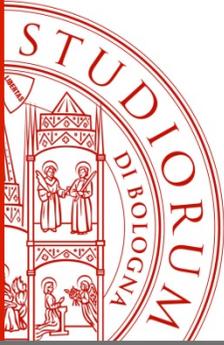


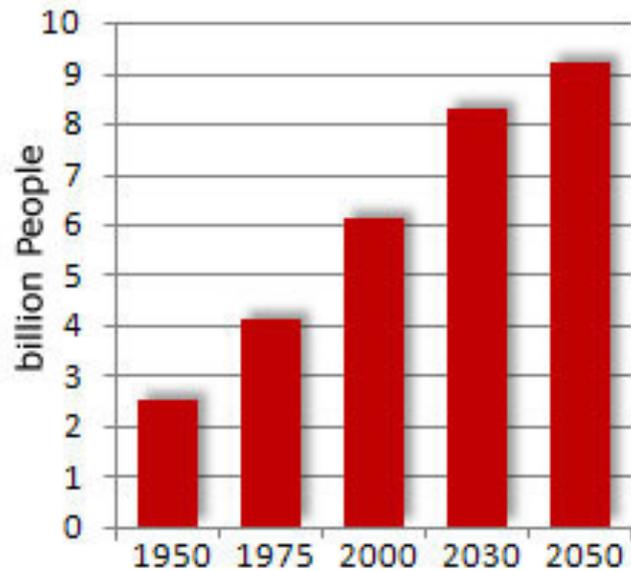
GREEN HIGHTECH

La Scienza nell'Arte di nutrire il mondo?



La grande sfida dei prossimi 30 anni

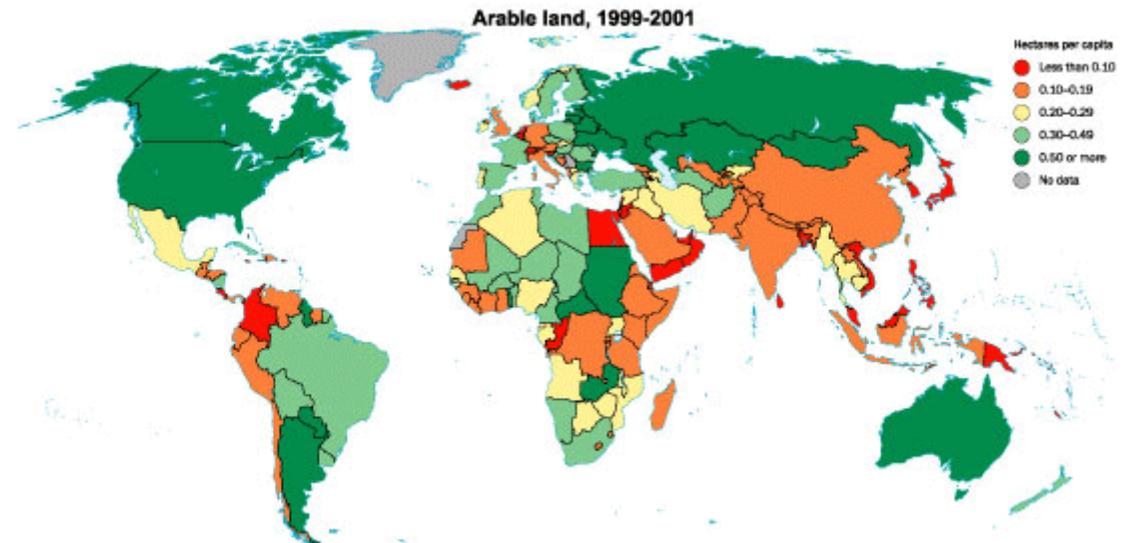
World Population Growth
1950-2050

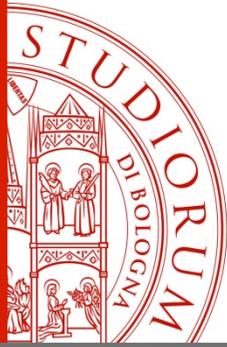


World-Crisis.net

Source: UN

Arable Land





Scienzagiovane

GreenHighTech

18 ottobre 2014

Dalla fotosintesi al frutto: è tutta questione di fotoni!

