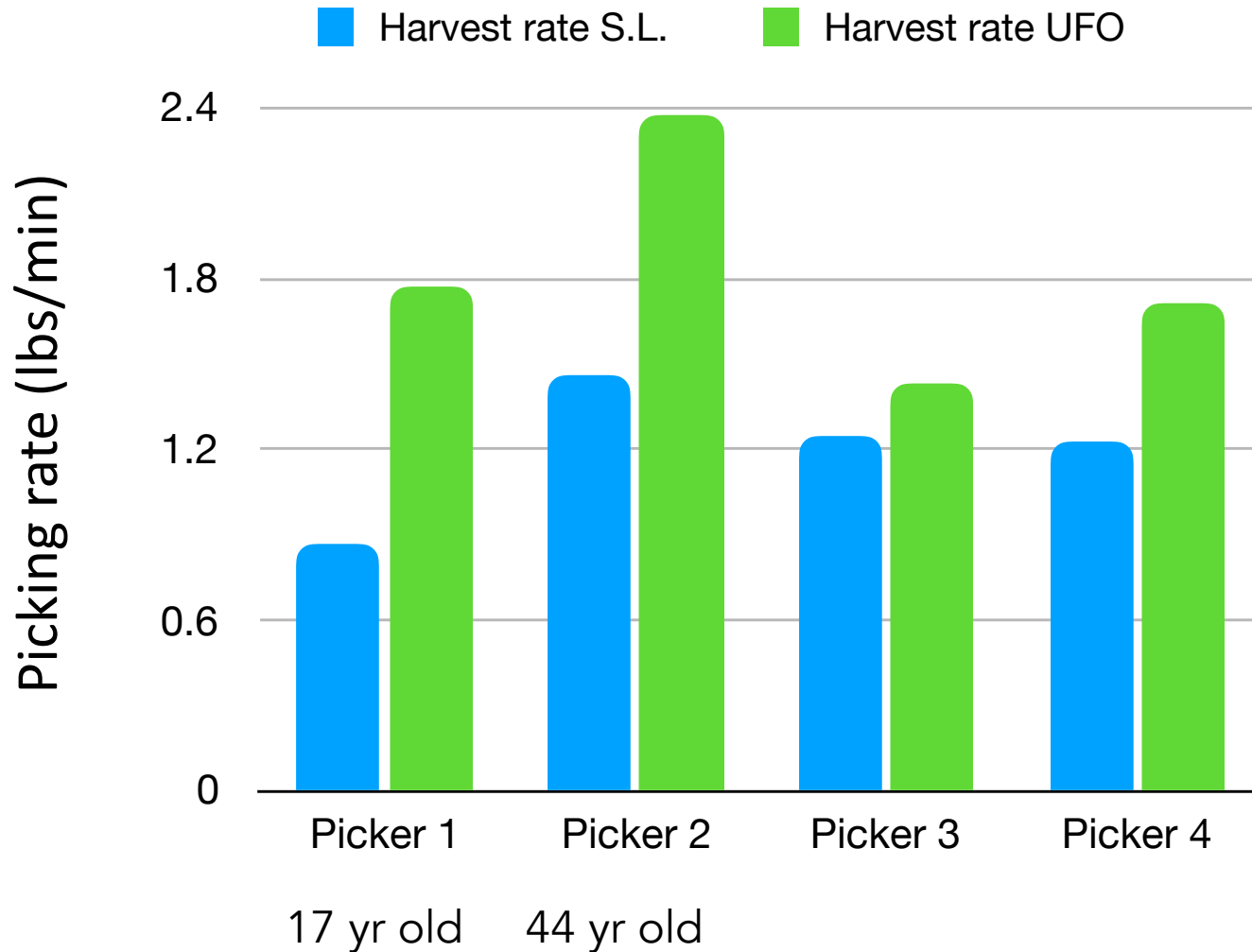


UFO



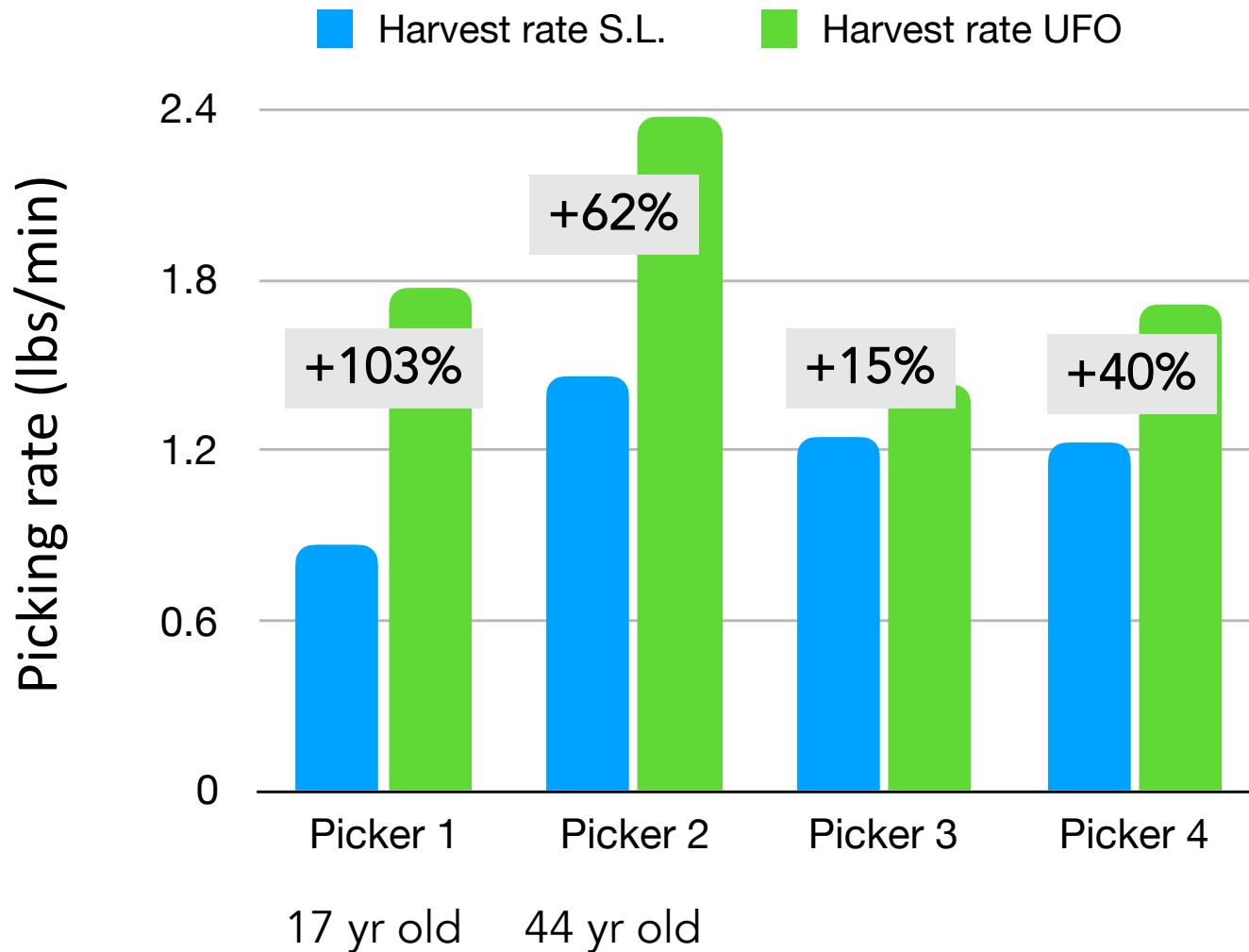
Harvest efficiency (lbs/min)

