A proposal for dose expression & dose adjustment in the EU-Southern Zone

DOSA3D system

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EPPO Workshop on harmonized dose expression for the zonal evaluation of plant protection products in high growing crops

Viena, 2016-10-18/20

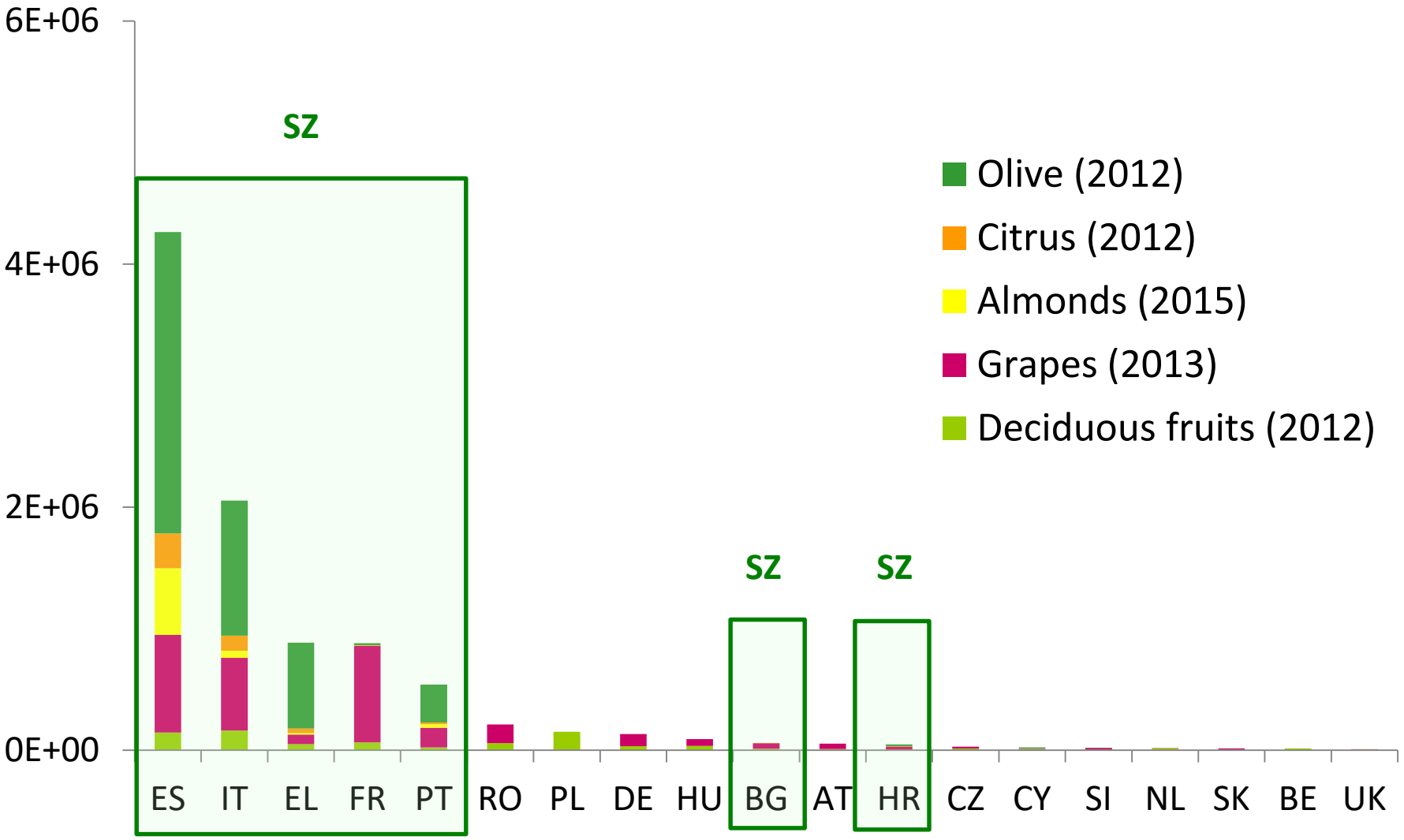
Universitat de Lleida

Generalitat de Catalunya
Departament d'Agricultura, Ramaderia, Pesca i Alimentació

AgVance

EUCLID
Europe China Lever for IPM Demonstration

Production area for EU Member States (ha)



