

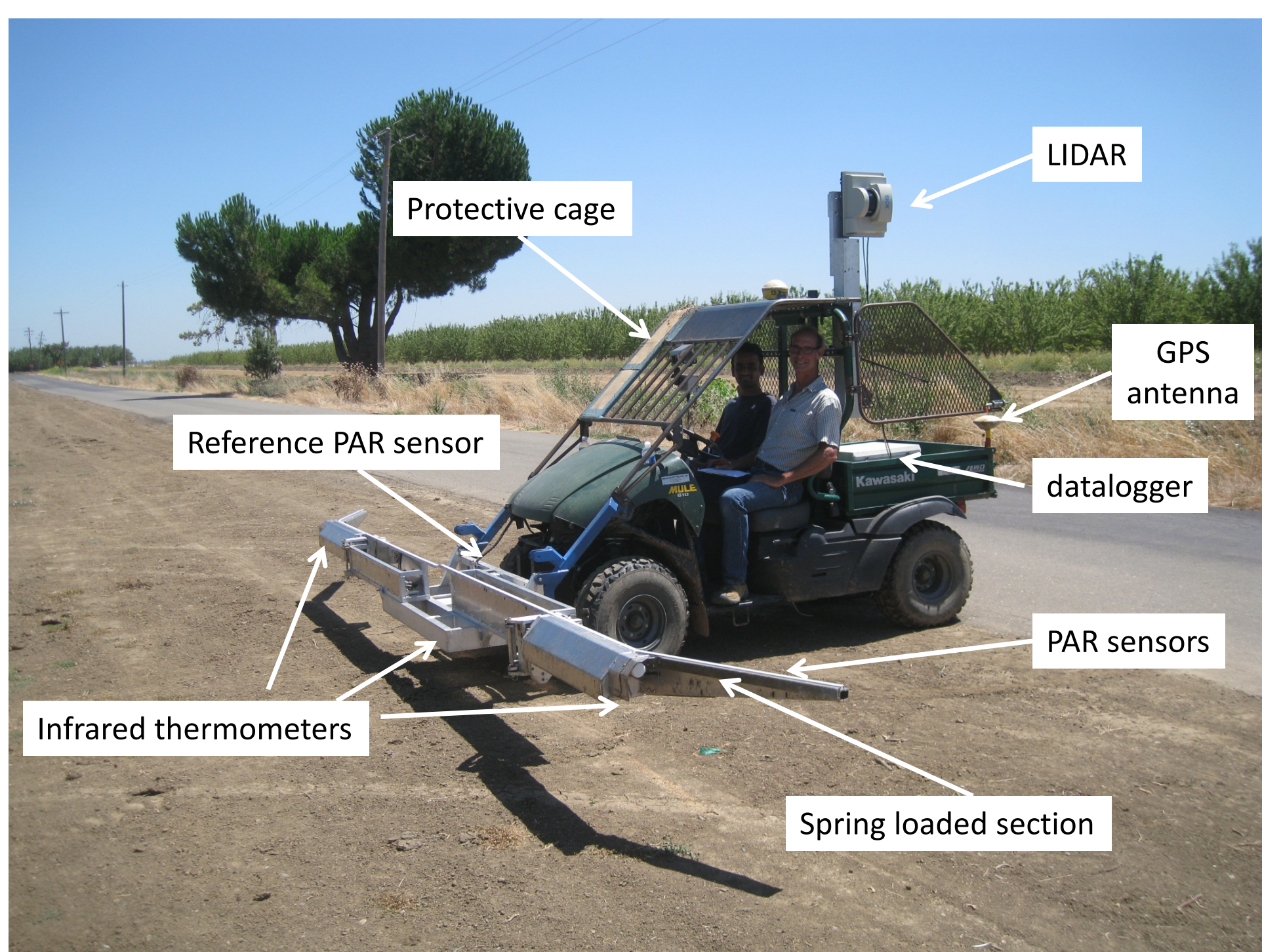
Development and Testing of a Mobile Platform for Measuring Canopy Light Interception and Water Stress in Almond



Introduction:

Data collected by the authors over the past several years has provided a rough upper limit to productivity in walnut and almond based on the percentage of the available midday canopy photosynthetically active radiation (PAR) that is intercepted. However, most of the data that was collected previously had limitations due to the difficulty in collecting light interception data with a hand lightbar.

