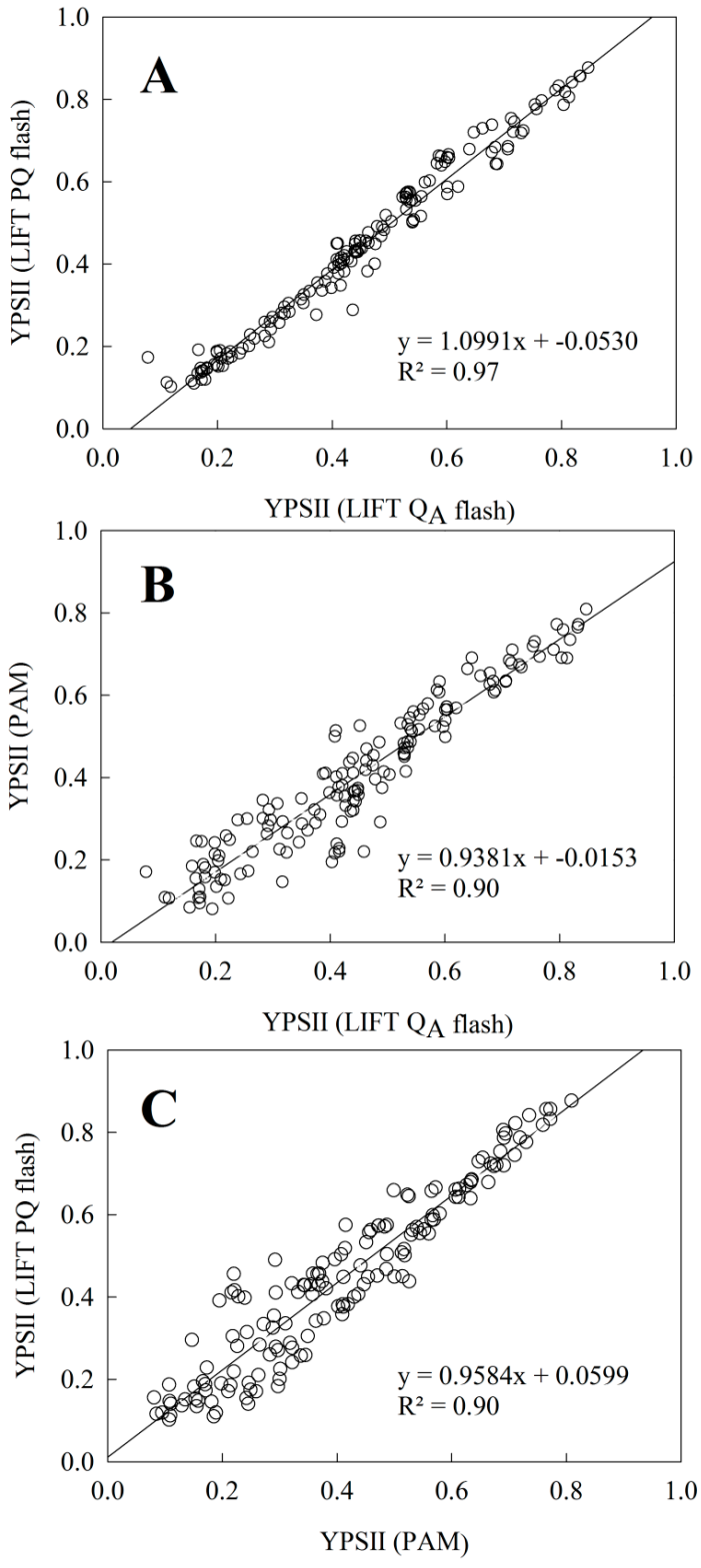

Figure S1. Relationship between YPSII calculated using the F'm from LIFT Q_A and PQ flashes (A), F'm from LIFT Q_A flashes and PAM (B) and F'm from PAM and LIFT PQ flashes (C). Points for each plot were generated from white light response curves on replicate (n = 6) avocado leaves varying in age and chlorophyll content. Light intensity of each leaf was modulated from 0 to 1000 μmol photons·m^{-2}·s^{-1} (50 μmol photons·m^{-2}·s^{-1} increments) using a quartz iodide projector lamp, with LIFT and PAM measurements performed simultaneously on adjacent section of leaves for each light intensity.