source: EUROSTAT - Extracted on: 2016-10-08

Hedgerow

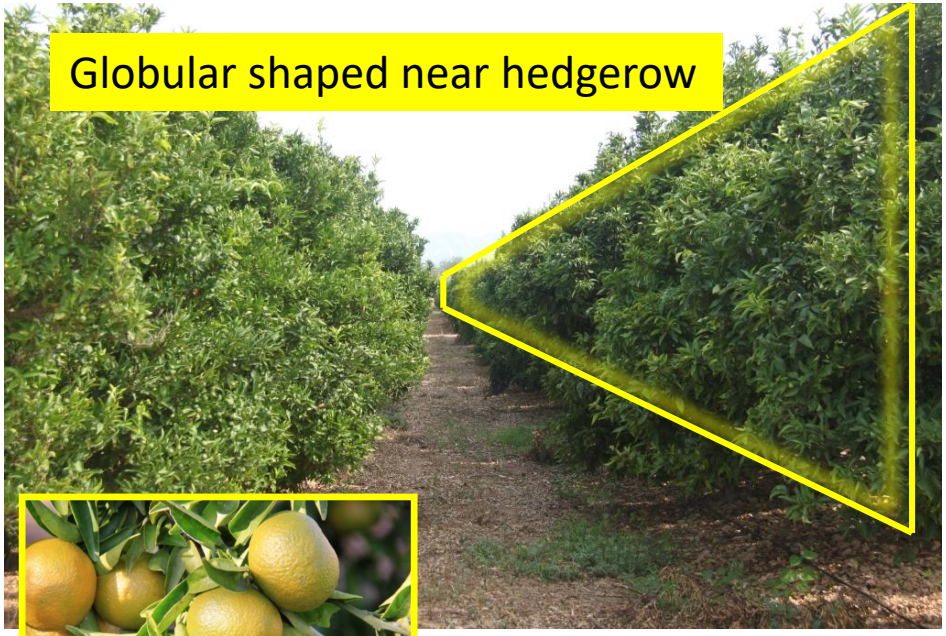
Stone fruits, October 2016 ES-Sunyer

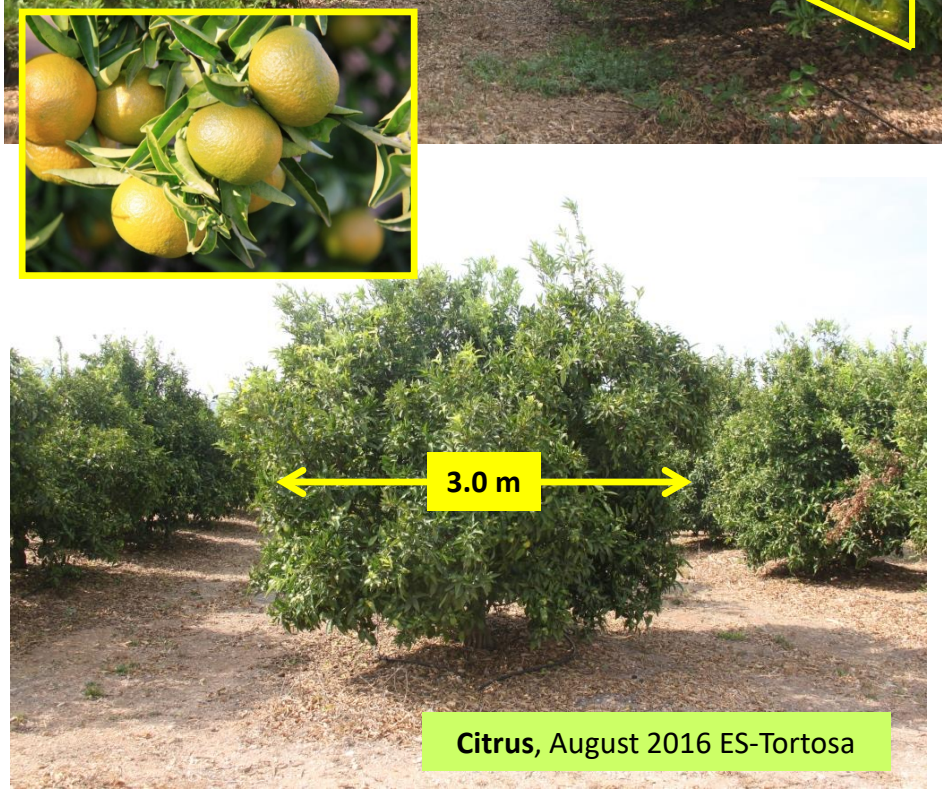
Orchards with isolated trees (traditional)