Luca Corelli Grappadelli

Dip. Scienze Agrarie
Alma Mater Studiorum - Università di Bologna

Piena luce

100%

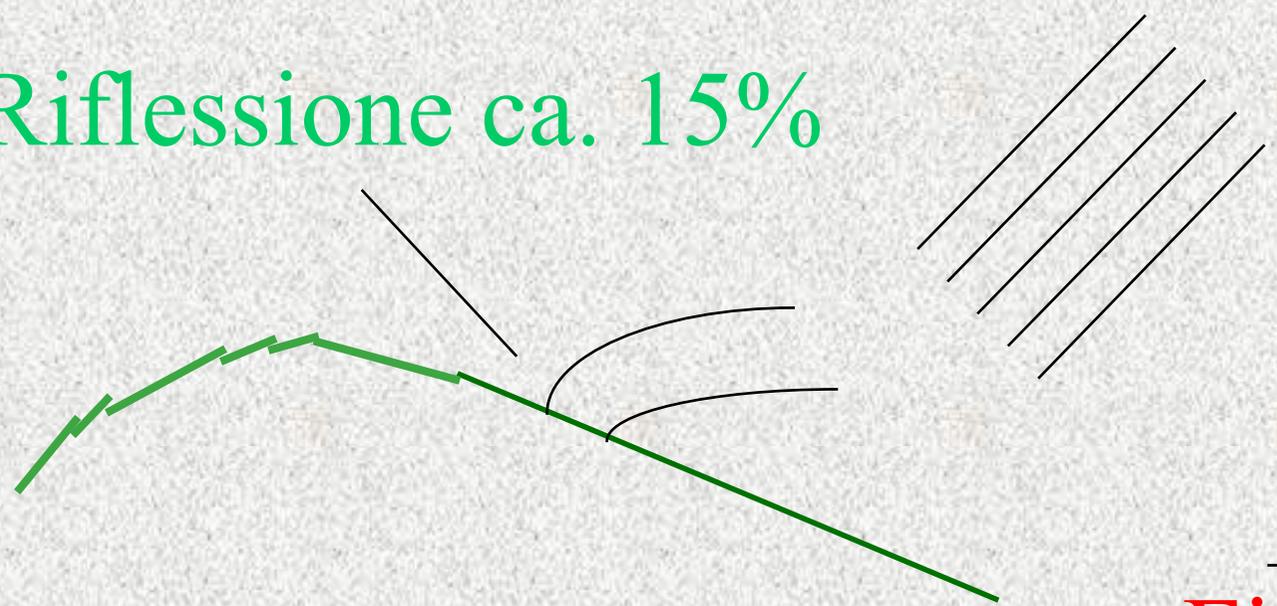
Riflessione ca. 15%

Calore
Fino a 85%

Trasmissione

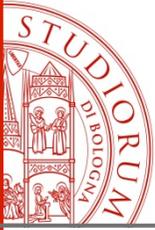
5%

Fotosintesi netta
0.5-3.5%





[animationATP.cgi.htm](#)



