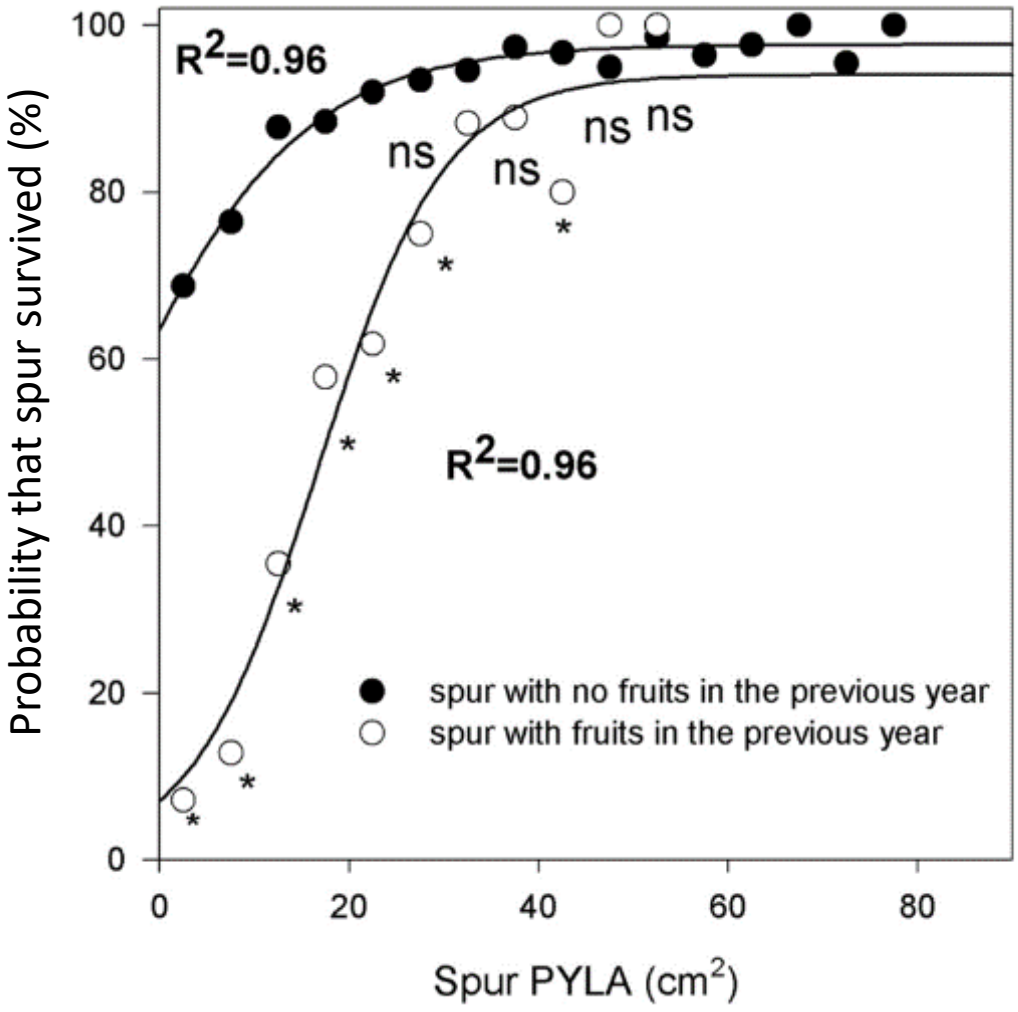
112

147

376
378
CENTIMETERS
Cat. No. 09-016
Fisher Scientific
INCHES
375
377



Spurs that bear one year are more likely to die in the year following bearing compared to non-bearing spurs and spur death is strongly related to previous year leaf area

If only a few spurs can bear fruit in two subsequent years, why aren't almond strongly alternate bearing?

Total number of spurs, and percentage of flowering and bearing spurs per each year. **Only about 15% of the spurs bore in a single year.**

Year	Total number of spurs	Flowering spurs	Bearing spurs	Spur % set
2002	1887	27.13%	12.56%	46.3
2003	2086	24.83%	9.44%	38.0
2004	2106	37.27%	18.57%	49.8
2005	1746	39.46%	15.12%	38.3
2006	1895	47.81%	15.57%	32.6
Mean		35.30%	14.25%	

Research Article

Yield in almond is related more to the abundance of flowers than the relative number of flowers that set fruit

by Sergio Tombesi, Bruce D. Lampinen, Samuel Metcalf *and* Theodore M. DeJong

CALIFORNIA AGRICULTURE • VOLUME 71, NUMBER 2

Current year flower density

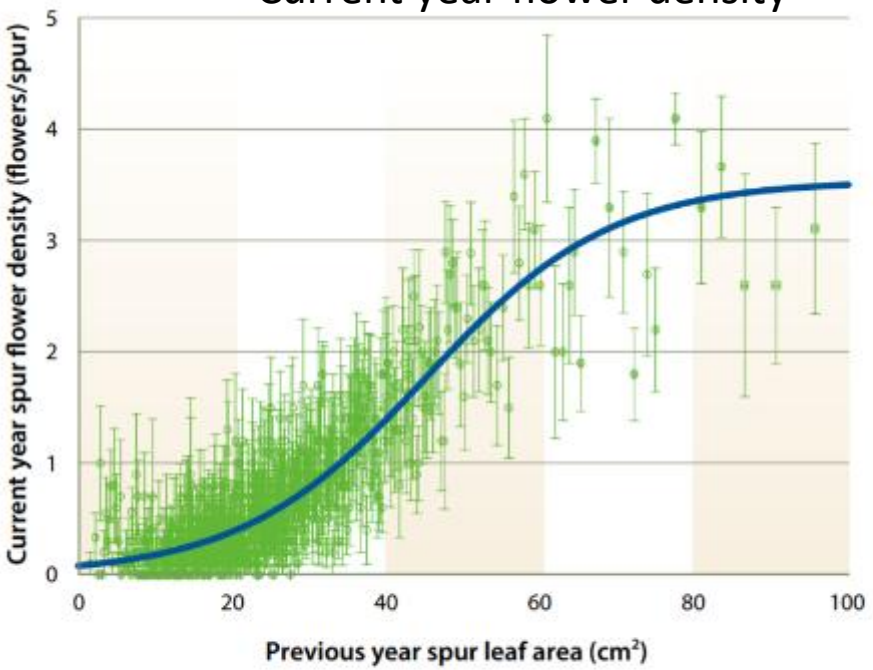


Fig. 1. Relationship between current year spur flower density and previous year spur leaf area on tagged spurs from 2002 to 2007 ($R^2 = 0.76$, $P < 0.0001$). Each point is the mean of 10 spurs ± SE.