Almonds, May 2016 ES-Sunyer

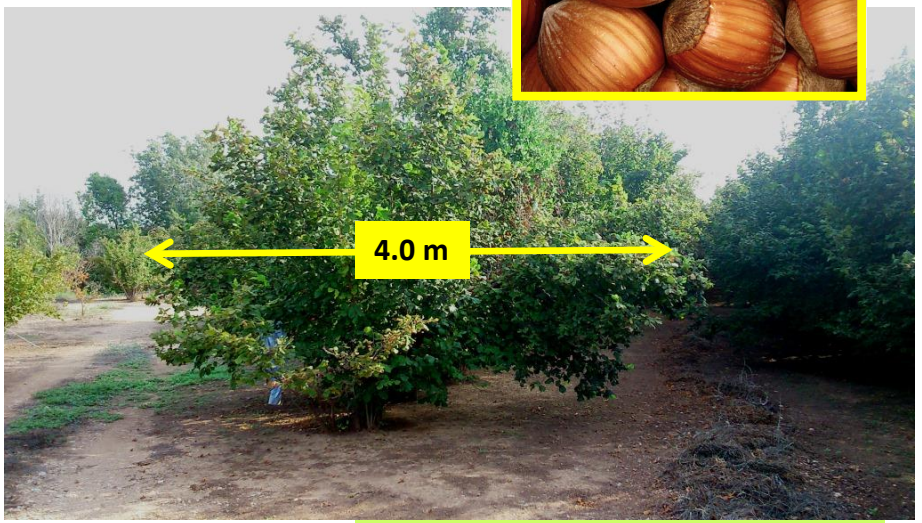
Olives, August 2016 ES-Tortosa

Globular shaped near hedgerow



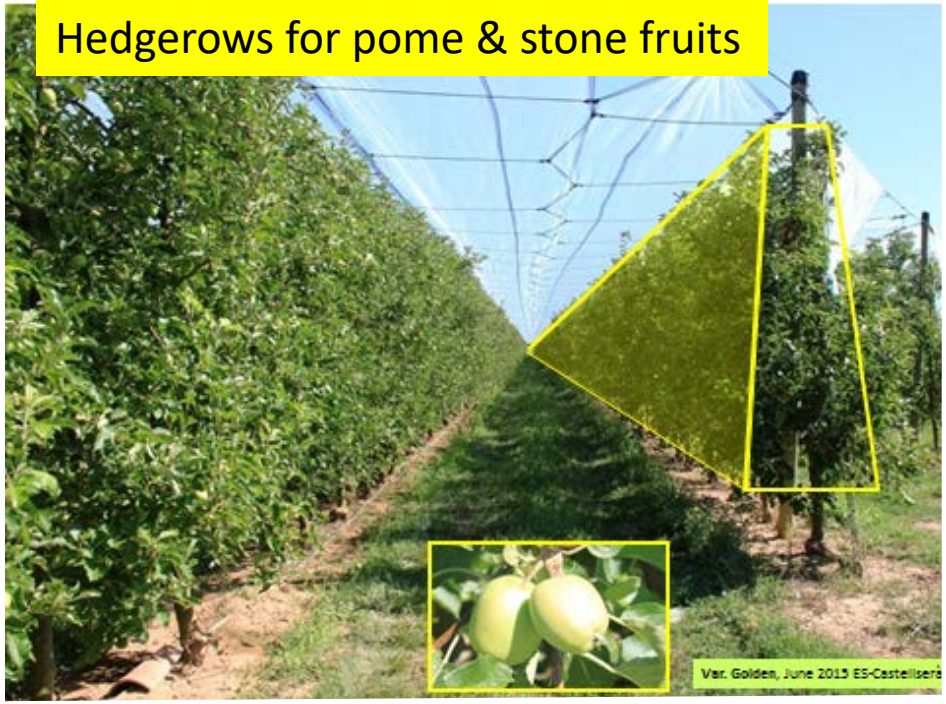


Citrus, August 2016 ES-Tortosa



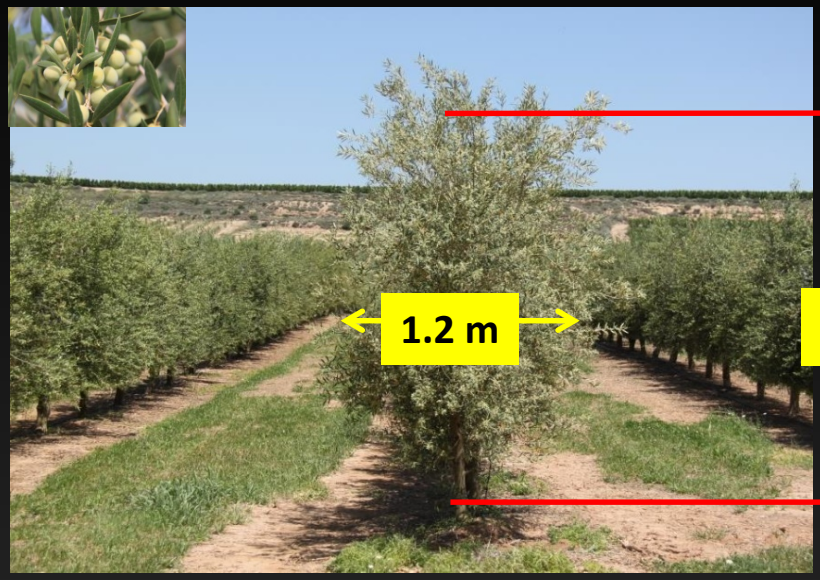
Hazelnuts, August 2016 ES-Puigpelat

Hedgerows for pome & stone fruits

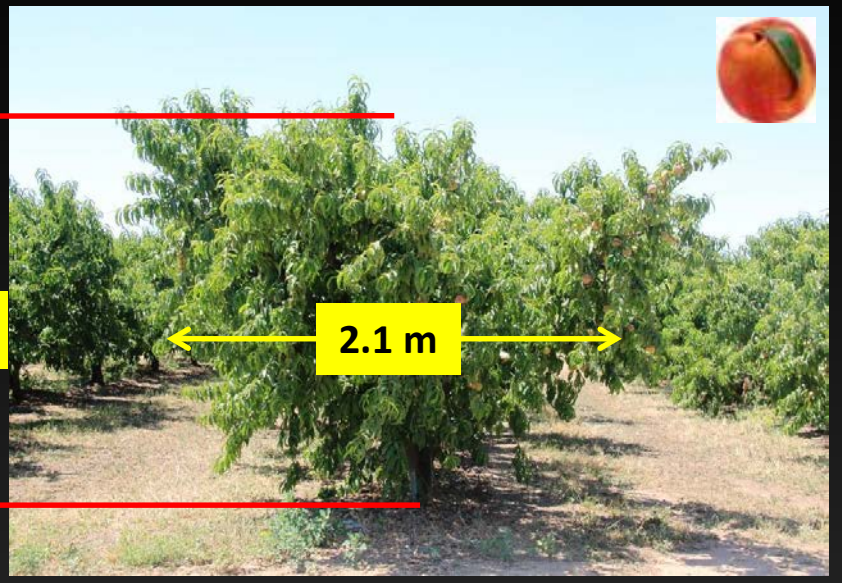


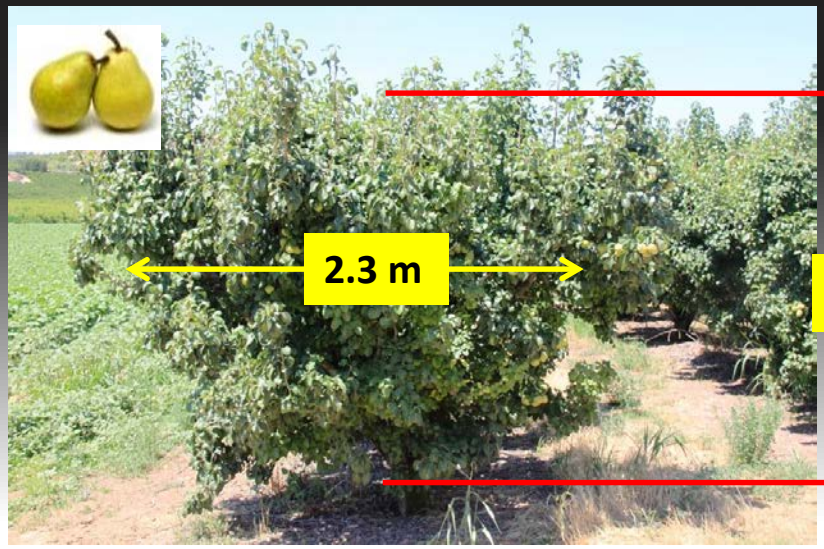
Extreme differences on training systems between crops
Should they be protected with the identical amount of pesticide?

4.0 m between rows

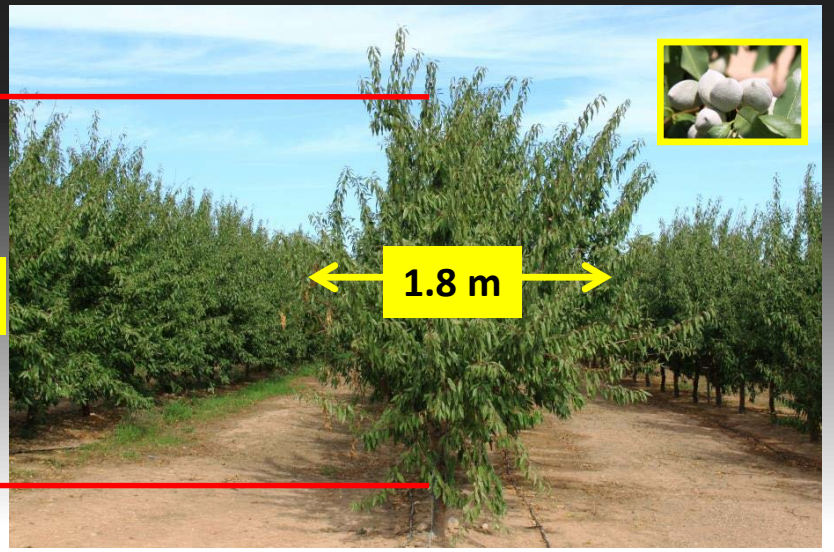


2.0 m

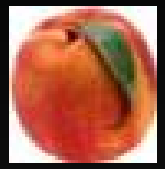




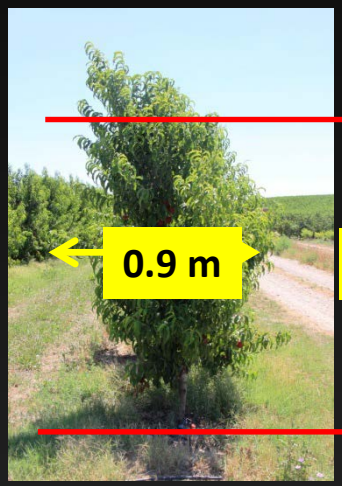
2.0 m

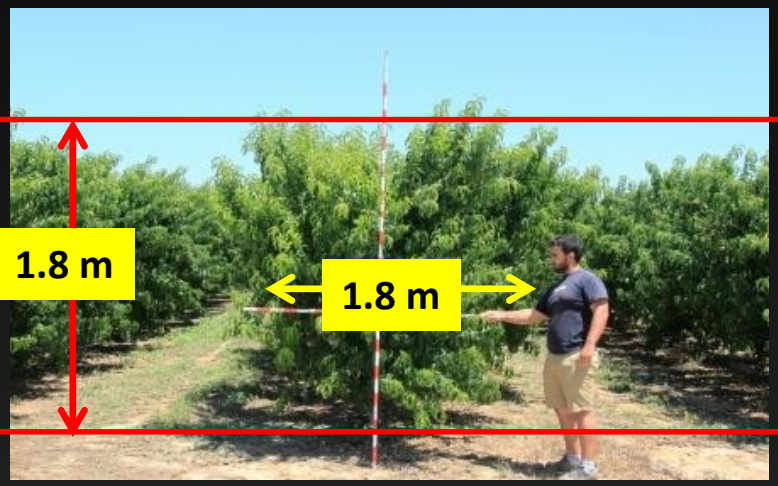


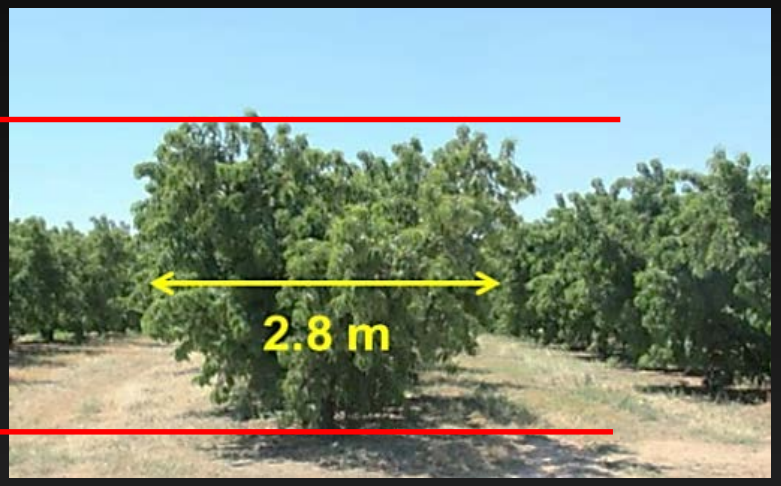
Extreme differences on training systems within crops
Should they be protected with the identical amount of pesticide?