We have outfitted a mobile platform (Kawasaki Mule) with the 2nd generation light bar that is able to measure light across an entire row (up to 32 feet wide). The photo below shows the 2nd generation mobile platform and lists some of the equipment included.



Objectives:

Objective 1) Use the mobile platform mounted lightbar to measure light interception and relate that to yield data from the same area in almond orchards throughout the almond growing area of California.

Site #	County	Trial	Date Mapped	Site #	County	Trial	Date Mapped
1	Kern	SCRI-Belridge	6/28/2013	12	Kern	Paramount hedging trial	7/20/2013
2	Kern	Spur Dynamics	6/29/2013	13	Merced	Doll WPF	7/27/2013
3	Kern	Paramount 3541 fumigation trial (fumigated replicates)	6/30/2013	14	Stanislaus	Duncan almond pruning, spacing and rootstock	7/28/2013
4	Colusa	Nickels organic almond	7/3/2013	15	Madera	Agriland irrigation trial	7/29/2013
5	Colusa	Nickels almond rootstock	7/4/2013	16	Madera	Agriland fumigation trial	7/29/2013
6	Colusa	Nickels almond pruning/training trial	7/4/2013	17	Madera	Madera Growers South	7/30/2013
7	Colusa	Nickels precision irrigation	7/5/2013	18	Madera	Paramount New Columbia main fumigation trial	7/31/2013
8	Tehama	ETPF Fulton	7/11/2013	19	Madera	Paramount New Columbia fumigation/irrigation trial	7/31/2013
9		Paramount 3541 fumigation trial (non-fumigated replicates)	7/14/2013	20	Merced	Browne Littlejohn almond	8/7/2013
10	Kern	Kern WPF	7/16/2013	21	Merced	Browne Frago trial	8/8/2013
11	Kern	McFarland Variety trial	7/17/2013	22	Merced	Bandoni	8/16/2013

Table 1. Orchard sites used for light interception versus yield and food safety related research in 2013.

The goal of this aspect of the work is to help establish the upper limit to the light interception/yield relationship for almond (shown in Fig. 1).

Objective 2) The second component of the project involves continuing work on new methods of measuring water stress in almond. This work will be reported in a separate poster #46.

Materials and methods:

Objective 1- Continue running the lightbar in almond orchard sites throughout California to better define the relationship between light interception and yield. Sites were selected across the almond growing area of California for studying the light interception yield relationship. An attempt was made to get sites that were relatively productive for their age and whenever

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possible, sites were utilized that were parts of other ongoing studies where yield data was already being collected as part of the original study. The sites where the mobile platform was used to collect PAR data are listed in Table 1.

Objective 2- A mobile sensor suite was developed and evaluated to predict plant water status by measuring the leaf temperature of nut trees and grapevines. See Poster #46 for details.

Preliminary results:

Data collected with the mobile lightbar has provided a rough upper limit to productivity in almond and walnut based on the percentage of the available midday canopy photosynthetically active radiation (PAR) that is intercepted (Fig. 1).