Current year fruit density

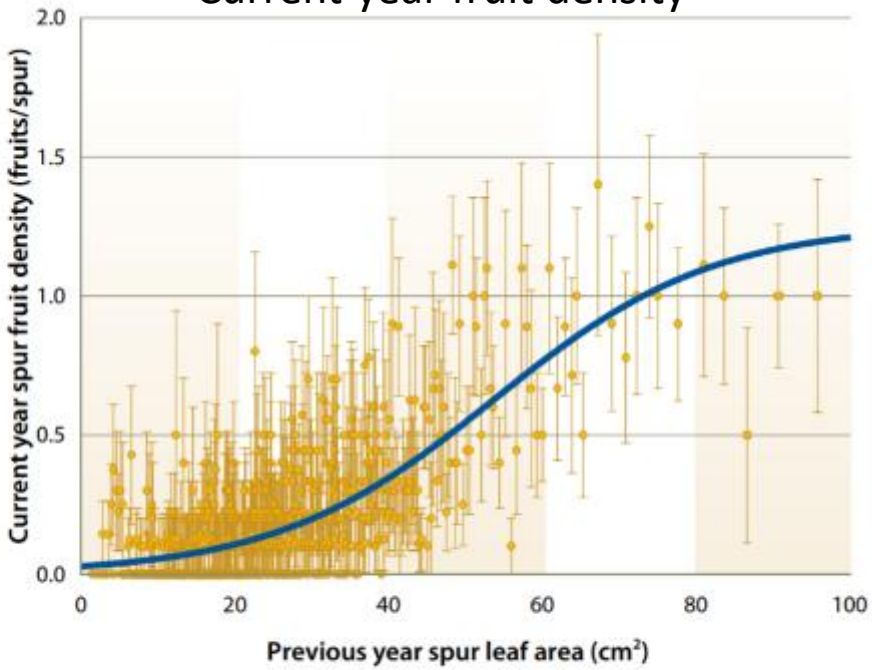
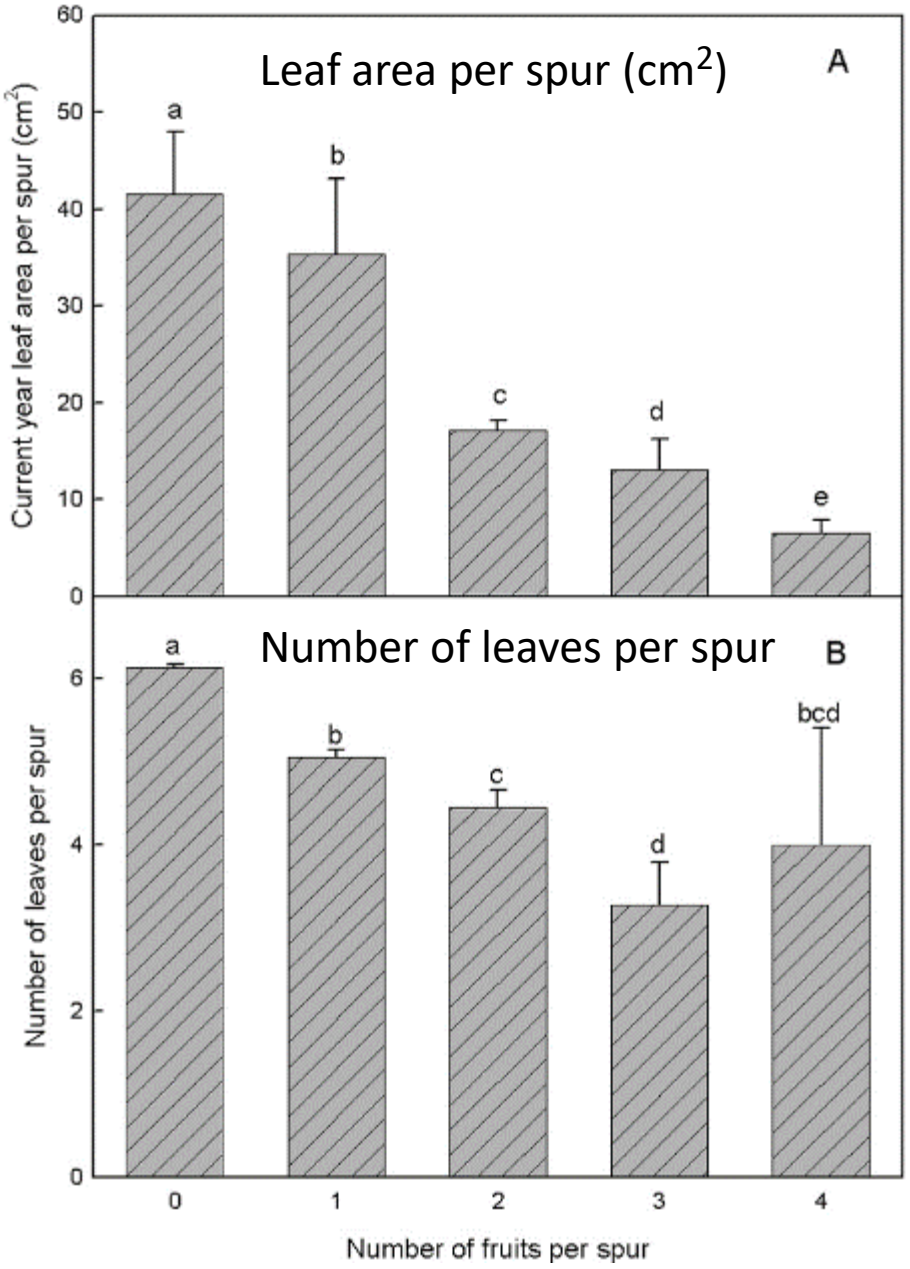
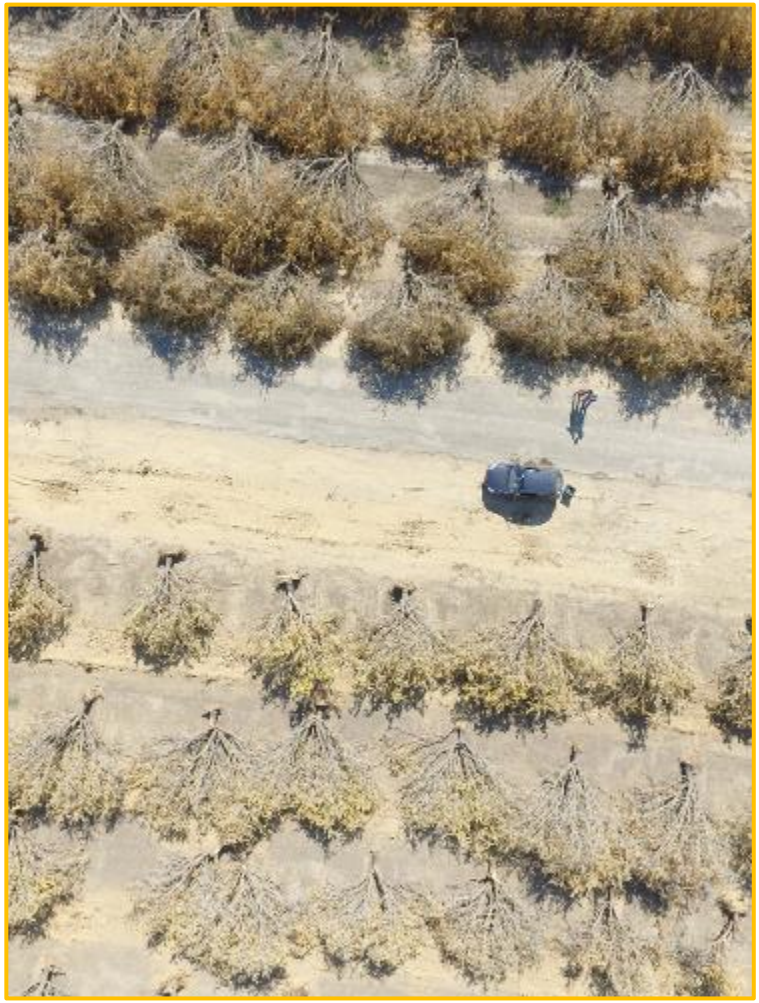