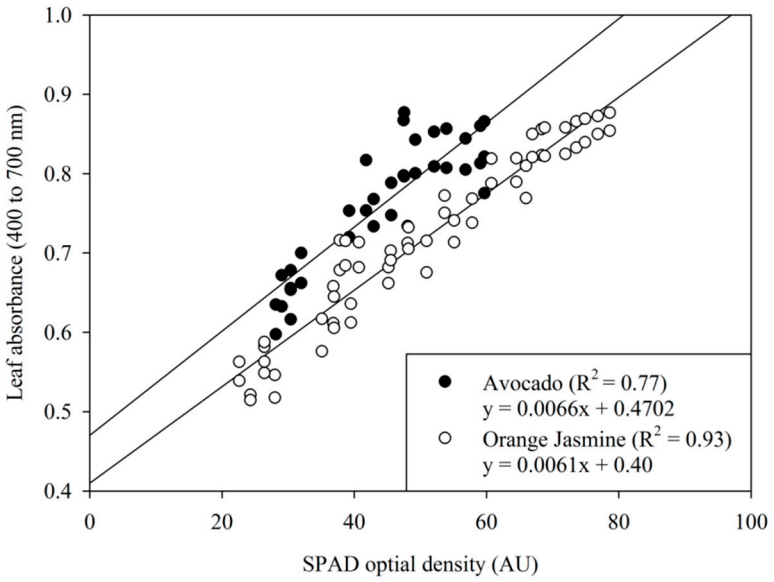

Figure S2. Relationship between leaf absorbance (400 to 700 nm) and leaf SPAD optical density measurements for leaves of avocado (n = 36; black points) and orange jasmine (n = 62; white points), where each data point represents the mean of three inter-vein SPAD and leaf absorbance measurements from a single leaf. Leaf absorbance (400 to 700 nm) was calculated from leaf reflectance and transmittance measurements collected using a Licor 1800-12 integrating sphere and a QE Pro spectrometer. Reflectance and transmittance measurements were collected with a 0.7 nm spectral resolution between 400 to 700 nm, with absorbance from 400 to 700 nm taken as the integrated area between those wavelengths.