Orchard system comparison



Harvest efficiency (lbs/min)

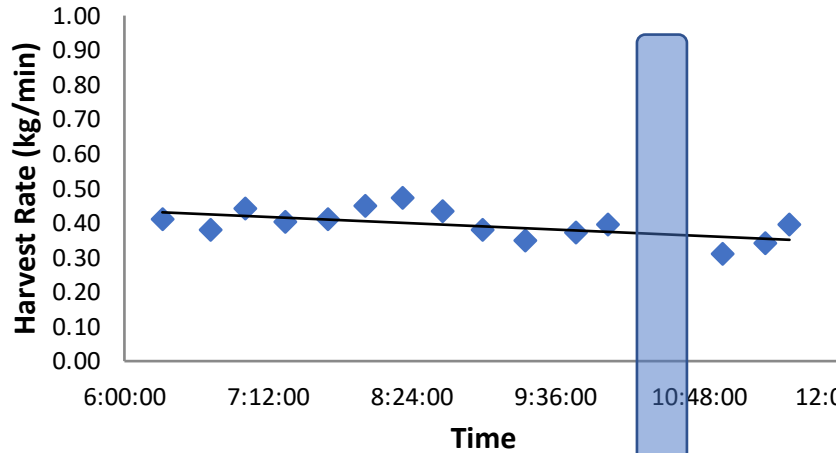
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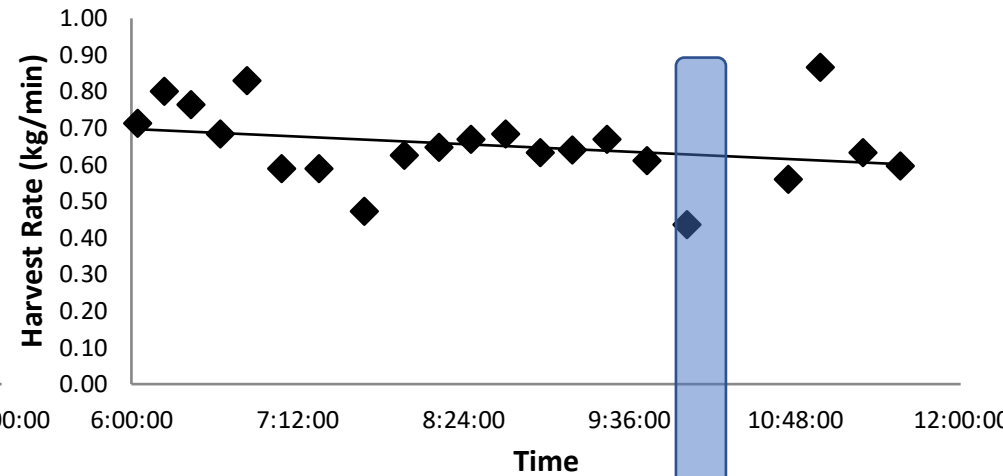
Harvest efficiency (kg/min)