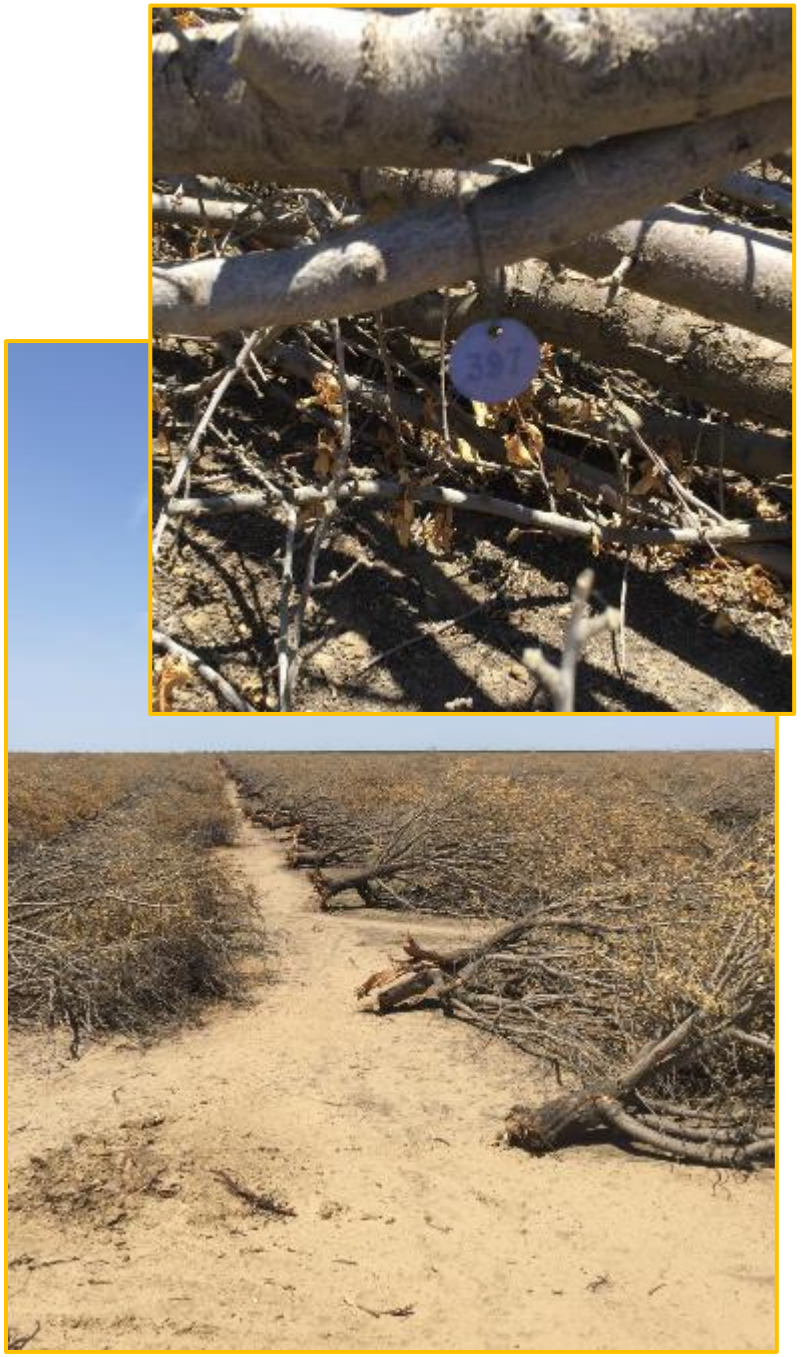
Fig. 2. Relationship between current year spur fruit density and previous year spur leaf area on tagged spurs from 2002 to 2007 ($R^2 = 0.59$ $P < 0.0001$). Each point is the mean of 10 spurs ± SE. 1 $cm^2 = 0.001$ ft^2.



More nuts = less leaf area

The spur dynamics orchard was removed a year or so ago and we still found living tagged spurs that were about 16 years old