Tempi di reazione

FENOMENO

SCALA TEMPORALE

Cattura e trasferimento energia tra i complessi antenna

femto/pico s
 $10^{-15} - 10^{-12}$ s

Trasferimento di e- nelle reazioni fotochimiche (PSII) del tilacoide

Pico/nano s
 $10^{-12} - 10^{-9}$ s

Catena di trasporto e- fino alla sintesi di NADPH e ATP

micro/milli s
 $10^{-6} - 10^{-3}$ s

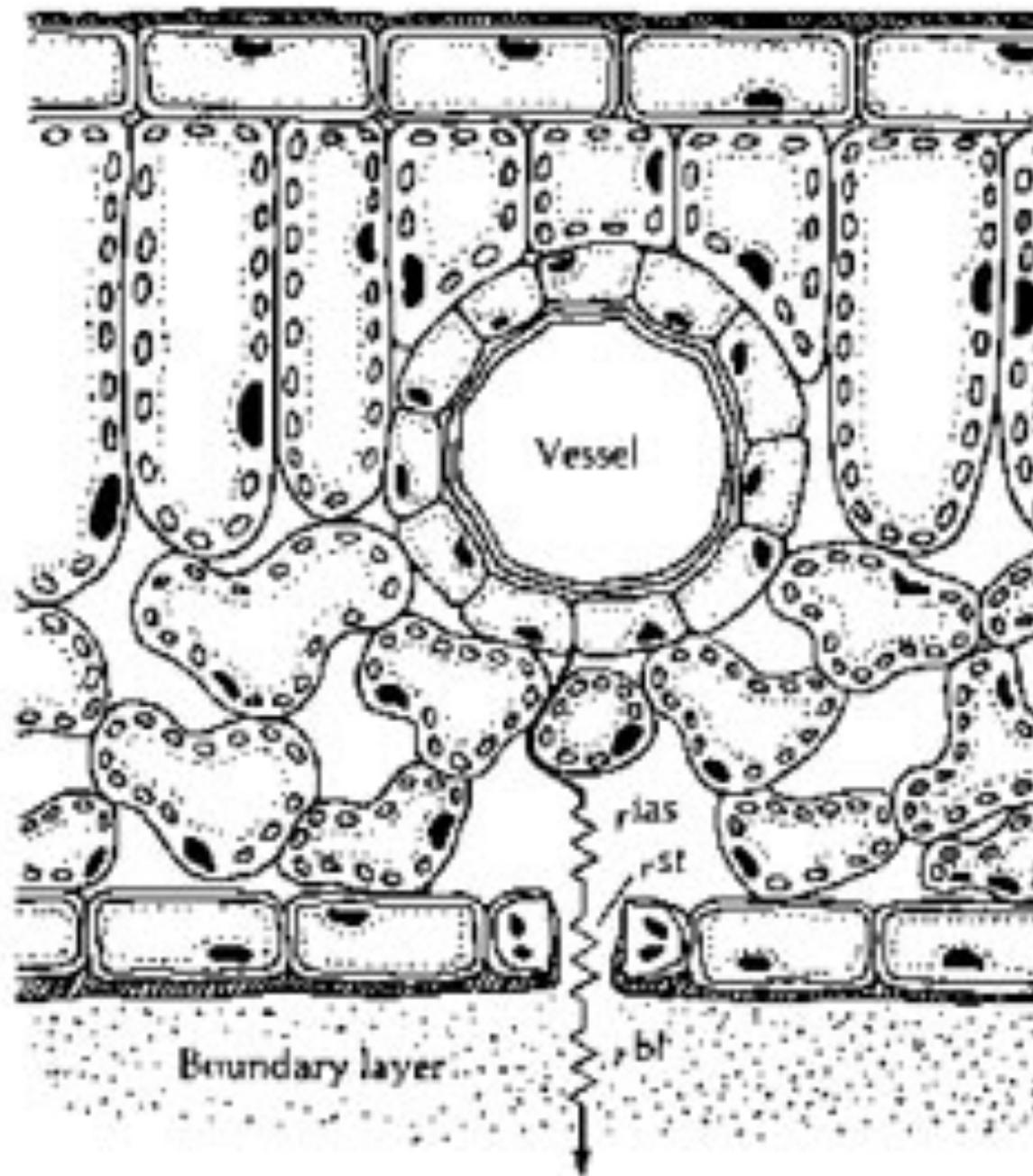
Ciclo di Calvin ed esportazione carboidrati

milli/ s
 $10^{-3} - 10^0$ s



Troppa luce? Cosa succede a toglierne?