Performance over time

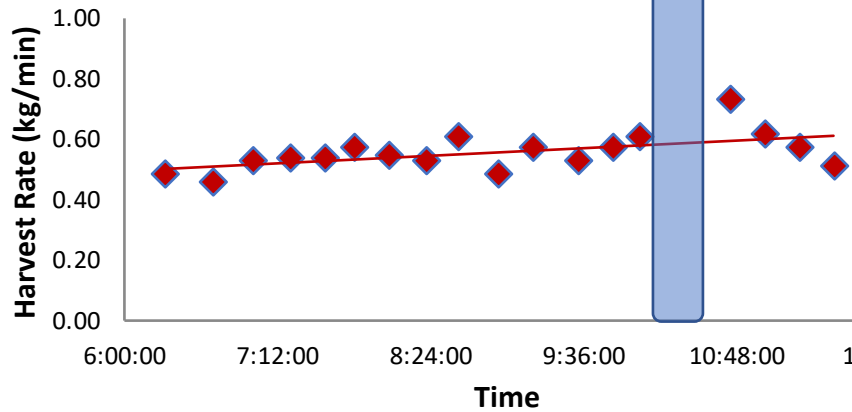
1st Picker



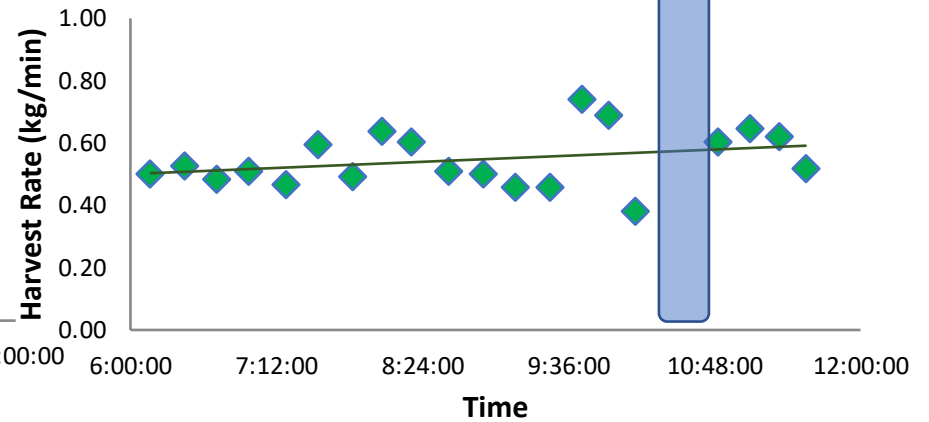
2nd Picker