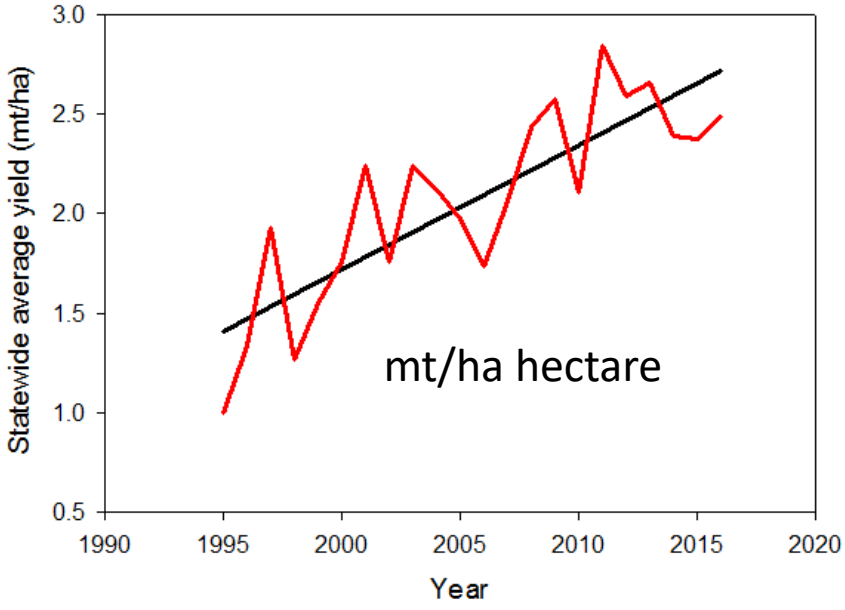




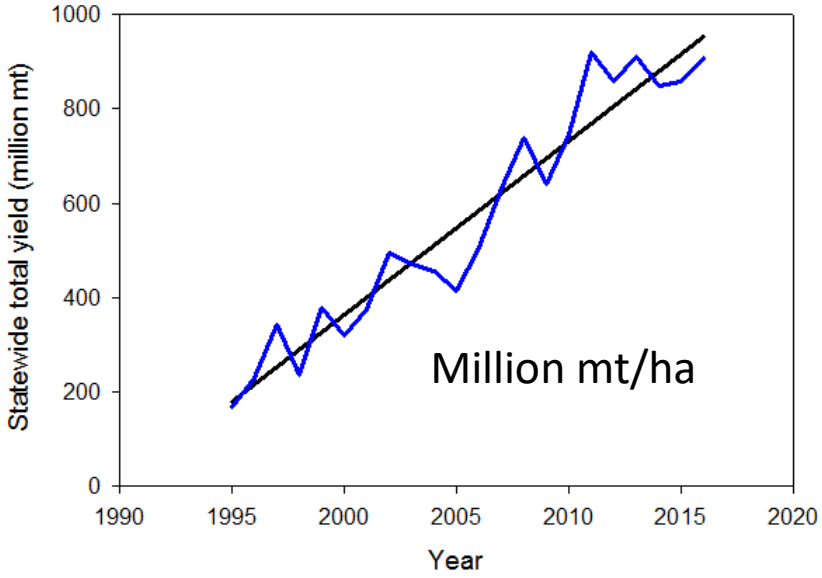
Although individual spurs are strongly alternate bearing, almond trees in general are not since only a limited percentage of spurs bear in any given year.

Statewide average

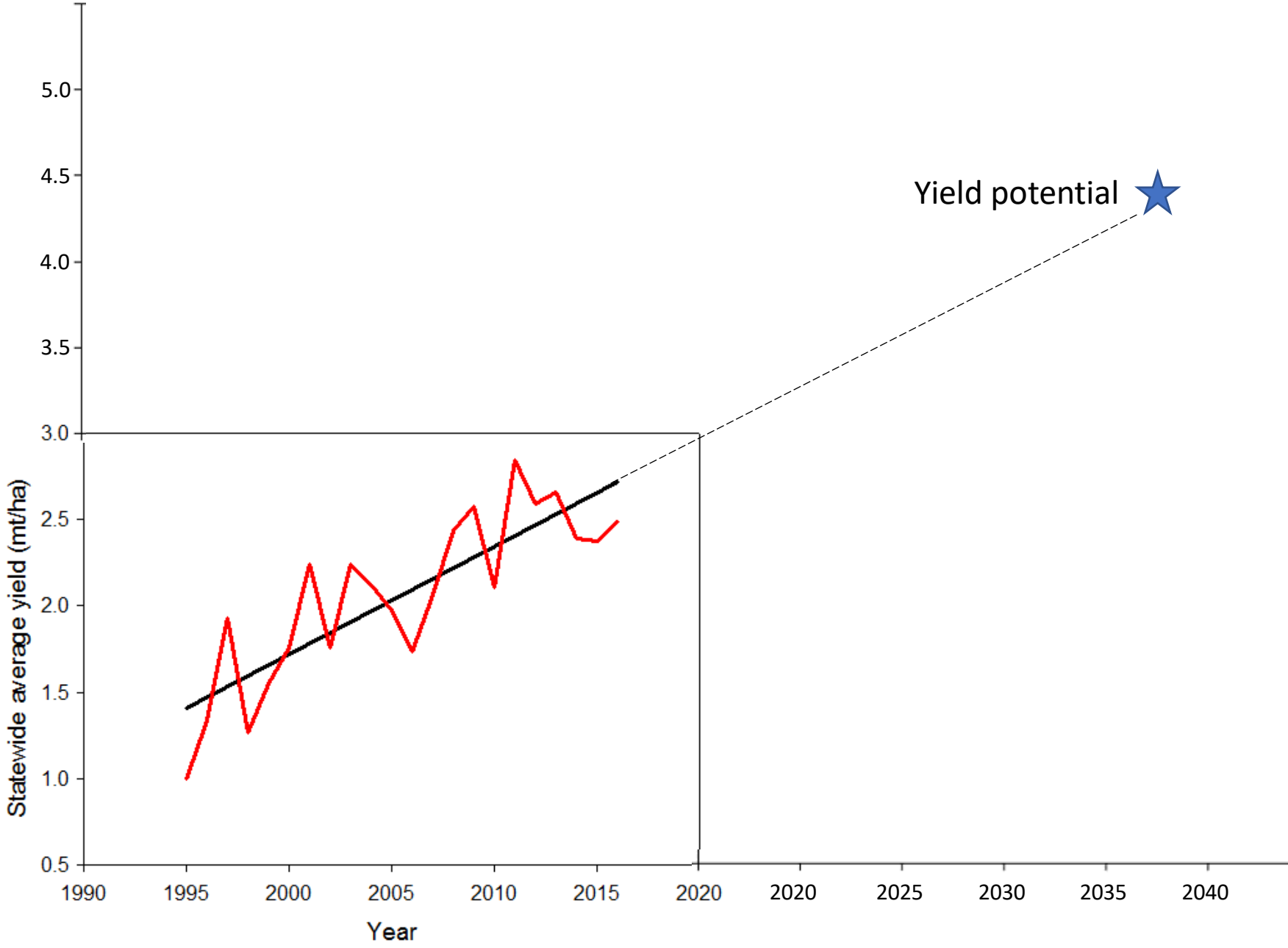
Statewide average yield in California has been increasing by 0.067 mt/ha per year



Statewide total yield in California has been increasing by 68 million mt per year