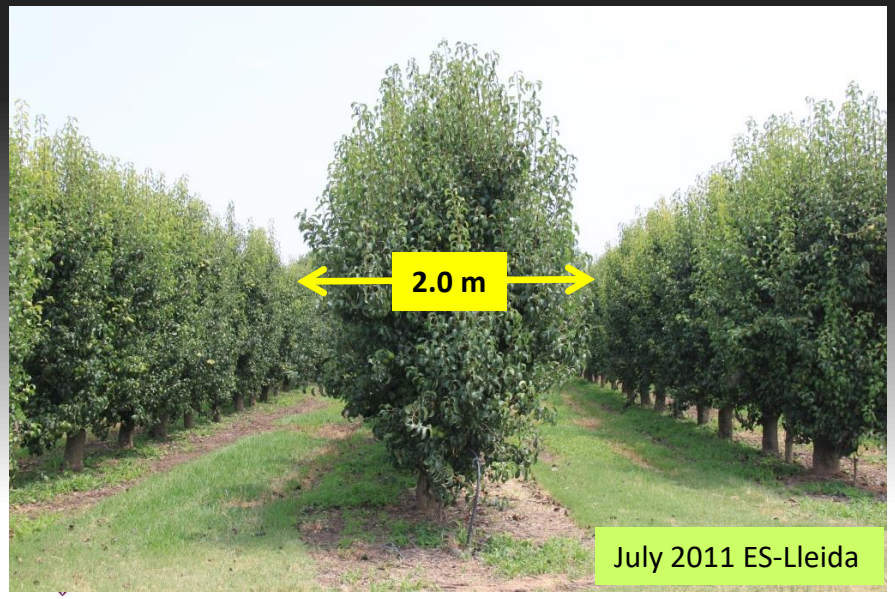
4.0 m between rows

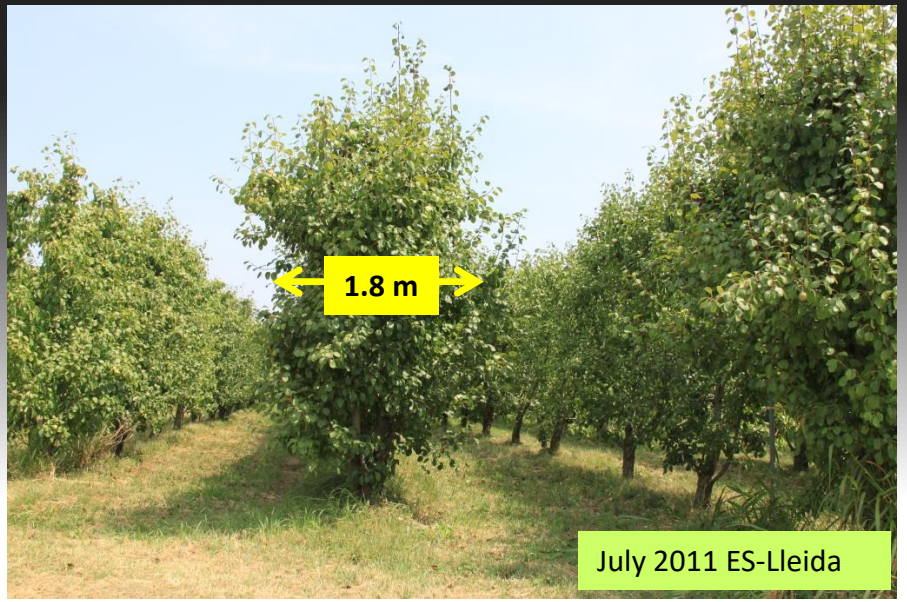






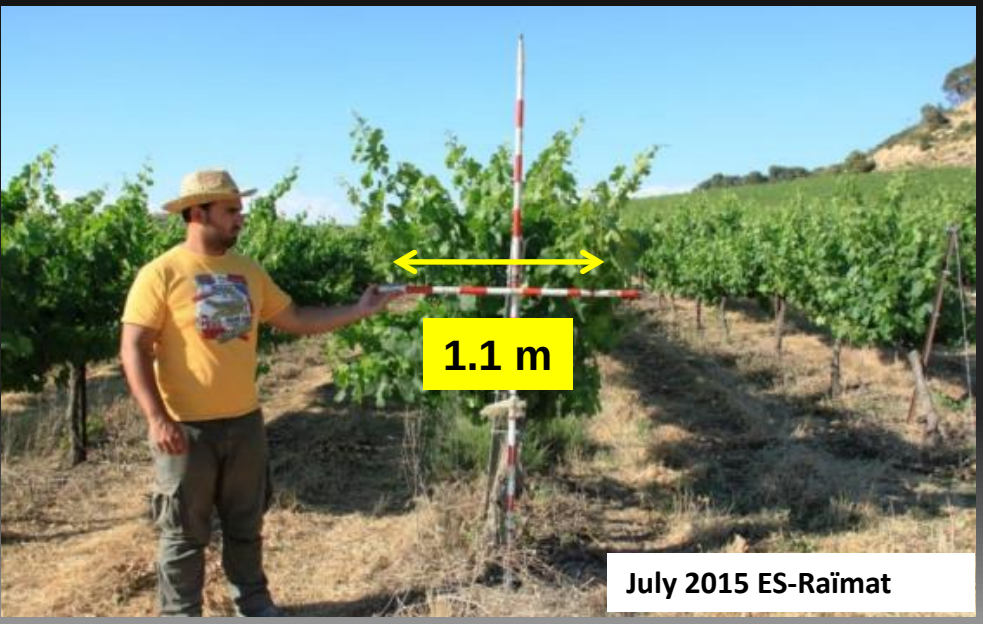
Extreme differences on training systems & cropping practices within crops
Do they be protected with the identical amount of pesticide?