3rd Picker

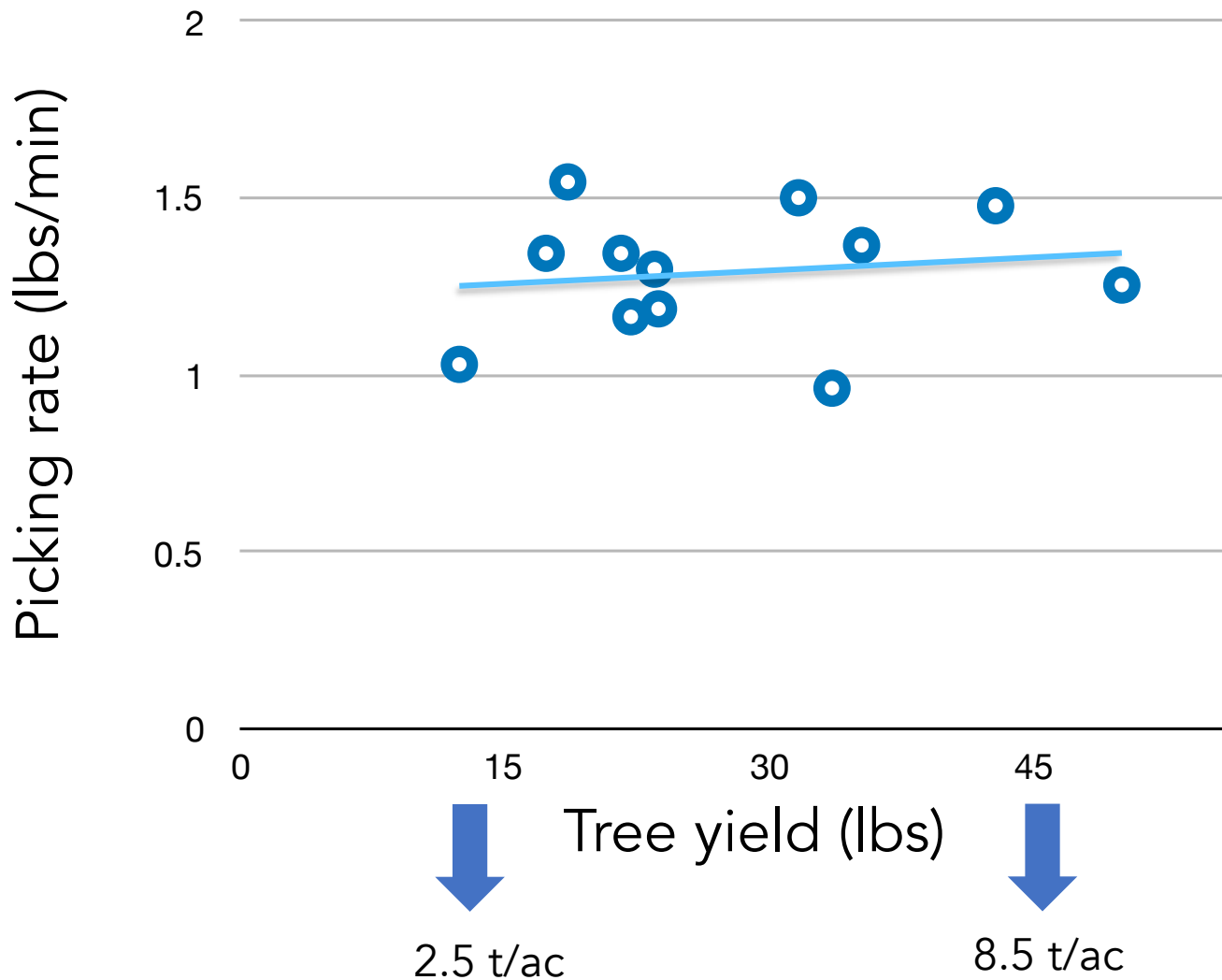


4th Picker



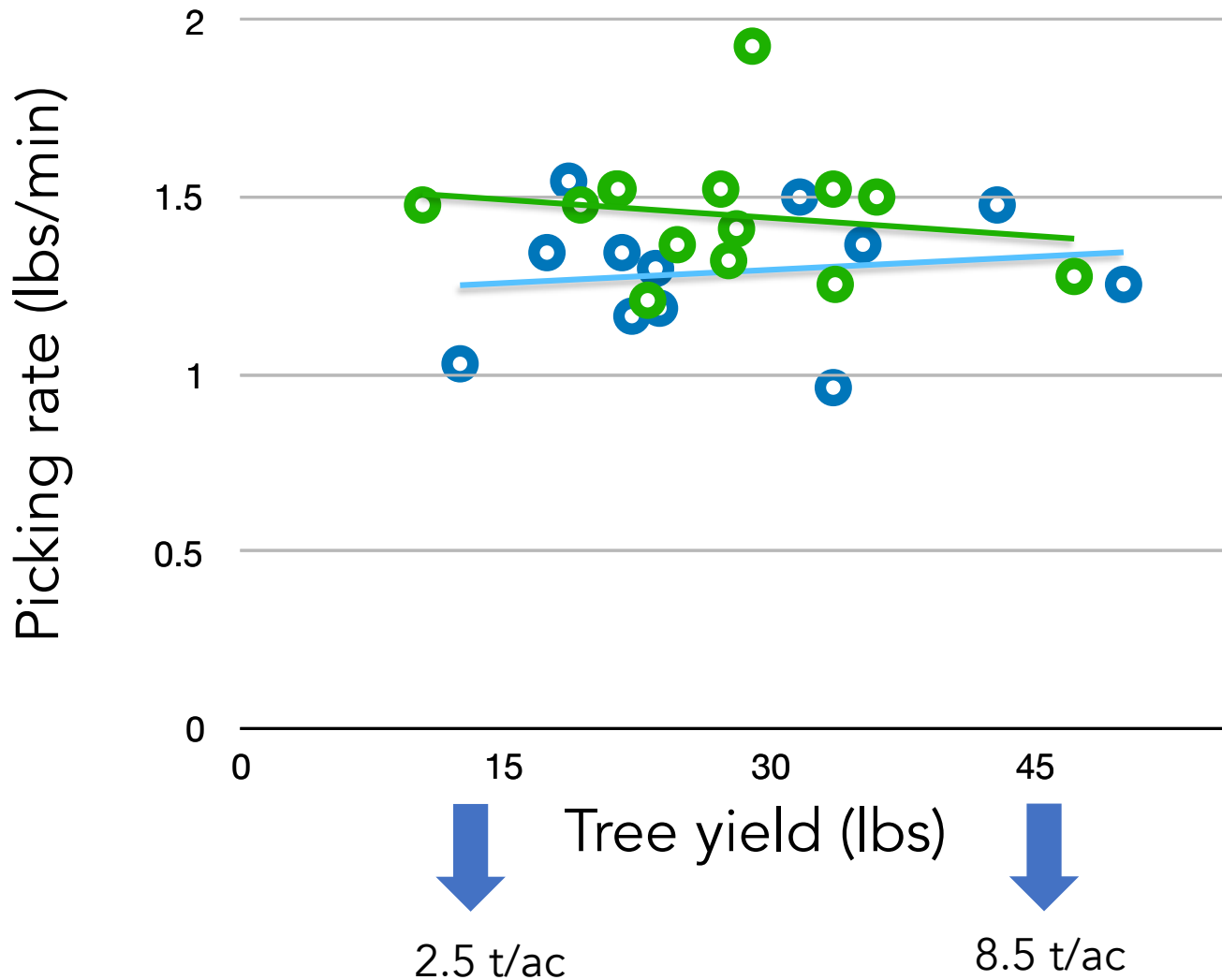
Harvest efficiency (lbs/min)