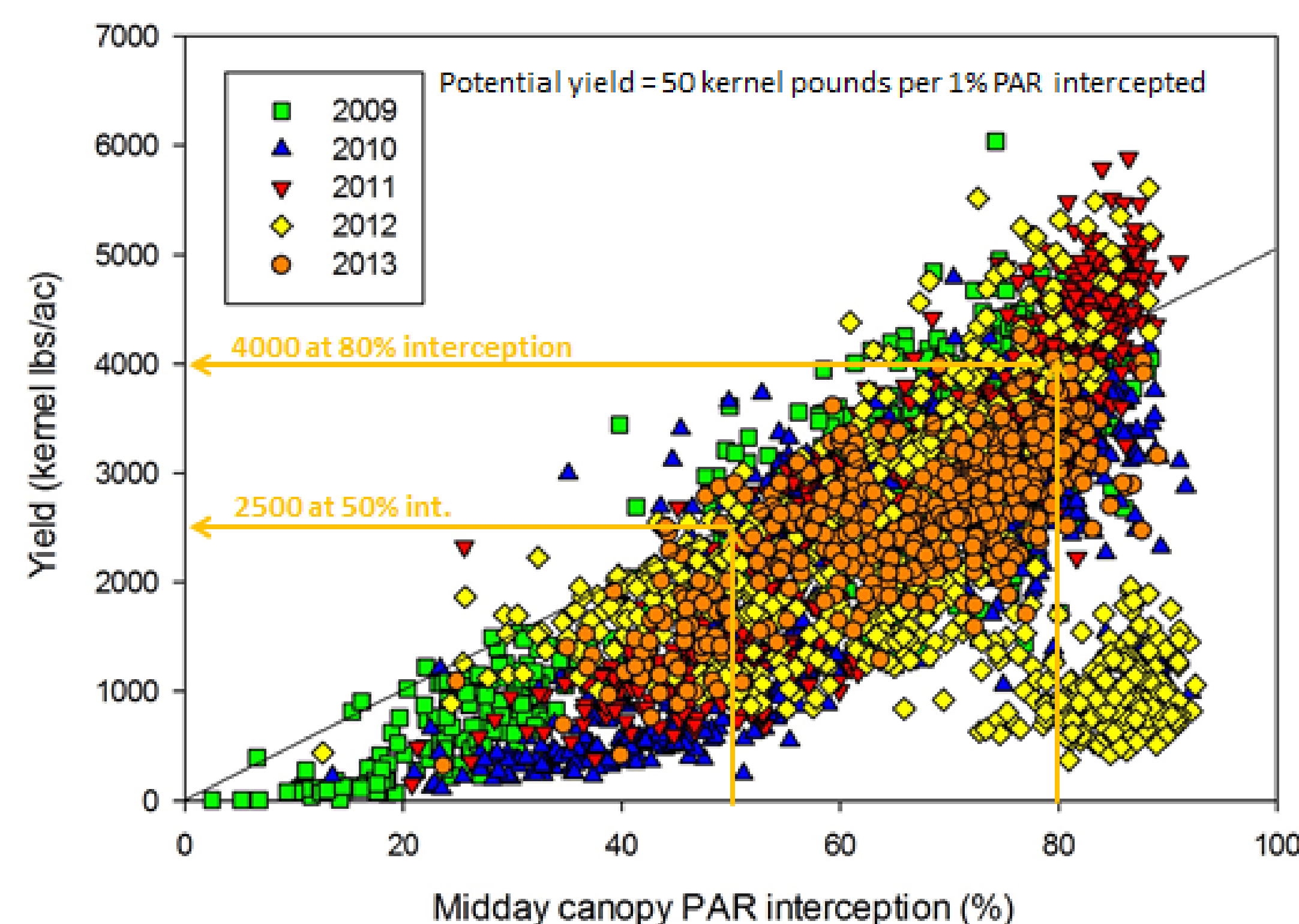


Figure 1. Light interception versus yield for all almond orchard sites from 2009 to 2013 seasons. Solid black line indicates limit line about which the best orchards can alternate.

The yield per unit light intercepted can be used to compare productivity of different varieties. Fig. 2 shows the yield per unit light intercepted for the varieties and selections from a variety trial in McFarland. This figure suggests that there might be differences in productivity per unit light intercepted among varieties. The previous year