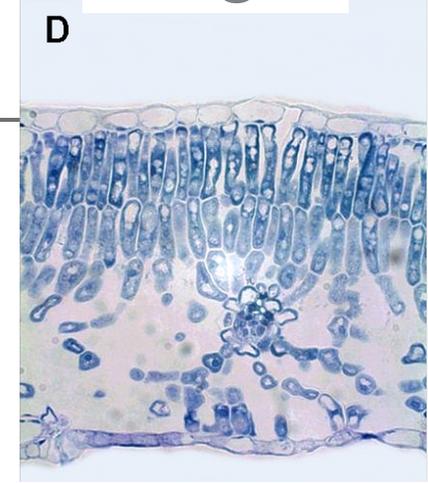
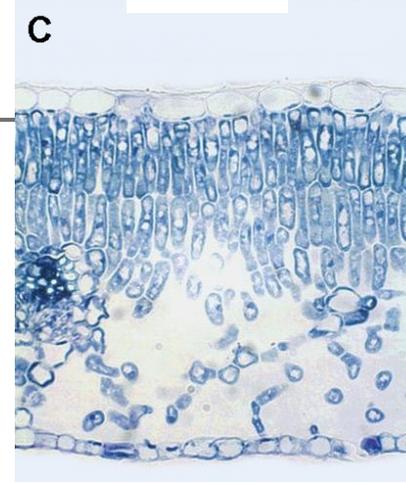
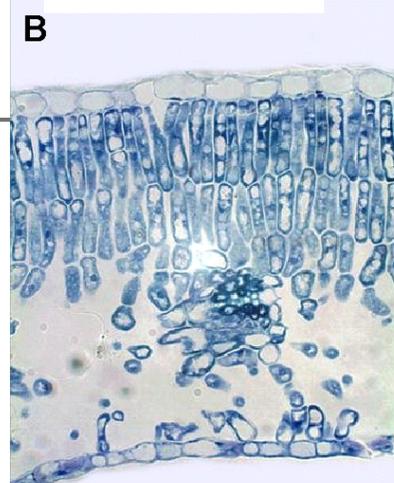
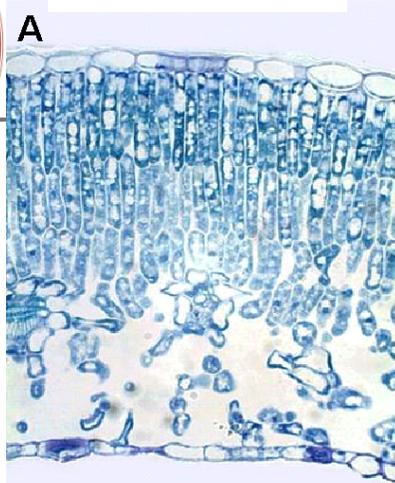


Bianco

Rosso

Blu

Grigio



Bianco

Rosso

Blu

Grigio

11:30 – 13:00 h

A_n ($\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$)

g_n ($\text{mol m}^{-2} \text{ s}^{-1}$)

E_s ($\text{mmol H}_2\text{O m}^{-2} \text{ s}^{-1}$)

WUE ($\mu\text{mol CO}_2 \text{ mmol}^{-1}$

H_2O)