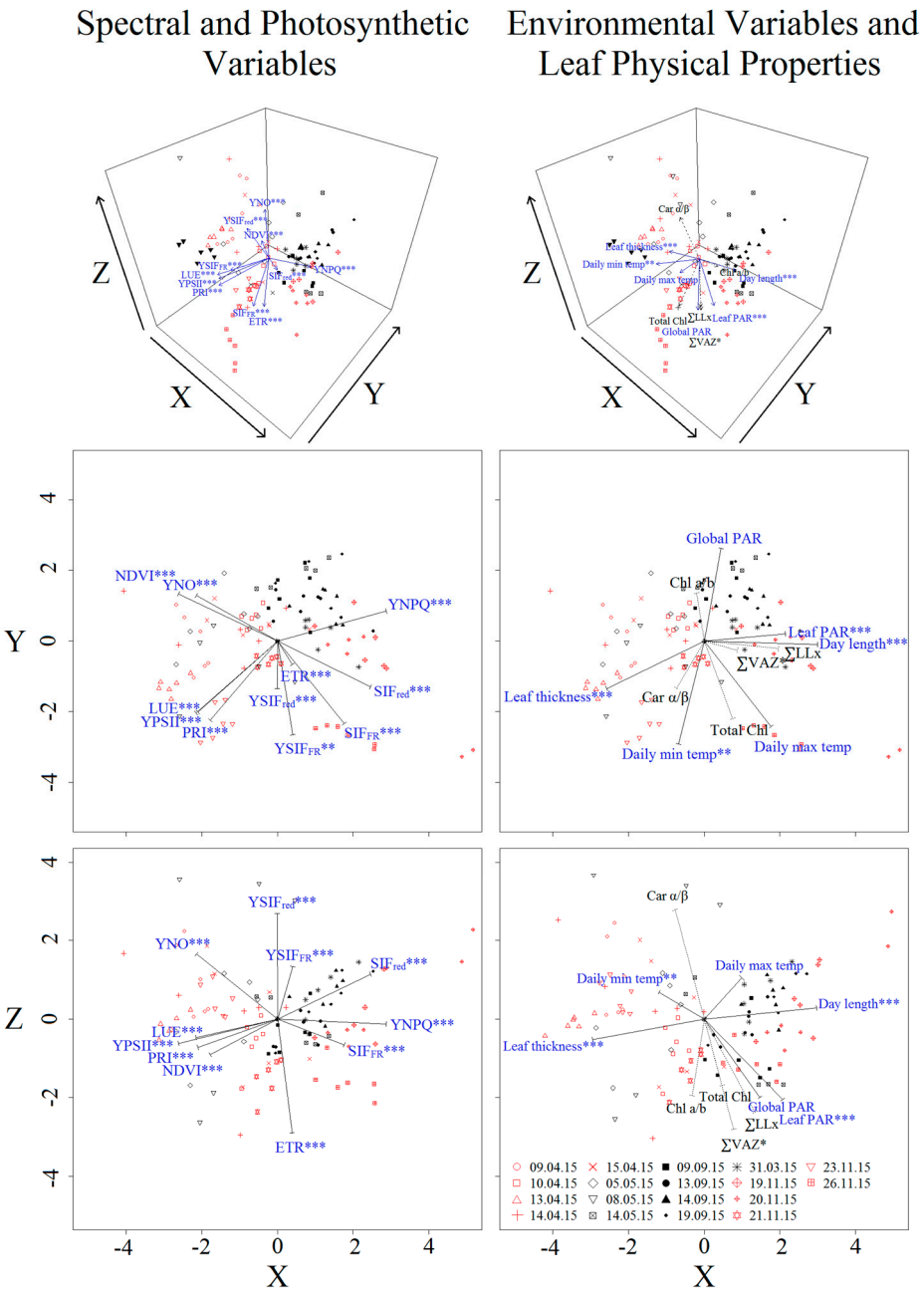

Figure S3. Three dimensional multidimensional scaling analysis of daily photosynthetic, physical, leaf pigment and remotely sensed measurements from leaves of avocado and orange jasmine (stress = 0.09). Photosynthetic and remotely sensed measurements collected at a resolution of ~3 minutes and analysed as the AUC for each daily measurement. Analyses were performed on the spectral and photosynthetic variables (ETR, YPSII, YNPQ, YNO, SIF; SIF_{red} and SIF_{FR}, $YSIF_{red}$ and $YSIF_{FR}$, LUE, NDVI and PRI), with vectors calculated for the spectral and photosynthetic variables, the environmental variables (day length, global PAR, leaf PAR, daily min air temperature and daily max air temperature) and the leaf physical properties (leaf total chl, Chl a/b, ΣVAZ, ΣLLx, Car α/β, leaf thickness). Measurement dates are marked by symbol type, with dates given in day/month/year format in the legend. Where data was available for both avocado and orange jasmine leaves, vectors are shown as solid lines and vectors names are in blue, where data was only available from avocado leaves (leaf pigments), vectors are shown as broken lines and vectors names are in black. Significant vectors are marked by *, where *** = $P < 0.001$, ** = $P \geq 0.001$ & $P < 0.01$ and * = $P \geq 0.01$ & ≤ 0.05. All vectors have been scaled by a factor of three to facilitate visualisation.