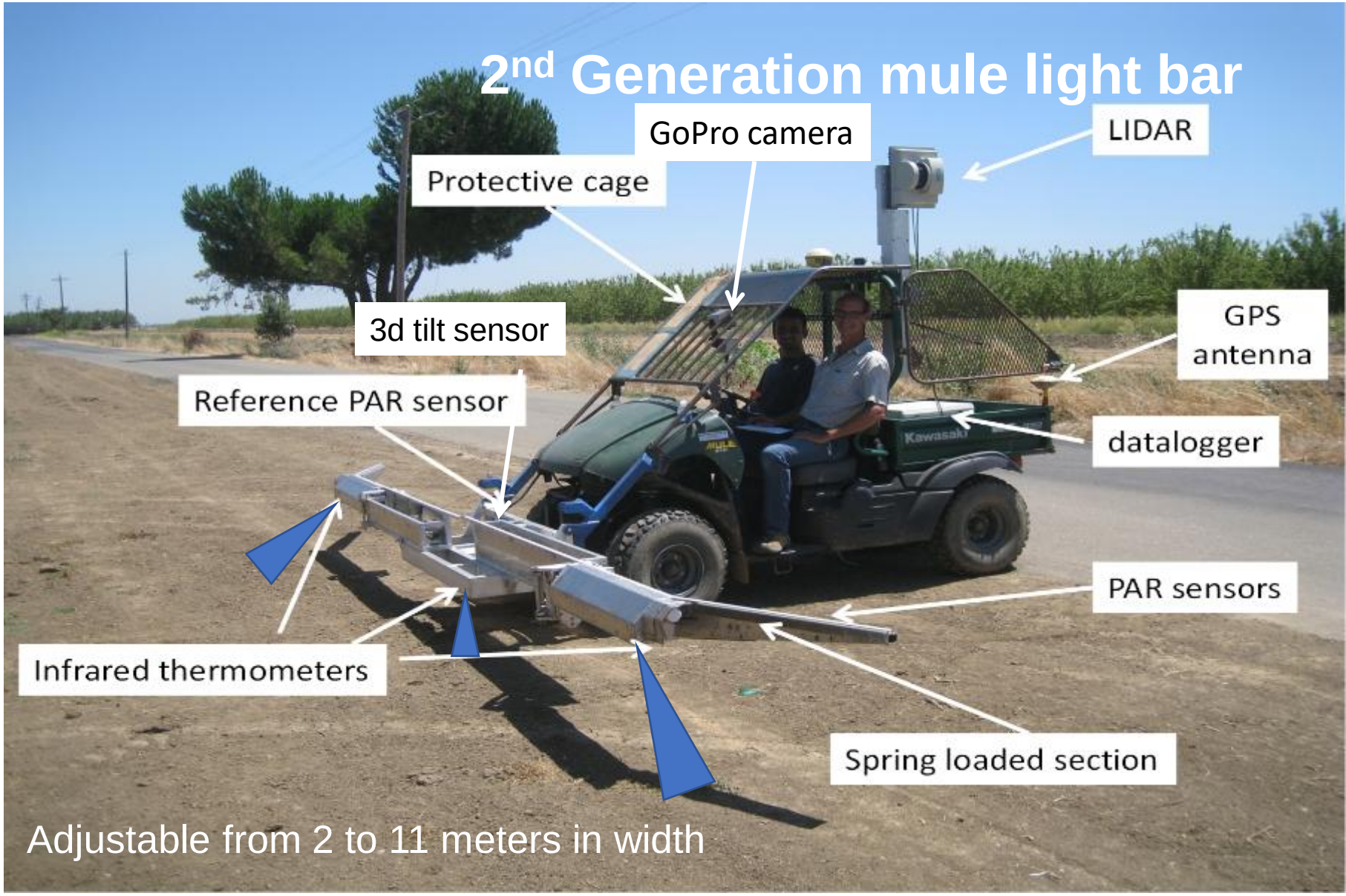


Overall increase is about equally due to increase yield per ha and increased planted area