11.7b

0.17b

4.2b

2.8a

12.5ab

0.22a

5.1a

2.5b

14.2a

0.23a

5.2a

2.7ab

13.5ab

0.24a

5.4a

2.6b



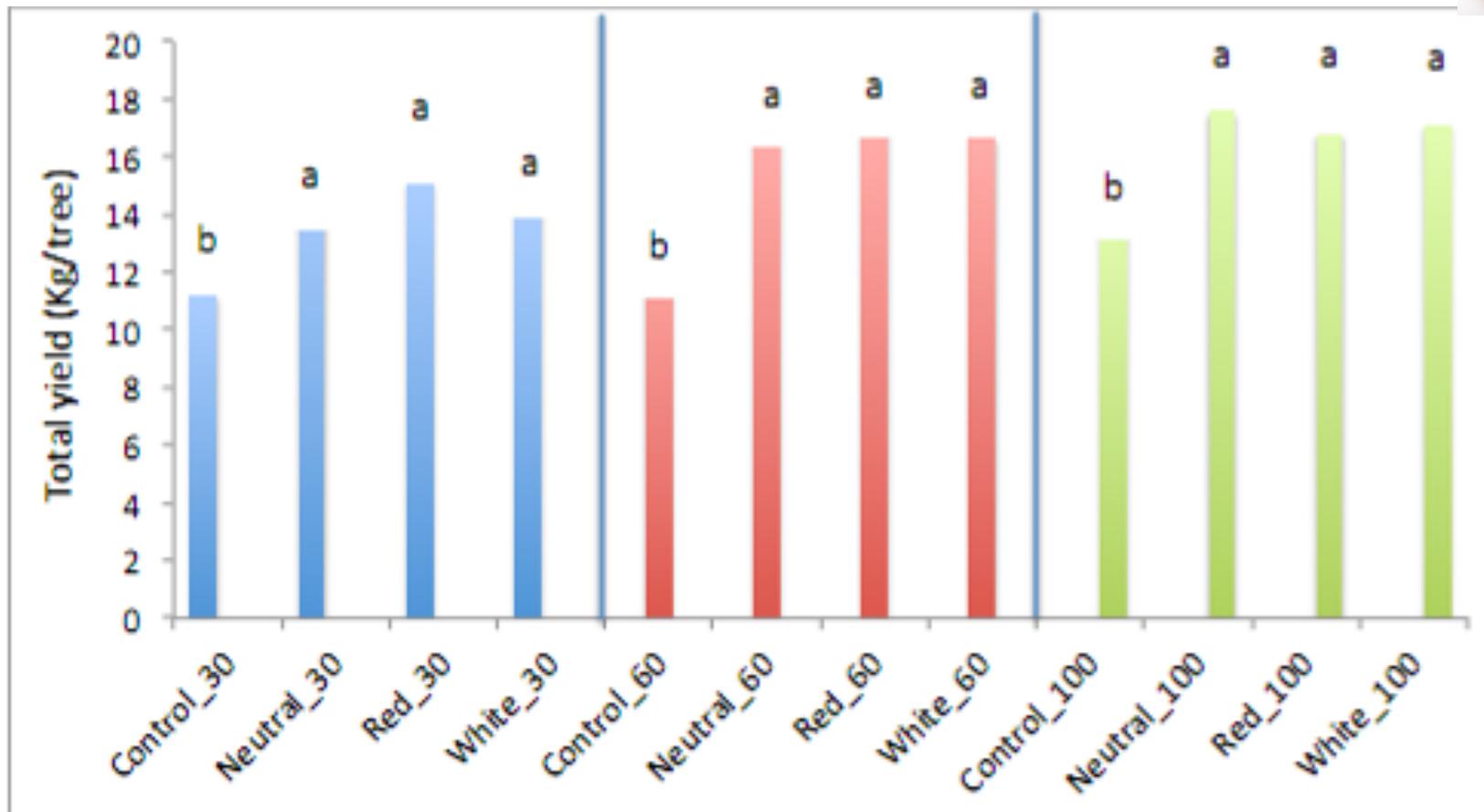
L'ombra rende l'albero più efficiente!



51 mm

116 mm

256 mm



Sulle pesche si può fare?

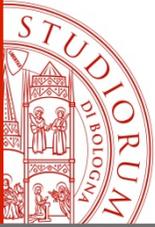




Si, ma...



Time	Trt	PPFD ($\mu\text{mol m}^{-2}\text{s}^{-1}$)	Pn ($\mu\text{mol m}^{-2}\text{s}^{-1}$)	Cond ($\text{mol m}^{-2}\text{s}^{-1}$)	Tr ($\text{mmol m}^{-2}\text{s}^{-1}$)	T_{air} ($^{\circ}\text{C}$)	WUE ($\mu\text{mol mmol}^{-1}$)
10.00	CTRL	1801	18.43	0.33	6.65	31.1	2.77
	SHD	1049 *	18.38	0.25 *	5.98 *	30.5 *	3.07 *
13.30	CTRL	1599	10.20	0.17	3.8	30.8	2.69
	SHD	850 *	9.23	0.11 *	2.74 *	29.2 *	3.44 *
16.30	CTRL	201	3.14	0.07	1.94	28.2	1.74
	SHD	100 *	2.43	0.08	1.79	28.2	1.48