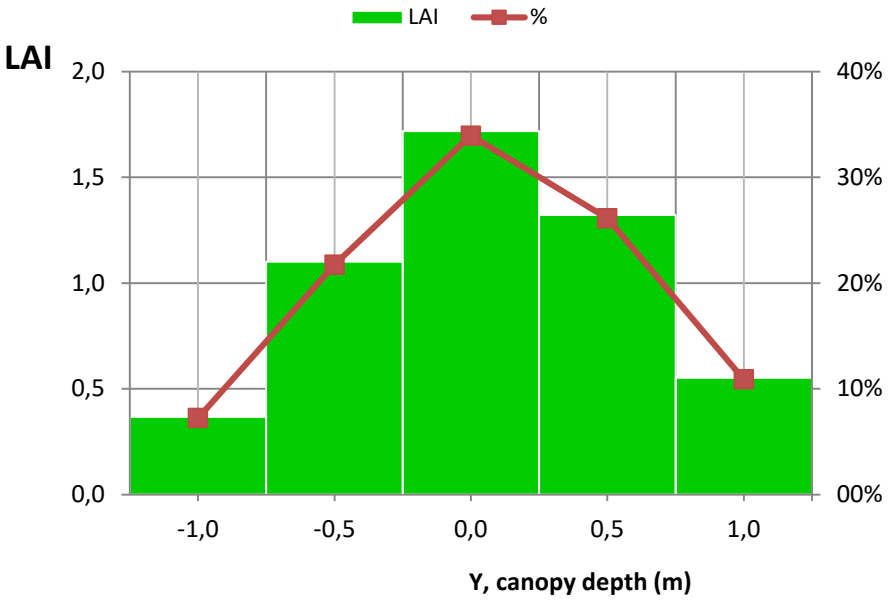
Differences on training & pruning practices within crops
Should these vineyards be protected with the identical amount of pesticide?

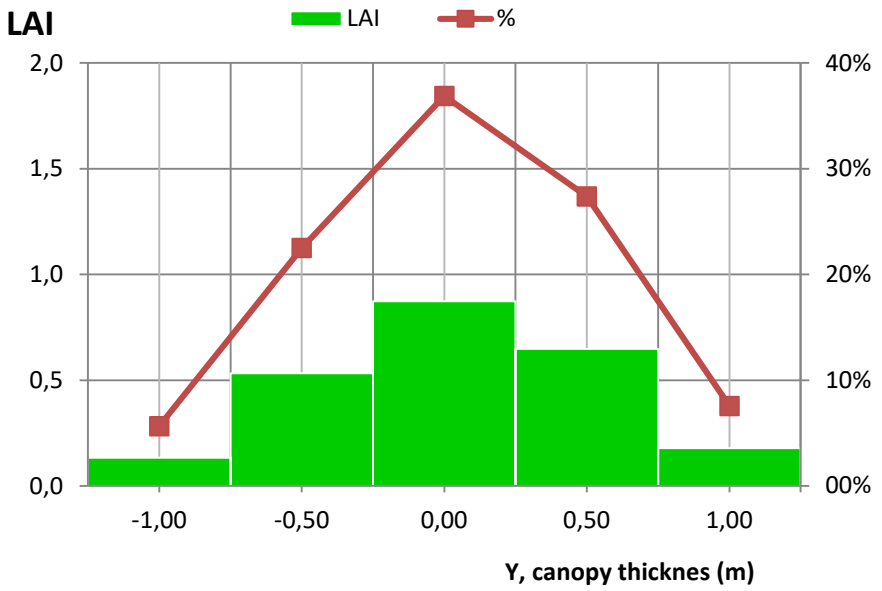
2.7 – 3.0 m between rows

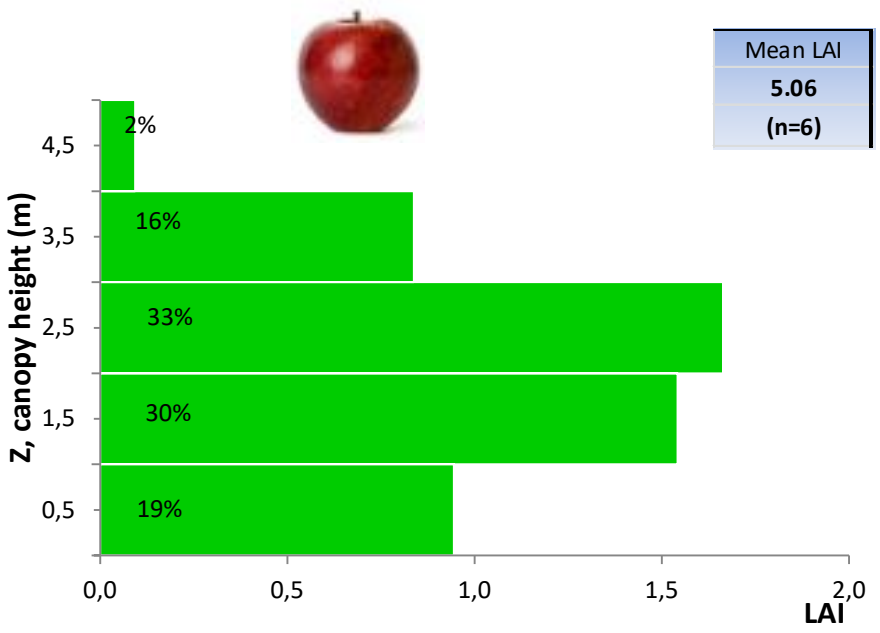


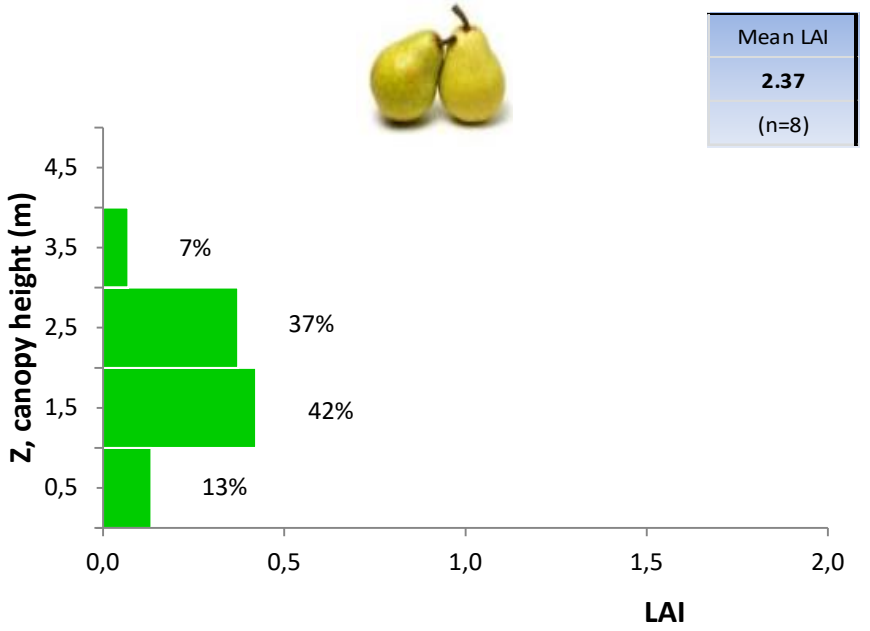
Extreme differences through growing stages

Peach, from March to October 2016 ES-Sunyer









Universitat de Lleida
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Departament d'Agricultura, Ramaderia, Pesca i Alimentació
EU-FP3 CT-1304 Project AIR (1994-97)
Generalitat de Catalunya
Cemagref
UPV
HARDI
SRI

Summary

- Cropping structures in SZ: extreme differences
- **Spraying equipment & penetrability**
- Principles for dose expression and dose adjustment
- From DOSAFRUT to DOSA3D
- Conclusions & proposal