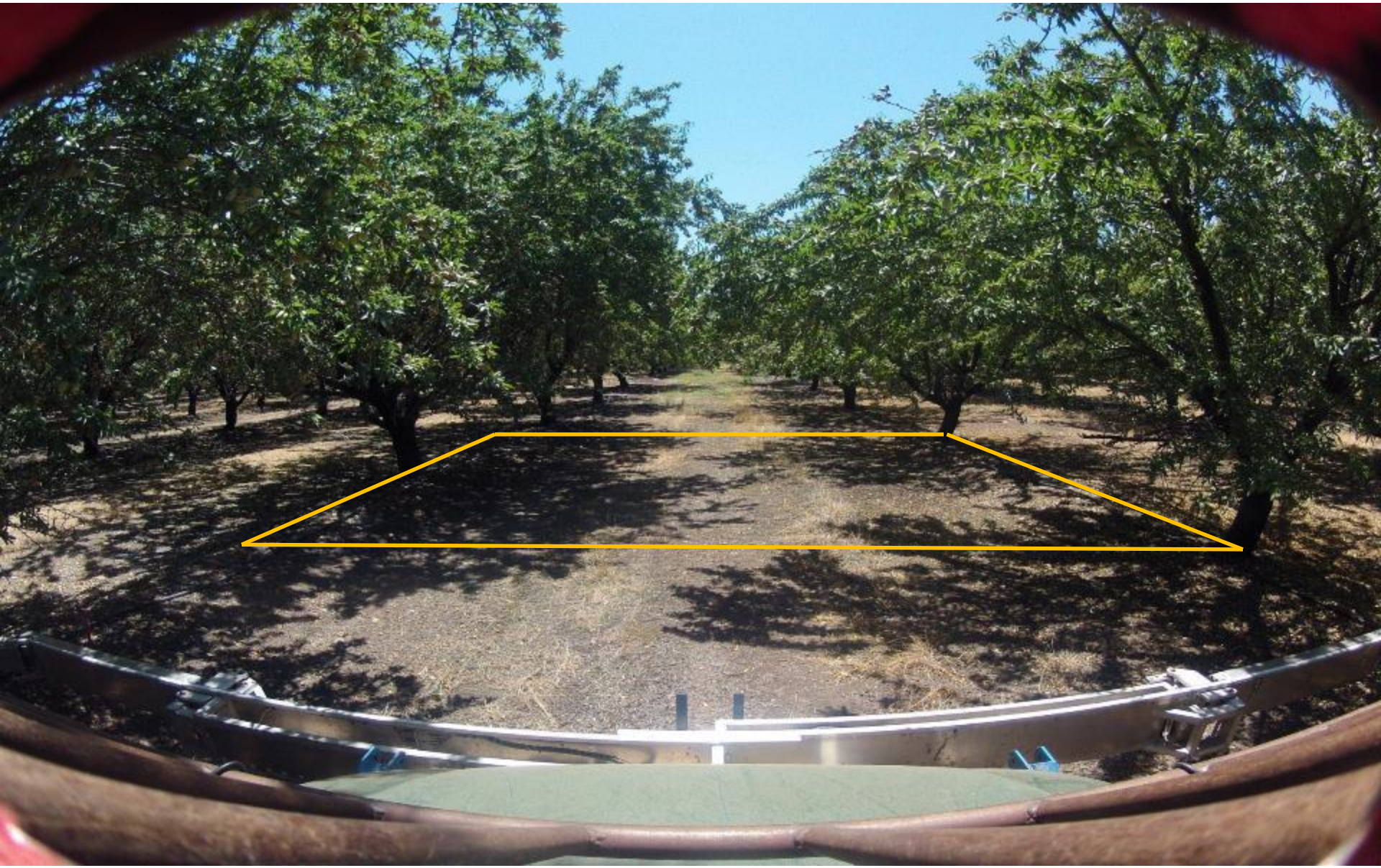

Yield potential
Statewide average yield (mt/ha)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
1990
1995
2000
2005
2010
2015
2020
2020
2025
2030
2035
2040
Year

4.5 kernel metric tons per hectare- how do we get there?

491


2nd Generation mule light bar
GoPro camera
LIDAR
Protective cage
3d tilt sensor
GPS antenna
Reference PAR sensor
datalogger
PAR sensors
Infrared thermometers
Spring loaded section
Adjustable from 2 to 11 meters in width

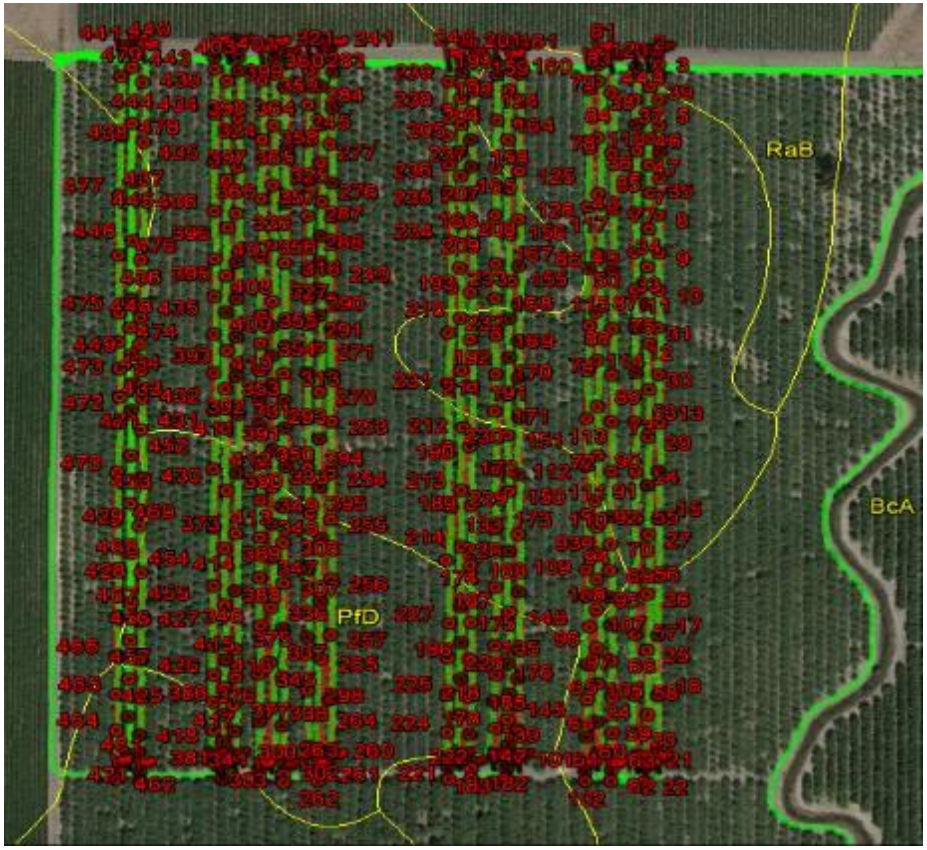
We also take GoPro photos of the shadows on the orchard floor 2 times per second



We set up a portable weather station with temp, RH, windsweed and PAR sensors outside orchard

Normal speed of travel is 10 km/hr so we can map about 20 km within 1 hour of the time the sun is directly overhead

RaB
RbB
PeD
BcA
PfD

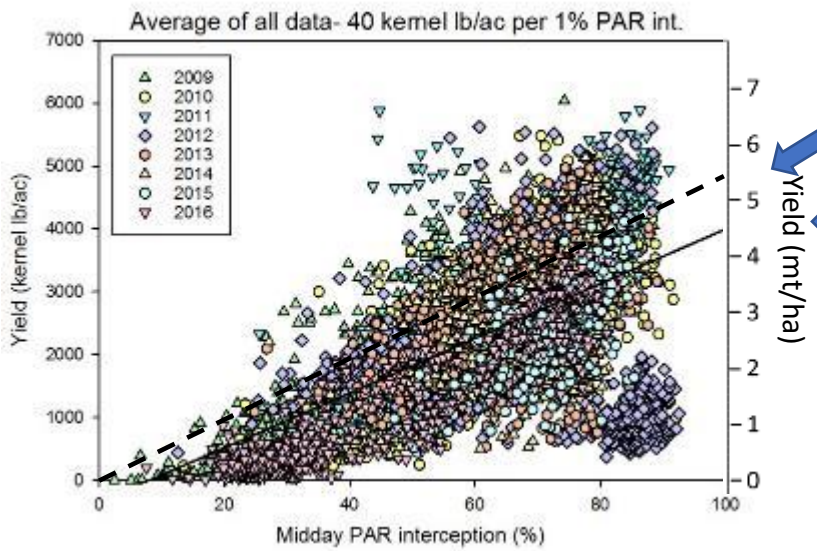

RaB
BcA
PfD

Self contained hydraulic system for operating augers, autosampler and elevator

Trimble GPS acts as datalogger to collect continuous yield data

Front skirt to prevent nuts from overflowing as cart fills

Wireless controller for hydraulically operated auto sampler



We have found the best managed orchards can alternate around the dashed line (0.056 mt/ha for each 1% intercepted) after about 5 years of age. This would equal about 4.5-5 mt/ha at 80% PAR interception.