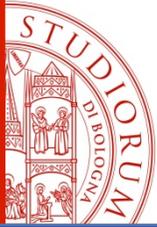


Perdita di qualità del frutto

TRT	PF (g)	Durezza	°Brix	% SS
Ctrl	159 a	3.49 b	12.88 a	0.126 b
Ombra	136 b	4.81 a	10.59 b	0.104 c
	**	**	**	**

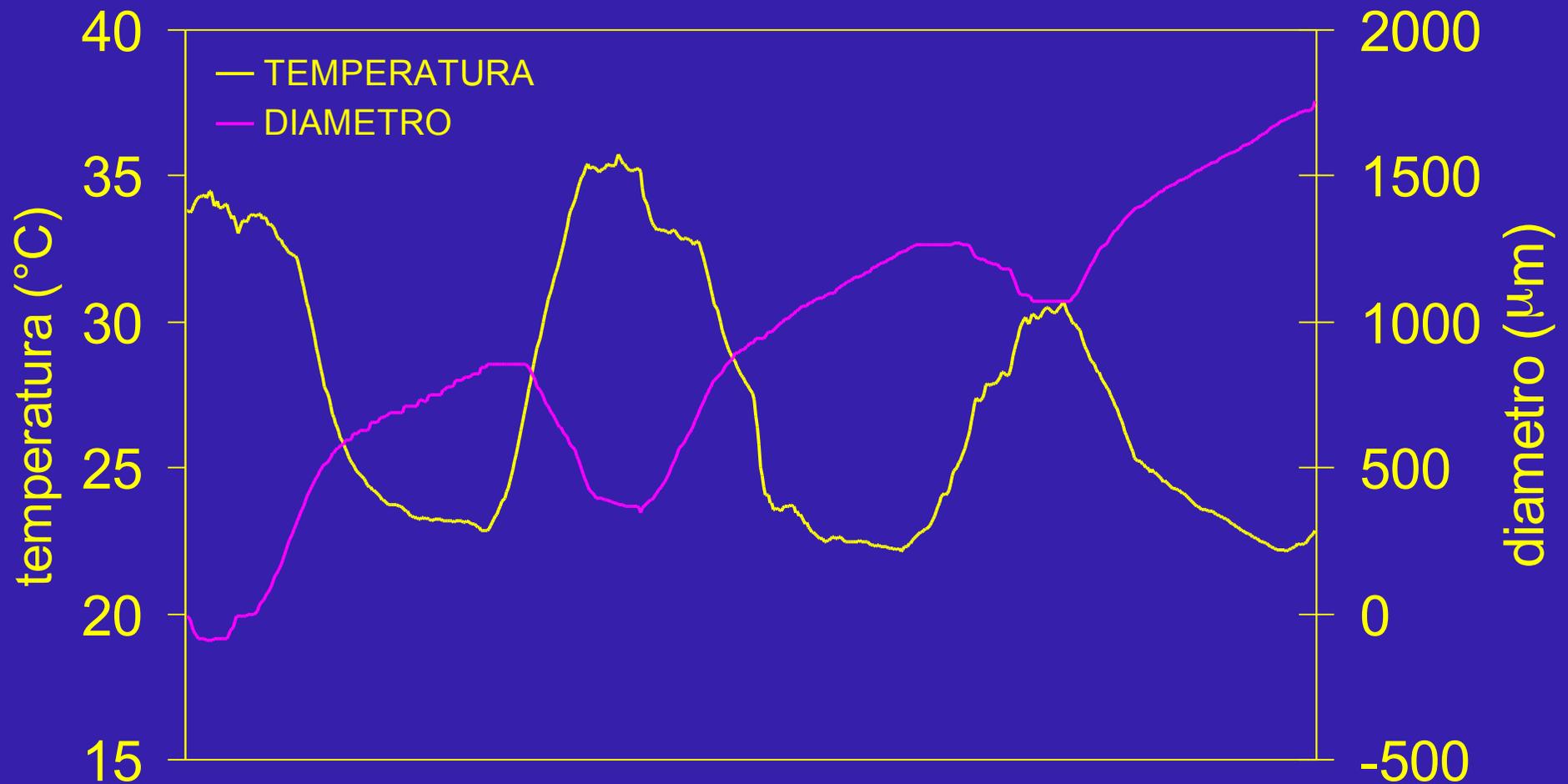
Come cresce una pesca?