ABS
Efficiency = 40-55%
1200 L ha^{-1}

August 2014 ES-Tortosa

ABS w/ deflectors
Efficiency = 60-70%
800 L ha^{-1}

July 2013. ES-Alcarràs

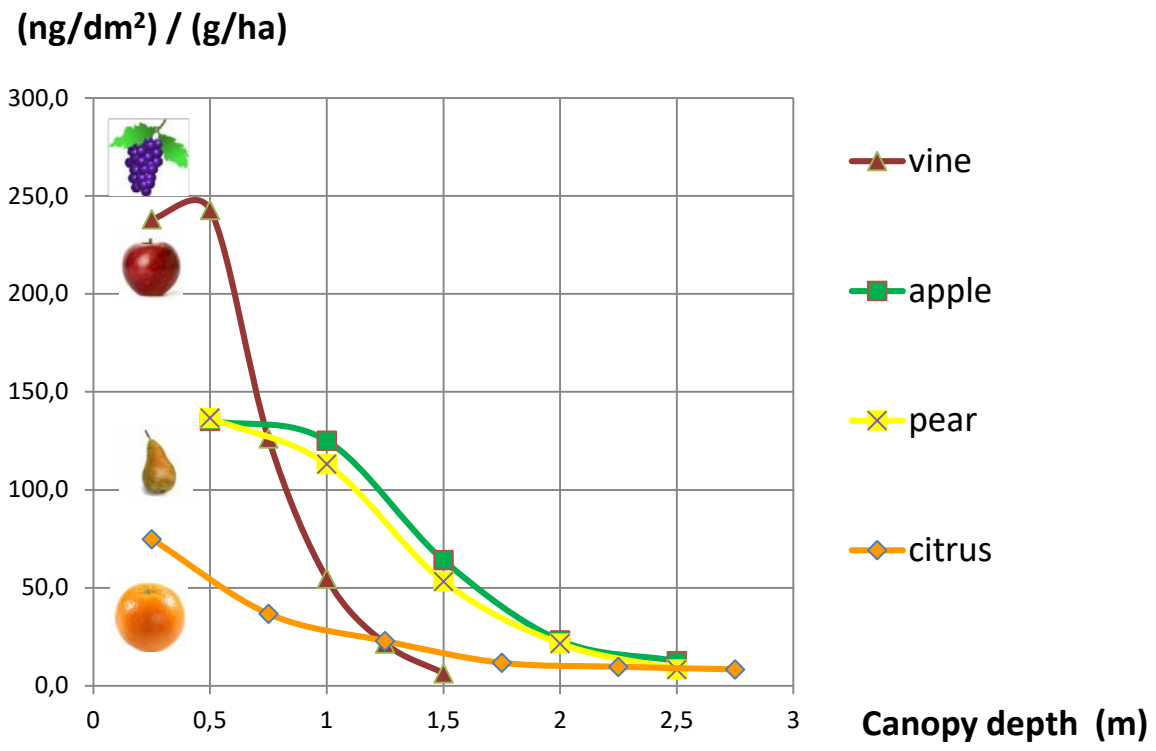
Hydraulic nozzles
Efficiency = 50-75%
300 L ha-^{1}

April 2014 ES-Raïmat DO Costers del Segre

Pneumatic nozzles
Efficiency = 60-80%
180 L ha-^{1}

June 2009 ES DO Penedés

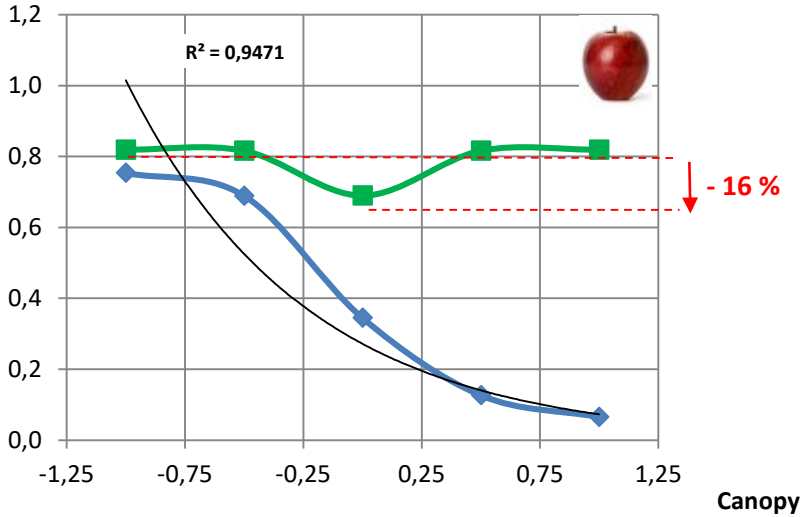
Penetrability
leaf deposition vs. depth



Two sides - penetrability

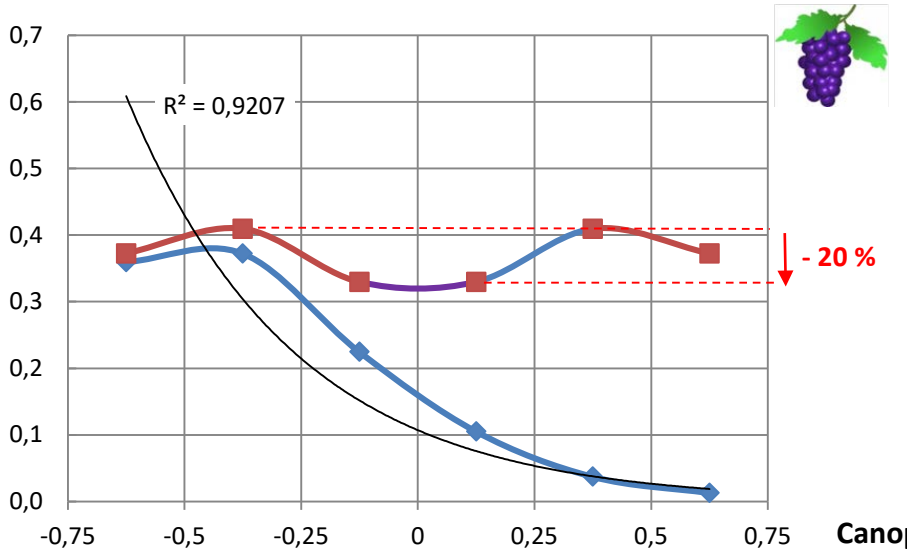
(µg/cm²)

Volume rate: 669 ÷ 730 L/ha
Trials (n = 6)



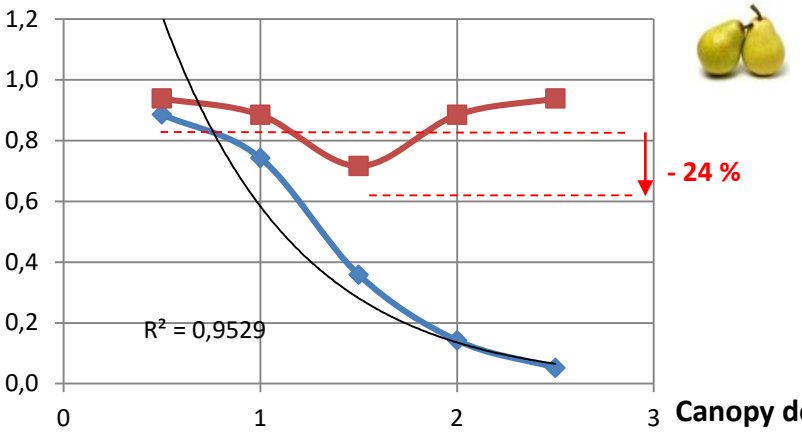
(µg/cm²)