Regression through all data (0.045 mt/ha for each 1% intercepted) This would equal about 3.6 mt/ha at 80% PAR interception.

39% interception (2.24 mt/ha potential)

50% interception (2.8 mt/ha potential)

80% interception (4.48 mt/ha potential)

90% interception (5.04 mt/ha potential)

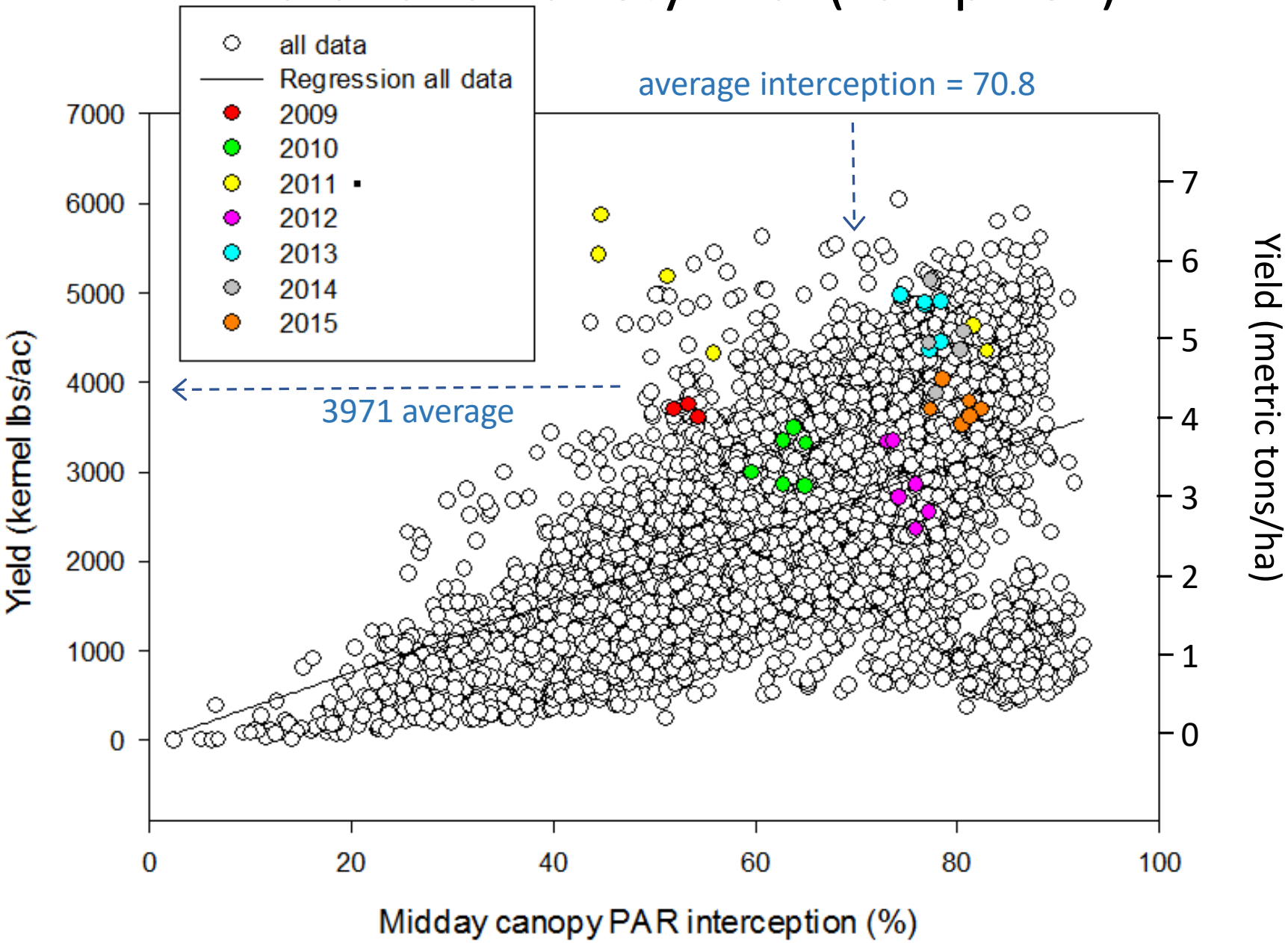
39% interception (2.24 mt/ha potential)

50% interception (2.8 mt/ha potential)

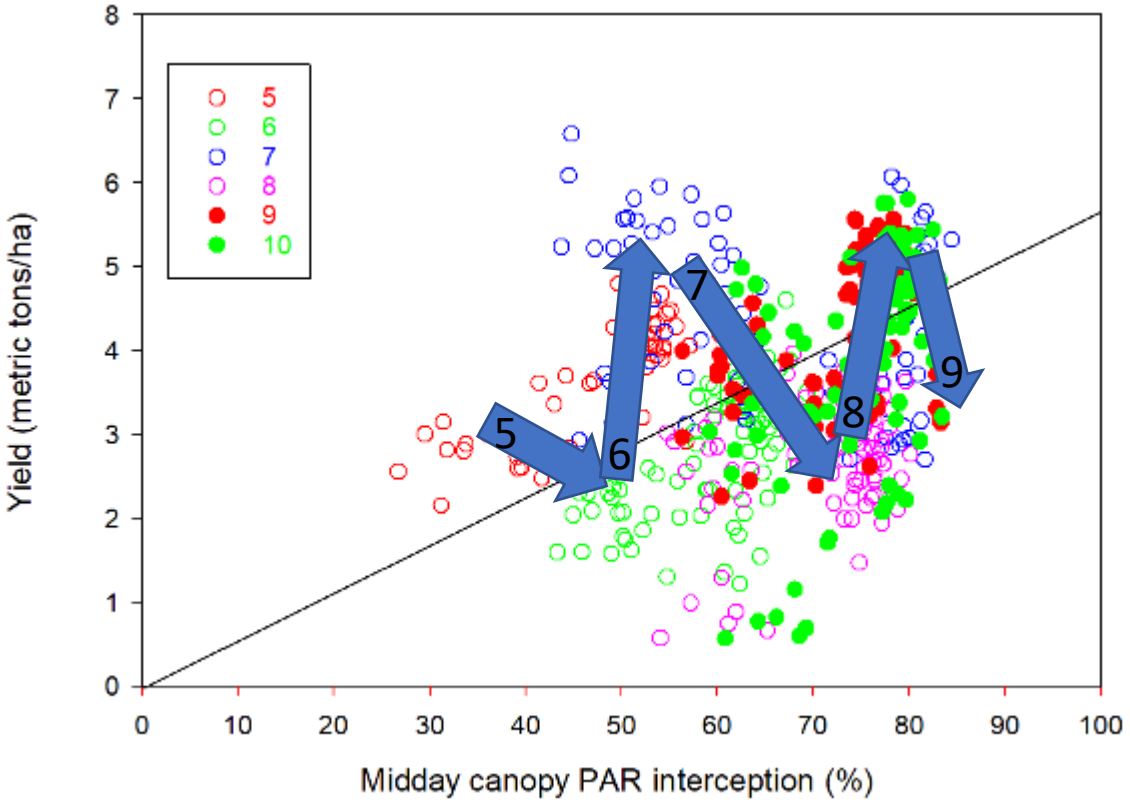
80% interception (4.48 mt/ha potential)