Effect of yield



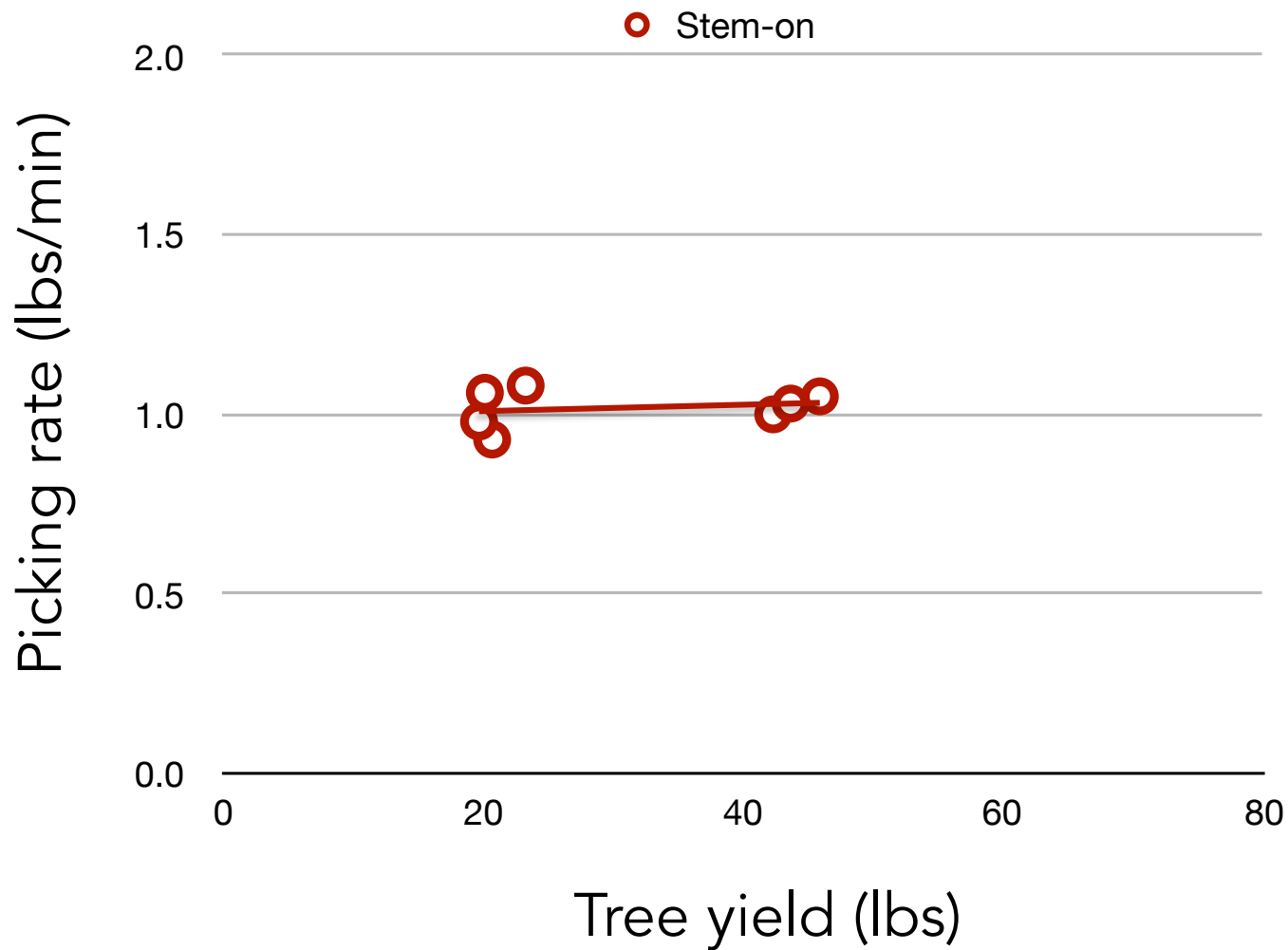
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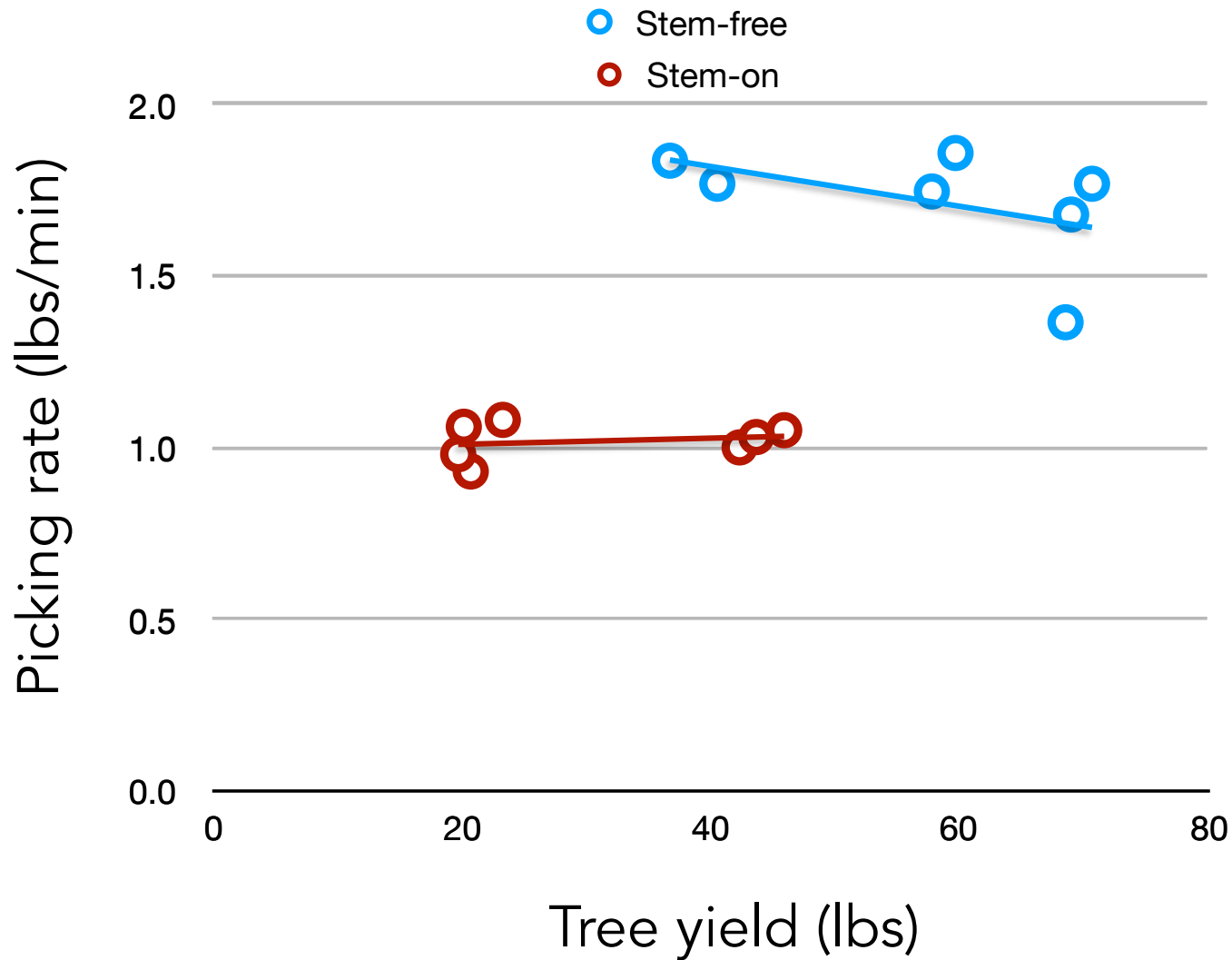
Harvest efficiency studies:

Effect of yield & stems



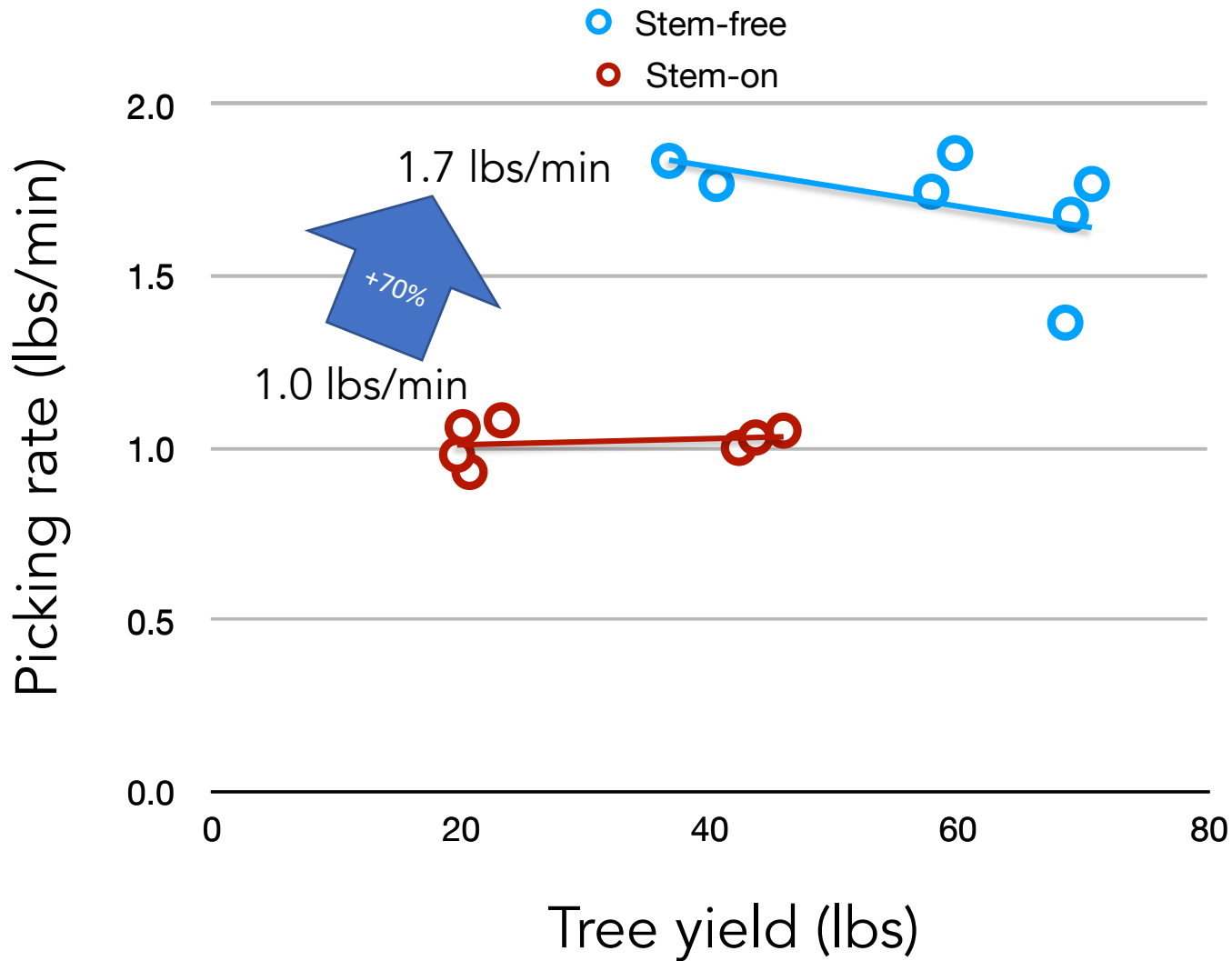
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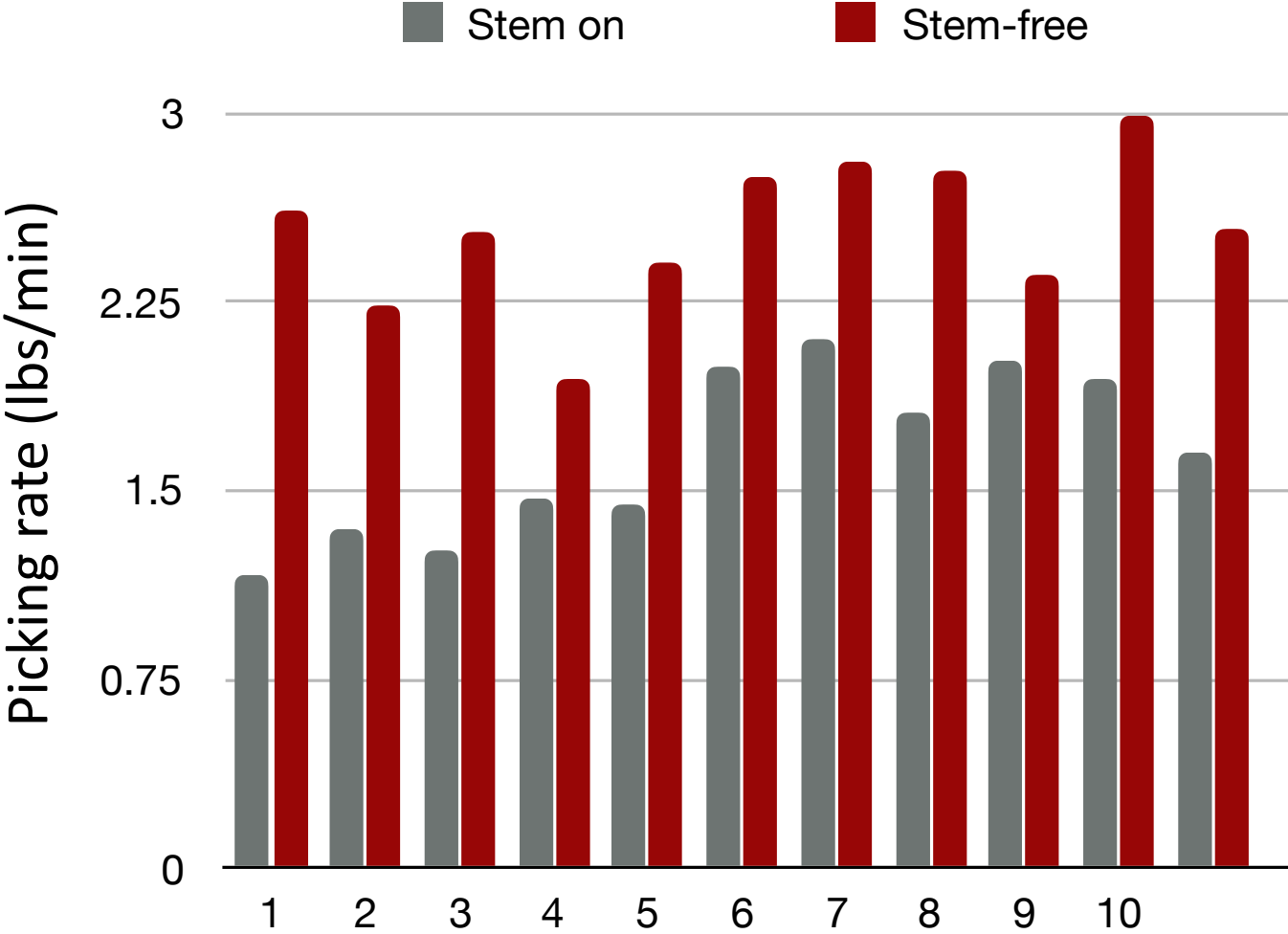


Harvest efficiency studies:

Effect of yield & stems



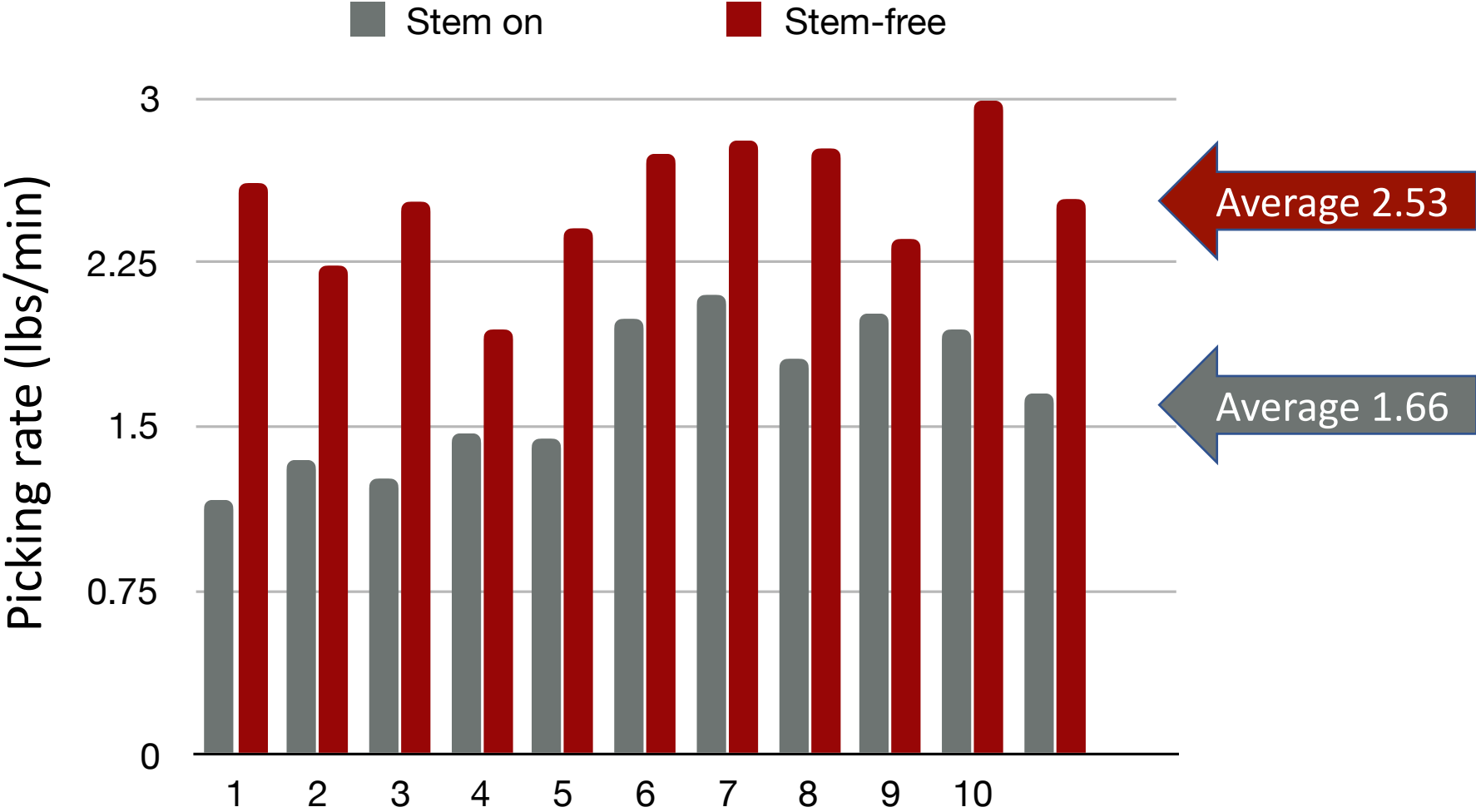
Harvest efficiency studies:



52% increase in harvest efficiency



Harvest efficiency studies:



52% increase in harvest efficiency

Opportunity to reduce picking costs?

	Bin Rate \$/bin	Harvest weight lbs/bin	Picking Rate lbs/min	Pay Rate \$/hr
Standard	65	300	1.5	\$19.50
Low pick rate	65	300	0.82	\$10.66
High pick rate	65	300	3.82	\$49.66
Low bin wt	65	265	1.34	\$19.72
High bin wt	65	418	3	\$27.99
Stem-free	65	395	2.56	\$25.28
Stem-on	65	335	1.66	\$19.33



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Stem-free	65	395	2.56	\$25.28
Stem-on	65	335	1.66	\$19.33
75% labor reduction	\$16.25	300	6	\$19.50

System available for efficiency studies in 2019



FAIRWEIGHT™

- Pay pickers by weight
- Facilitate payroll
- Harvest data



Improving harvest efficiency

- Because harvest is 50+% costs
- Taking short- and long-term approach
 - Mechanical assist (shake-and-catch)
 - Fully mechanical harvest



Harvest systems & solutions:



- Mechanically-assisted shake-and-catch
- Short-term solution
- Works in many architectures
- 3 – 4-fold improvement in efficiency
- Stem-free cherries



Harvest systems & solutions:

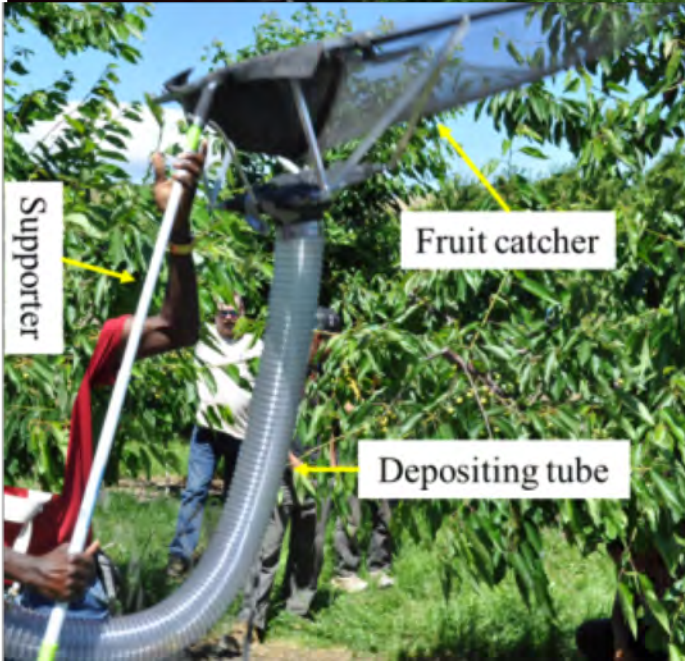


- Mechanically-assisted shake-and-catch
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- Full mech. harvest
- Longer-term prospect
- Requires Y-trellis
- 50+-fold improvement
- Stem-free cherries



Shake-and-catch prototype:





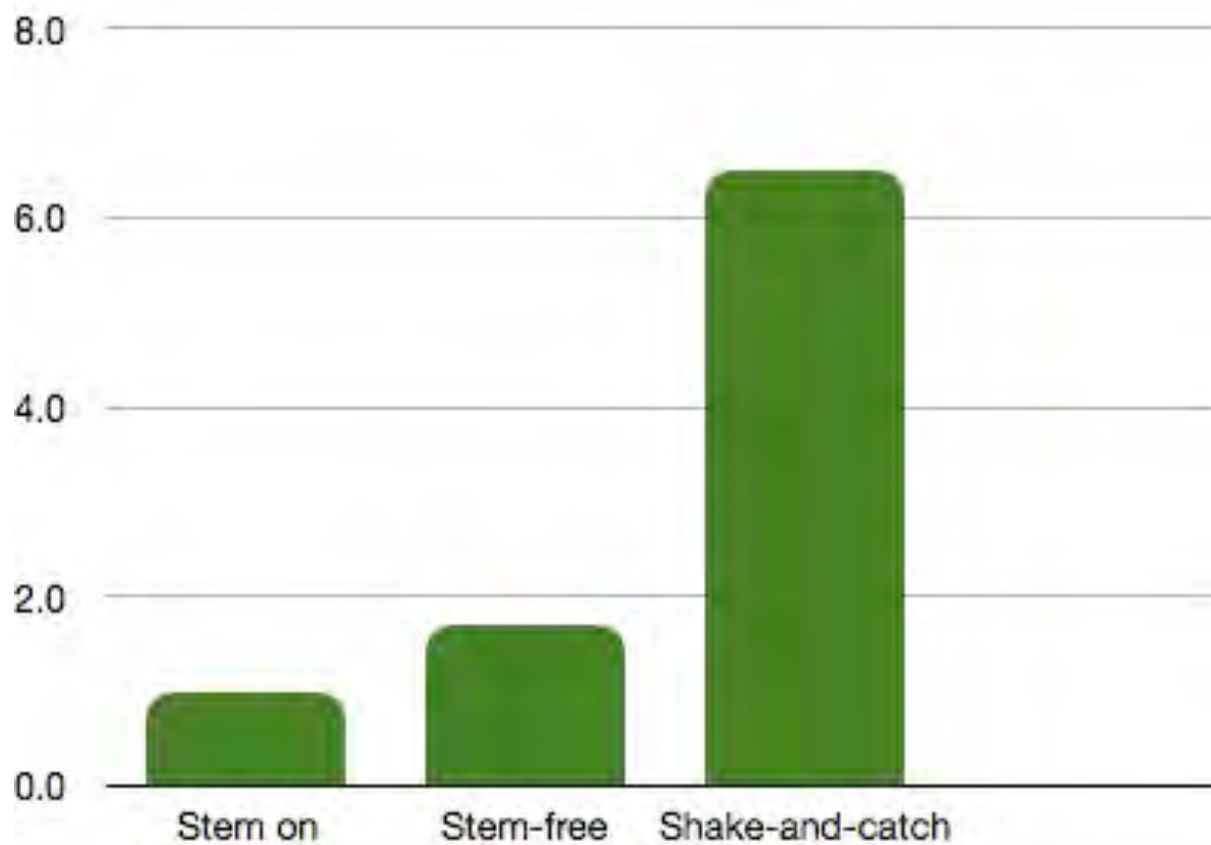
- 3-4 fold improvement in harvest efficiency
- 6-7.5 lbs per min/person

75 – 100 lbs/min

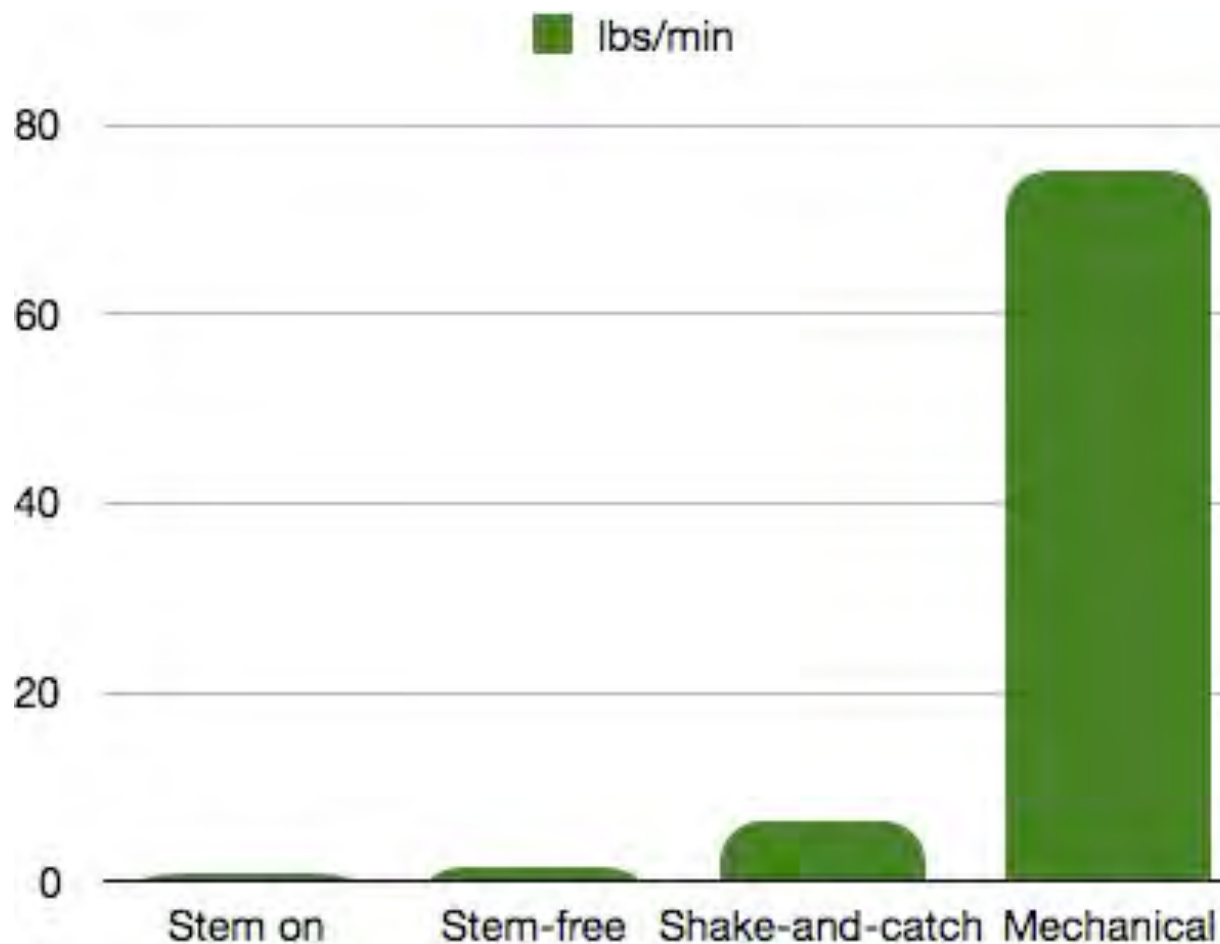




Harvest efficiency studies:



Harvest efficiency studies: Labor supply problems?



Factors affecting harvest efficiency:



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 - Rate of pay
 - PICKER
 - Presence/absence of stems
 - You can influence/control most of these
- 