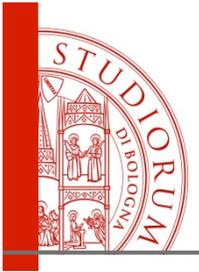




Restricting and then widening

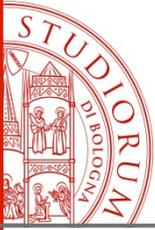
Temperature and Fruit Growth





Aumento di fotoni con teli riflettenti





Accelerare un frutto

TRT	PF (g)	Durezza	°Brix	% SS
Ctrl	159 a	3.49 b	12.88 a	0.126 b
Riflett.	166 a	3.43 b	13.27 a	0.140 a
Ombra	136 b	4.81 a	10.59 b	0.104 c
	**	**	**	**



Orientamento
dei filari e
inclinazione
degli alberi
possono
determinare
quantità di luce
diretta
intercettata



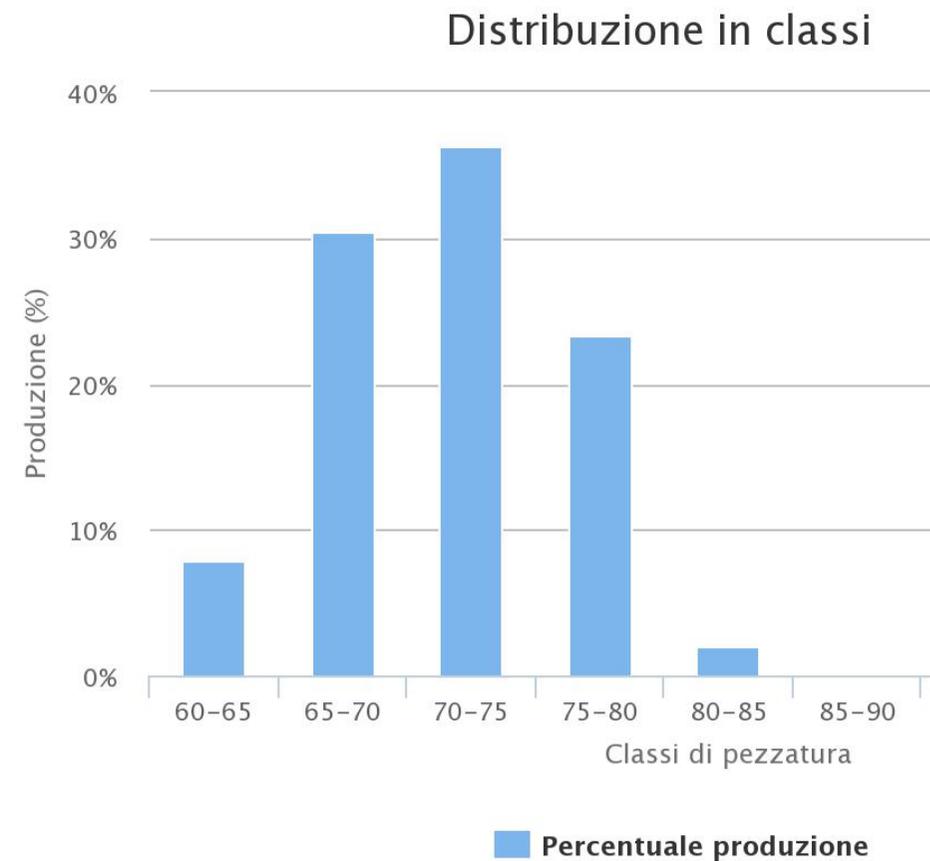
Flussi vascolari e crescita di un frutto di pesca ($\text{g PF frutto}^{-1} \text{g}^{-1}$)