90% interception (5.04 mt/ha potential)

McFarland Variety Trial (Lampinen)



McFarland Variety Trial (Lampinen)

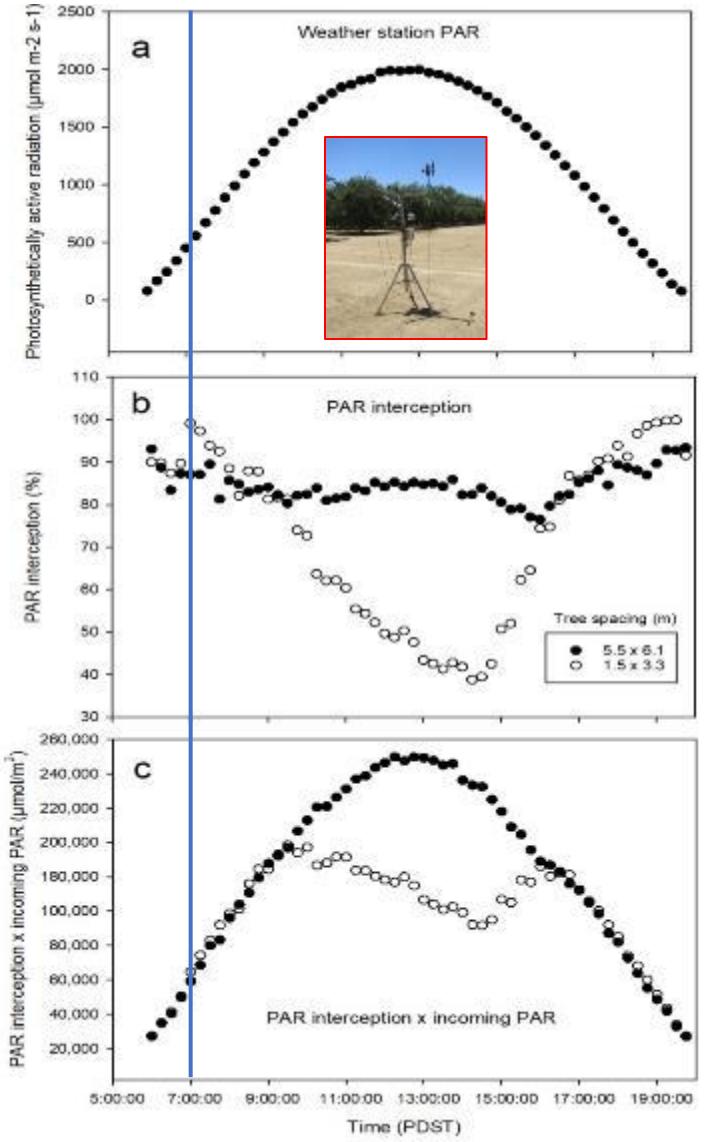
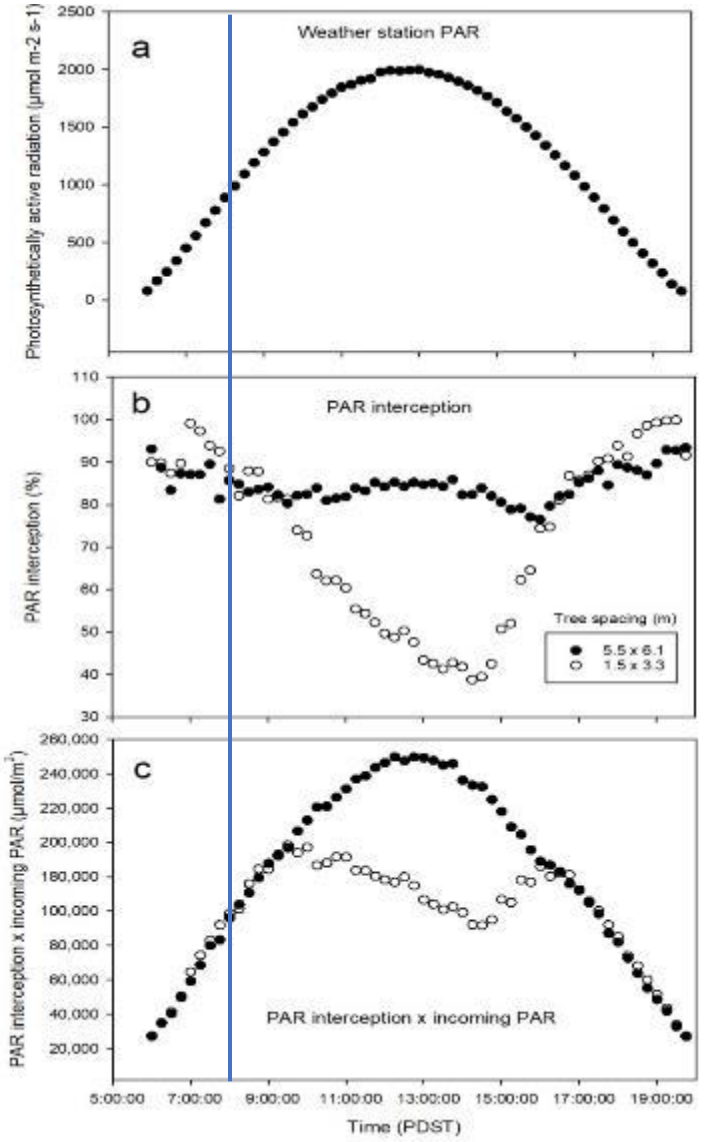


Black diagonal line indicate values around which best orchards can alternate

Fig. 2. Midday canopy photosynthetically active radiation interception (PAR) versus yield by year at the McFarland Variety Trial. Arrows indicate direction of average yield from year to year and numbers on arrows indicate orchard age.

Trial comparing 298 versus 2020 tree per hectare

PAR = photosynthetically active radiation ($mmol^{-2}$ sec^{-1})



Trial comparing 298 versus 2020 tree per hectare