Volume rate: 60 ÷ 144 L/ha
Trials (n = 9)



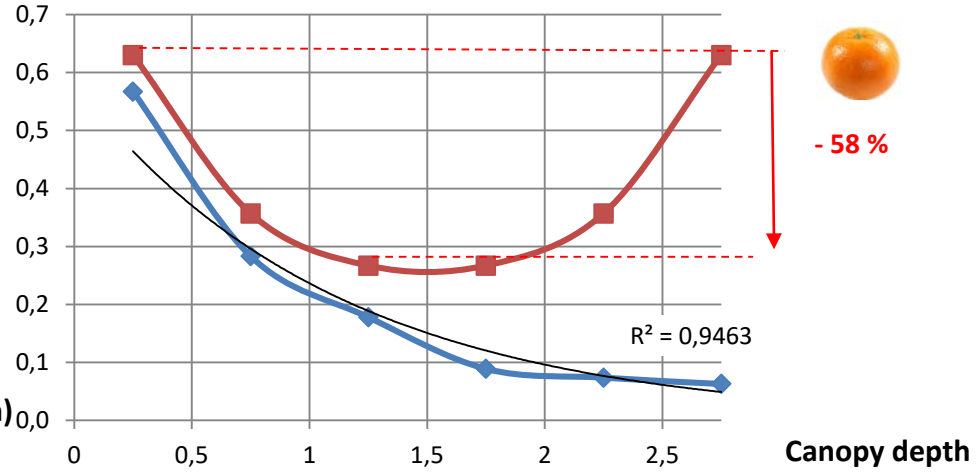
(µg/cm²)

Volume rate (L/ha): 375 ÷701
Trials (n = 8)



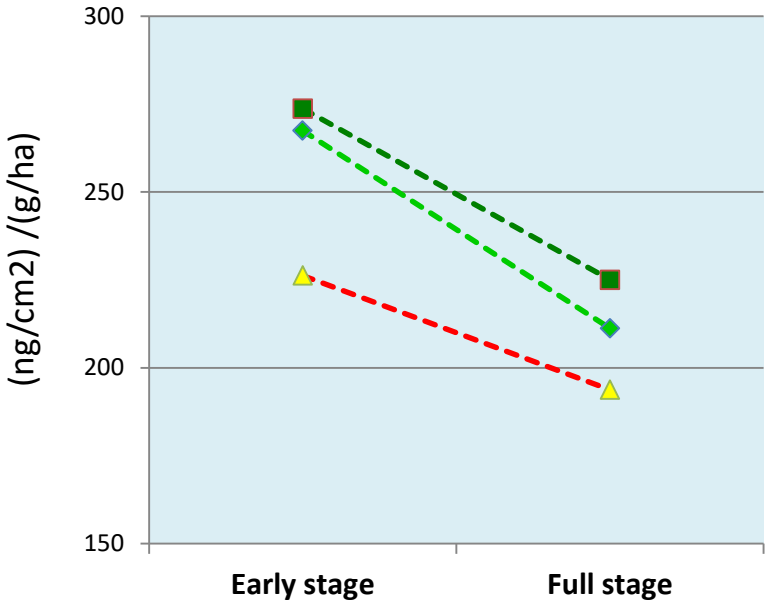
deposition (µg/cm²)

Volume rate (L/ha): 1016 -2605
Trials (n = 4)



EU-FP3 CT-1304 Project AIR (1994-97)

Leaf deposition for early & full leaf stages



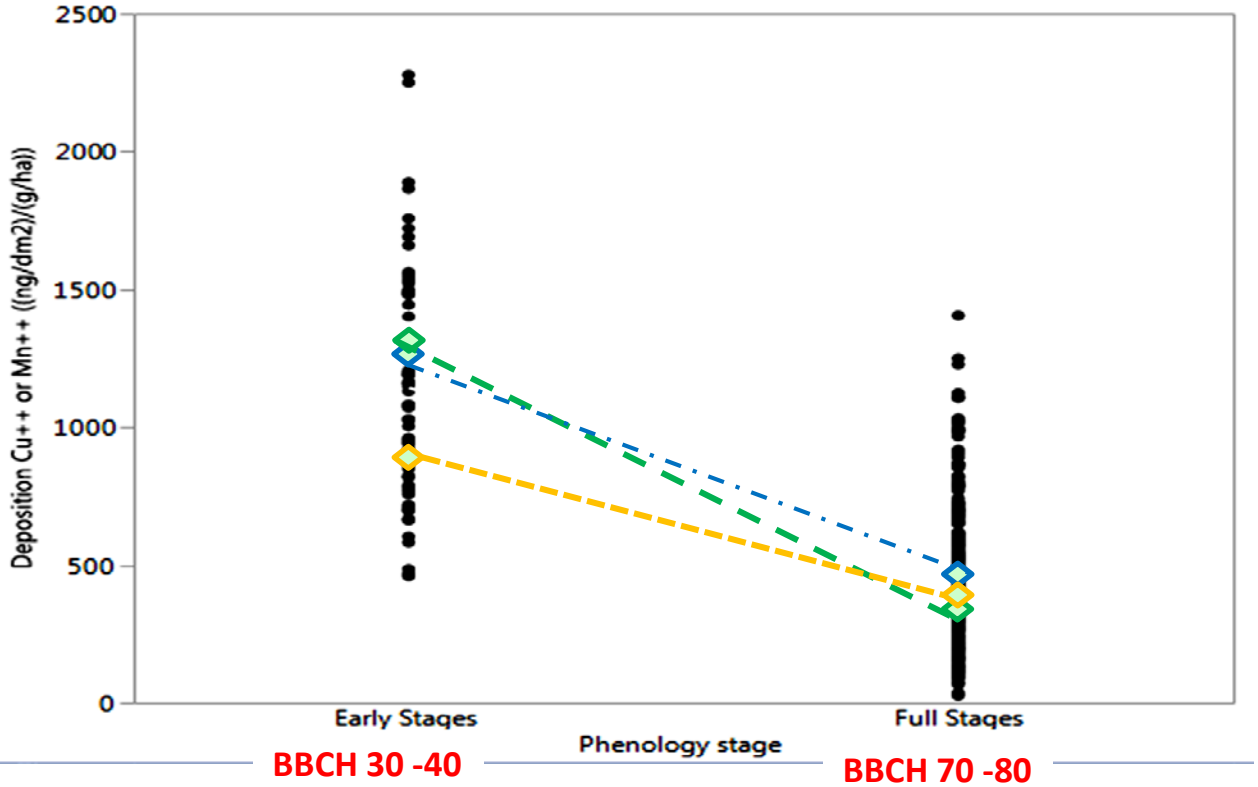
Volume rate: 800 L ha-1

Leaf deposition early & full leaf stages

HARDI - IRIS

MAKATO

HARDI - MULTIOUTLET



BBCH 30 -40

BBCH 70 -80

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Background paper for the EPPO Workshop on harmonized dose expression for the zonal evaluation of plant protection products in high growing crops