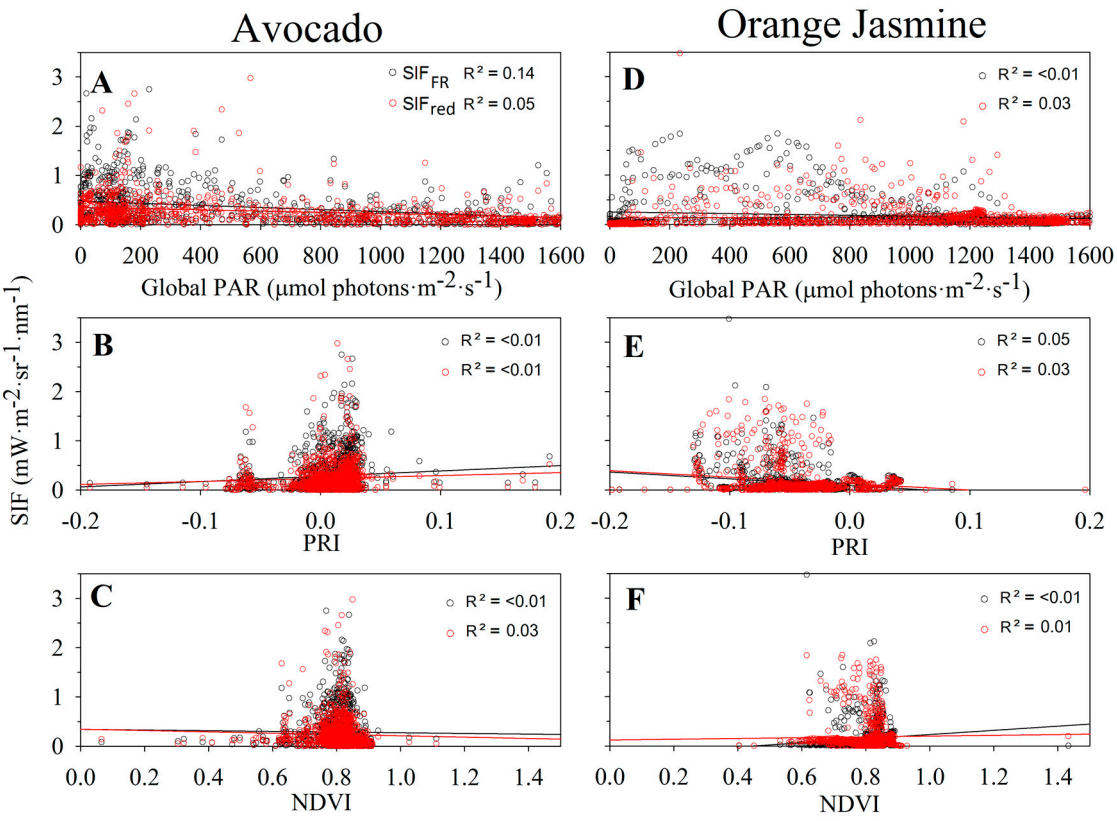

Figure S4. Scatterplots of daily measurements of SIF_{red} (red) and SIF_{FR} (black) against global PAR and QE Pro measured NDVI and PRI from leaves of both avocado (A to C) and orange jasmine (D to F). SIF, NDVI, PRI and global PAR measurements were collected simultaneously from sunrise to sunset, with a three minute time resolution, where each point represents the mean of six leaf replicates collected at the same time on a single measurement day ± 3 minutes. The black and red lines show the linear fit for SIF_{red} (red) and SIF_{FR} (black).