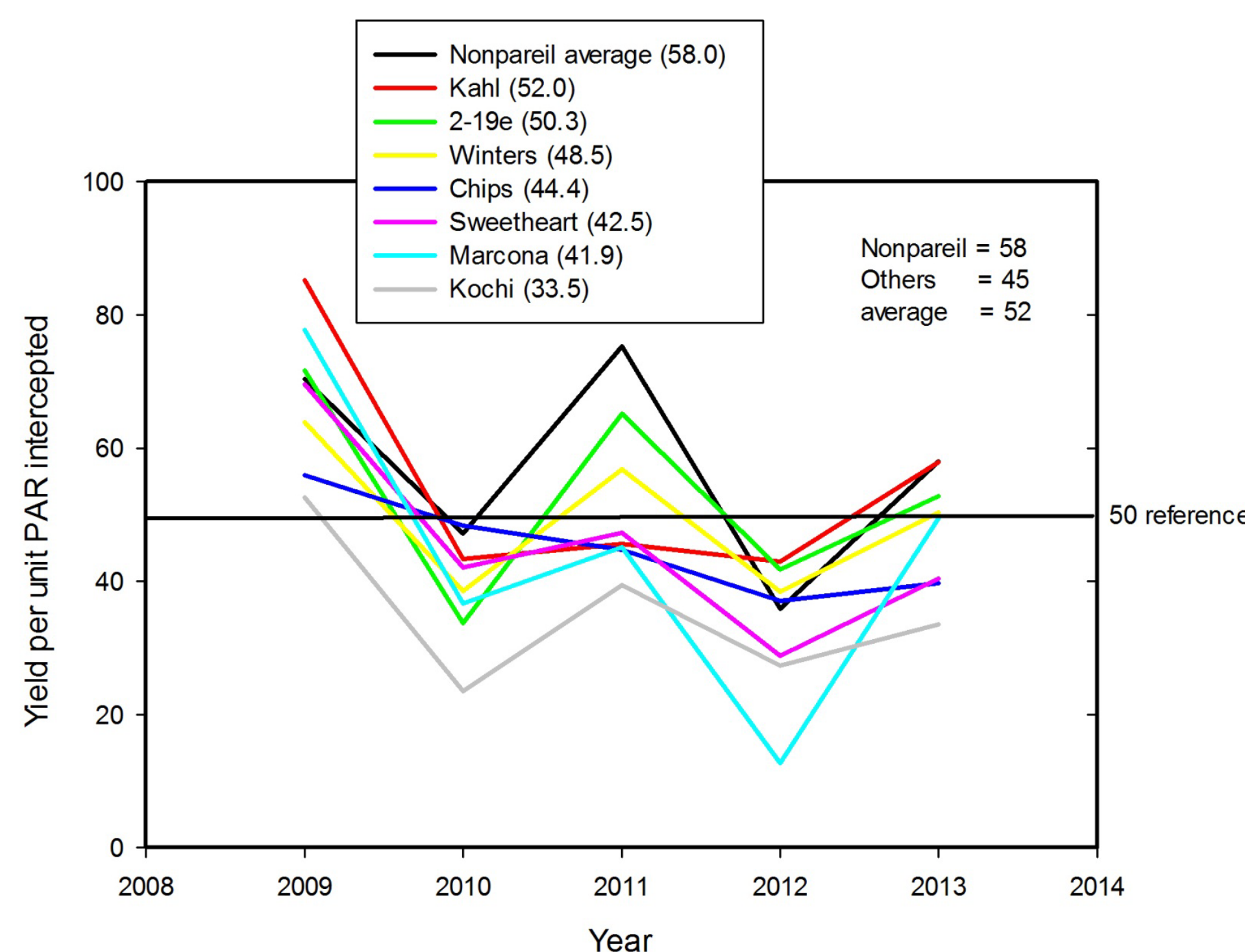


Fig. 2. Yield per unit PAR intercepted by treatment and variety or selection for 2009-2012 seasons at the McFarland variety trial.

yield per unit light intercepted can be used along with the current year light interception data to help predict current year yield.

The data for all almond sites for orchard age versus midday canopy light interception is shown in Fig. 3. These data suggest that orchard light interception peaks at about 13 years of age and declines thereafter. The area in pink at the top of the figure indicates where light interception is above the 80% upper limit currently suggested due to food safety concerns.