	AGR	TRASPIR.	FLOEMA	XYLEMA
Ombra	5.22	- 2.52 a	3.56 b	4.19 b
Controllo	5,36	- 5.01 a	4.22 ab	5.88 ab
Telo Rifl.	8.18	- 10.27 b	8.77 a	9.66 a
<i>P</i>	<i>0.08</i>	<i>0.002</i>	<i>0.01</i>	<i><0.001</i>

Frutticoltura di precisione



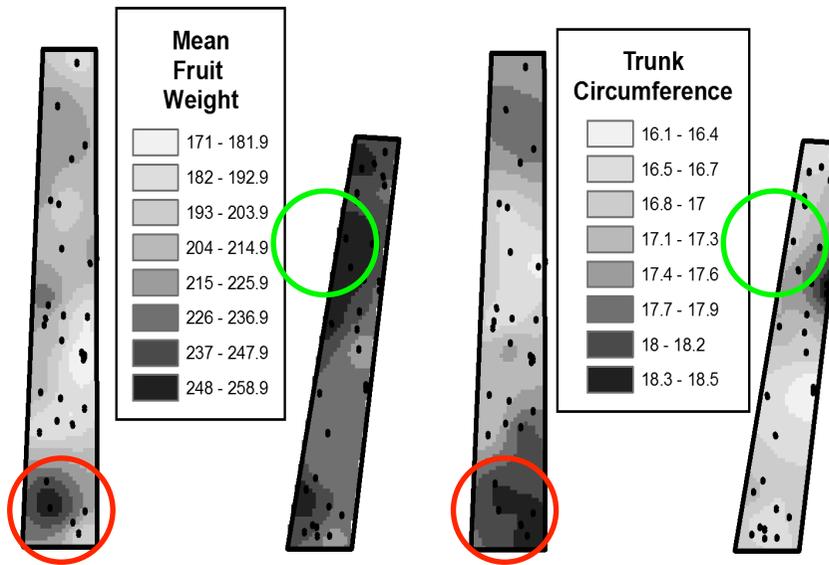
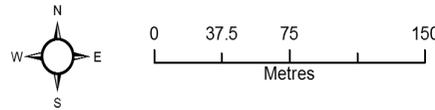
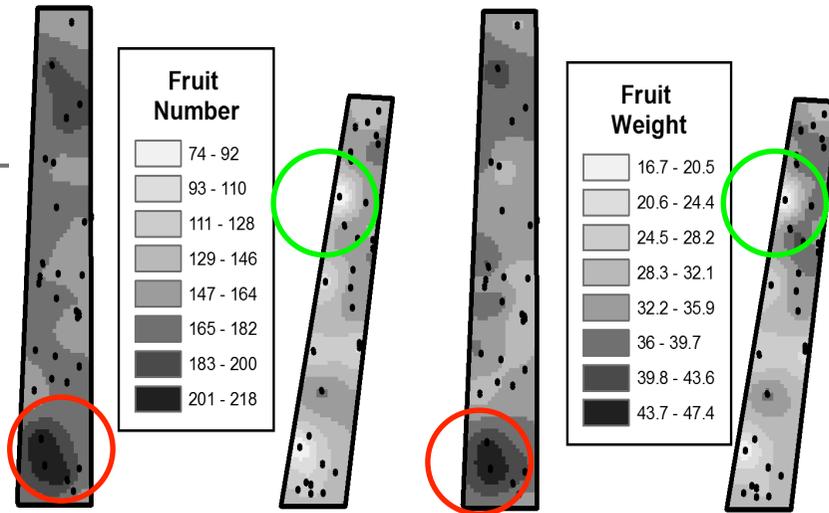
Con strumenti
semplici...





Frutticoltura di precisione

Oppure
con
robot...



L'obiettivo è capire la potenzialità produttiva del frutteto in ogni suo punto



Scienza, nell'Arte di nutrire il Mondo?