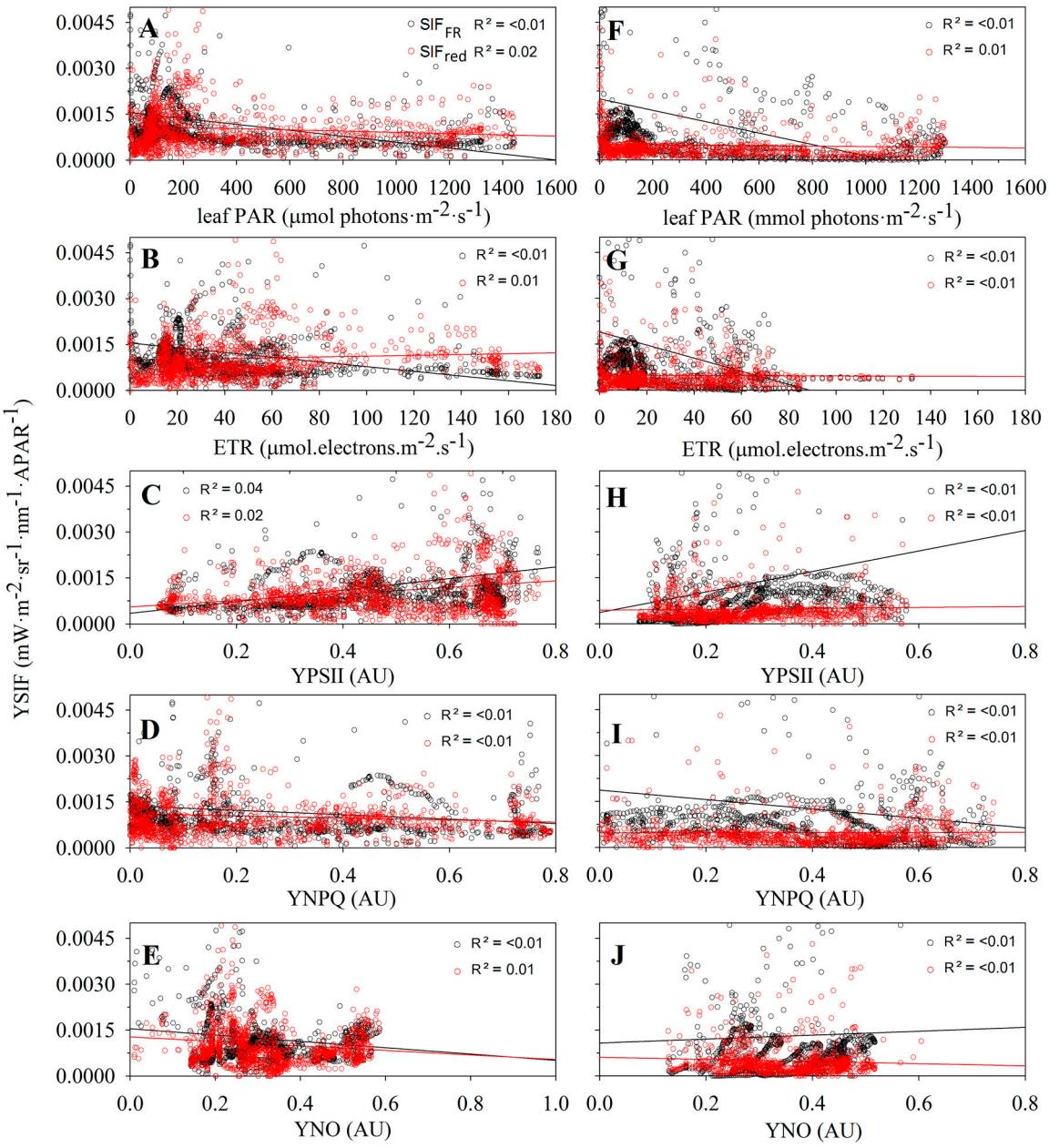

Figure S5. Scatterplots of daily measurements of $YSIF_{red}$ (red) and $YSIF_{FR}$ (black) against LIFT measured photosynthetic parameters and leaf PAR from leaves of both avocado (A to E) and orange jasmine (F to J). LIFT and SIF measurements were collected simultaneously from sunrise to sunset, with a three minute time resolution, where each point represents the mean of six leaf replicates collected at the same time on a single measurement day ± 3 minutes. The black and red lines show the linear fit for $YSIF_{red}$ (red) and $YSIF_{FR}$ (black).