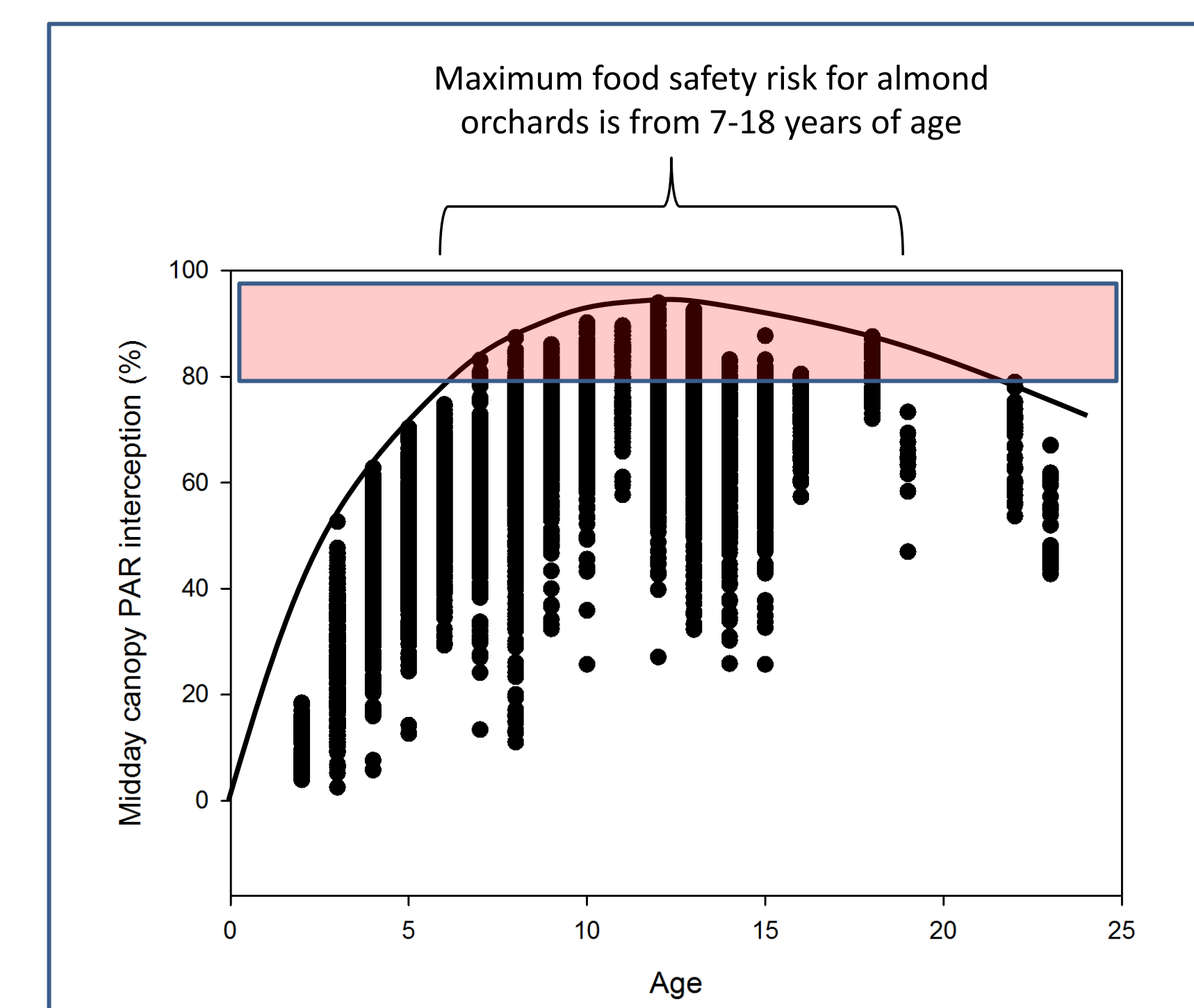


Fig. 3. Midday canopy PAR interception by orchard age for all almond sites.

Current and future uses of this technology:

- Investigate light interception/yield relationship (ongoing)
- Adjust treatments for relative canopy area in any type of study such as pruning trials (ongoing)
- Evaluate performance of new cultivars- separate out effect of faster tree growth versus higher productivity per unit canopy light interception (ongoing)
- Investigate role of orchard floor temperature on food safety risk
- Evaluate impacts of different pruning and training treatments on light interception and productivity
- Adapt mobile platform for measuring canopy temperature for stress investigations- work on this aspect of the project was reported in the annual project report and on Poster #46.

Acknowledgements

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