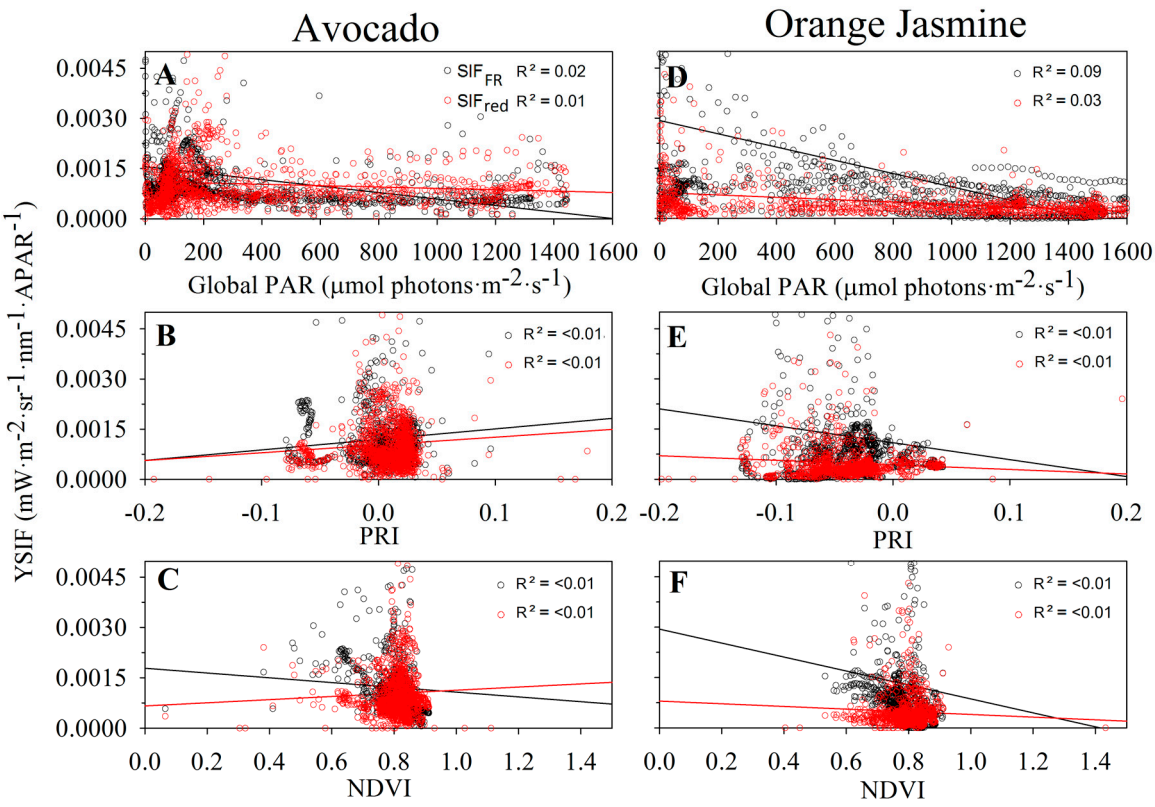

Figure S6. Scatterplots of daily measurements of $YSIF_{red}$ (red) and $YSIF_{FR}$ (black) against global PAR and QE Pro measured NDVI and PRI from leaves of both avocado (A to C) and orange jasmine (D to F). YSIF, NDVI, PRI and global PAR measurements were collected simultaneously from sunrise to sunset, with a three minute time resolution, where each point represents the mean of six leaf replicates collected at the same time on a single measurement day ± 3 minutes. The black and red lines show the linear fit for SIF_{red} (red) and SIF_{FR} (black).

Table S1. Matrix table containing the smallest absolute angles between vectors, generated by three dimensional multidimensional scaling analysis of daily photosynthetic, physical, leaf pigment and remotely sensed measurements from leaves of avocado and orange jasmine (stress = 0.08; n = 108). Significant vectors are marked by * in the left hand column of the matrix table, where *** = P < 0.001, ** = P ≥ 0.001 & P <0.01 and * = P ≥0.01 & ≤ 0.05. A three tone colour gradient scale has been used to illustrate positive (green) and negative (blue) relationships between data. Strong correlations have been marked in dark blue (strong negative; >165°) or dark green (strong positive; ≤15°), moderate correlations are marked in blue (moderate negative; >150° & ≤ 165°) and green (moderate positive; >15° & ≤ 30°), weak correlations marked in light blue (weak negative; >135° & ≤ 150°) and light green (weak negative; >30° & ≤ 45°) and for vectors where no correlation is present cells are not shaded (>45° & < 135°). Where vectors contained no correlations between other vectors along rows, these rows have been removed.

	Type	Photosynthetic					Spectral						Leaf Physical						Environmental			
Type	Parameter	ETR	YPSII	YNPQ	YNO	LUE	SIF_{red}	SIF_{FR}	$YSIF_{red}$	$YSIF_{FR}$	NDVI	PRI	Chl a/b	ΣVAZ	ΣLLx	Car α/β	Total Chl	Leaf thickness	Day length	Global PAR	Leaf PAR	Max temp
Photosynthetic	YPSII***	73																				
	YNPQ***	84	149																			
	YNO***	136	85	126																		
	LUE***	78	5	151	82																	
	SIF_{red}***	99	112	50	124	111																
	SIF_{FR}***	63	81	69	151	82	43															
Spectral	$YSIF_{red}$***	140	85	100	73	80	58	81														
	$YSIF_{FR}$***	102	67	98	104	64	49	48	37													
	NDVI***	91	69	134	45	69	170	144	112	127												
	PRI***	67	8	140	94	12	106	73	86	63	76											
Leaf Physical	Chl a/b	41	92	84	104	97	126	101	176	144	64	92										
	ΣVAZ*	12	85	73	140	90	95	63	144	108	95	80	38									
	ΣLLx	34	103	50	156	108	74	53	130	101	116	96	53	24								
	Car α/β	140	75	113	63	70	71	89	14	42	99	77	162	148	141							
	Total Chl	36	62	87	147	65	74	31	104	66	114	54	78	42	46	106						
	Leaf thickness***	77	16	160	73	16	127	96	91	80	53	23	86	89	110	79	74					
Environmental	Day length***	82	133	18	137	134	34	52	90	81	152	124	94	72	48	104	74	147				
	Global PAR	74	125	66	89	129	116	120	144	164	69	127	37	66	67	145	108	114	83			
	Leaf PAR***	41	112	43	150	117	73	59	131	106	117	105	53	30	9	144	55	118	44	61		
	Max temp	72	82	70	143	82	36	10	72	40	150	74	111	73	61	80	40	98	52	126	66	
	Min temp**	77	35	119	106	34	77	51	66	35	103	29	113	87	93	63	47	50	101	150	102	49

Strong positive (≤15°)
Moderate positive (>15° & ≤ 30°)
Weak positive (>30° & ≤ 45°)
No association (>45° & < 135°)
Weak negative (>135° & ≤ 150°)
Moderate negative (>150° & ≤ 165°)
Strong negative (>165°)

Table S2. Matrix table of P values and R^2 values for correlations between YSIF (red and FR) and LIFT photosynthetic (ETR, YPSII, YNPQ, YNO), PAR (leaf and global) and spectral (PRI and NDVI) measurements, from two different species of plants (avocado or orange jasmine). For each correlation the P value is given followed by the R^2 value in brackets, where significant correlations are bolded.

	Avocado P values (R^2)		Orange Jasmine P values (R^2)	
Measurement	YSIF685	YSIF760	$YSIF_{685}$	$YSIF_{760}$
Leaf PAR	**< 0.001 (0.02)**	**0.007 (< 0.01)**	**< 0.001 (0.01)**	0.174 (< 0.01)
Global PAR	**< 0.001 (0.01)**	**< 0.001 (0.02)**	**< 0.001 (0.03)**	**< 0.001 (0.09)**
ETR	**< 0.001 (0.01)**	0.084 (< 0.01)	**0.012 (< 0.01)**	0.756 (< 0.01)
YPSII	**< 0.001 (0.02)**	**< 0.001 (0.04)**	**0.049 (< 0.01)**	0.368 (< 0.01)
YNPQ	**0.026 (< 0.01)**	**0.004 (< 0.01)**	0.160 (< 0.01)	0.870 (< 0.01)
YNO	0.053 (< 0.01)	**< 0.001 (0.01)**	0.776 (< 0.01)	0.118 (< 0.01)
PRI	0.113 (< 0.01)	**0.001 (< 0.01)**	0.298 (< 0.01)	**0.005 (< 0.01)**
NDVI	0.394 (< 0.01)	0.127 (<0.01)	0.522 (< 0.01)	0.217 (< 0.01)

Video S1. Video can be found at: https://youtu.be/QpWW5drJ2No and shows a time-lapse of LIFT and QE Pro measurements of six avocado leaves collected from the UOW. Using a computer controlled tripod the LIFT and QE Pro can be sequentially moved between white reference measurements (white panels) and avocado leaves (figure 1). Inset top right, shows the measurement perspective of the LIFT instrument, where the blue flashes are LIFT Q_A measurements. Additionally, on each leaf a small LS-C micro quantum light sensors can be seen, which was utilized for measurement of leaf PAR.