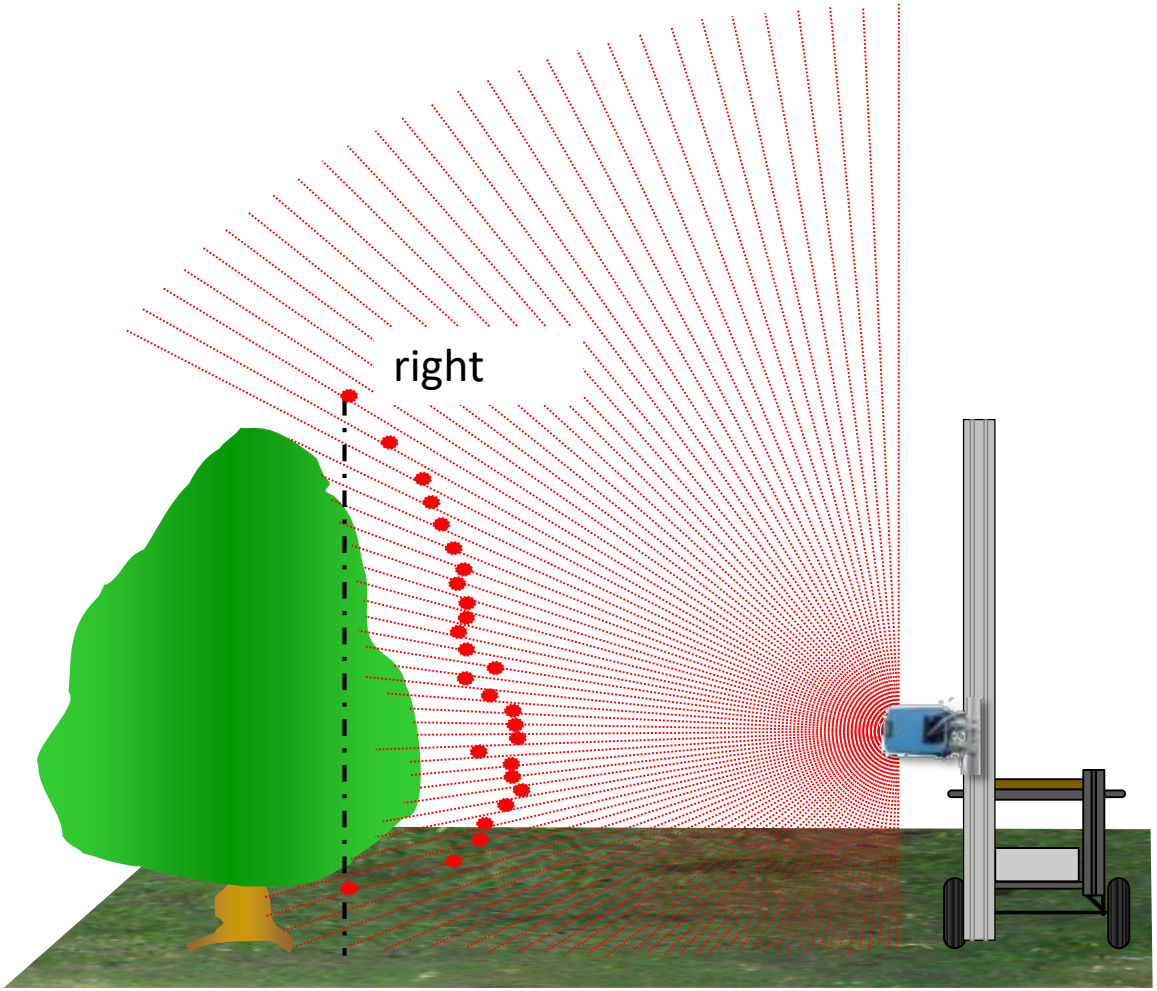
Prepared by Gabriele Kovacs and Gregor Kral[1]

- the ideal method for expression of the dose should take account of the total leaf area in relation to the field area but should be sufficiently simple to be understandable on the product label and practical for farmers. It should also take account of the efficiency of spraying techniques.

However, the meeting could not agree on a single system of expression of the dose.

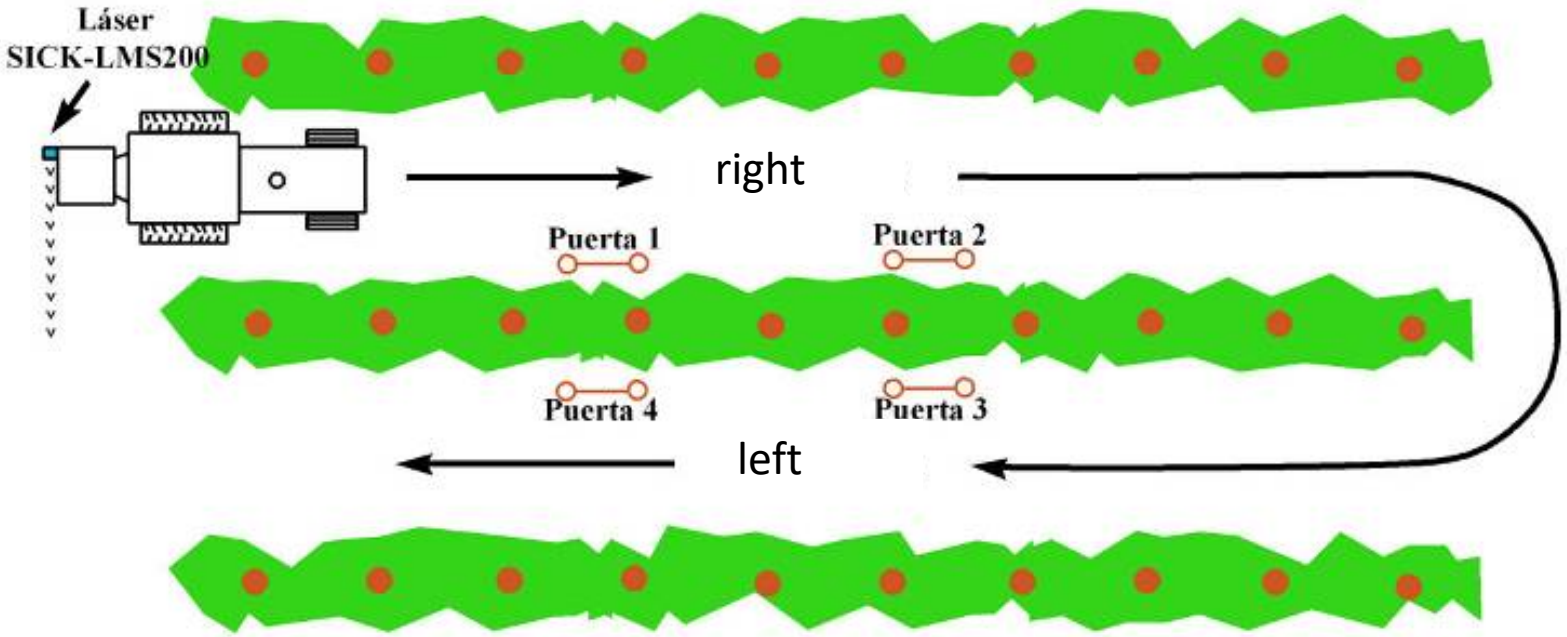
Previous works - PULVEXACT Project (2002-2006)

LIDAR data recording for structures characterization (more than 55 orchards & vineyards)



Previous works - PULVEXACT Project (2002-2006)

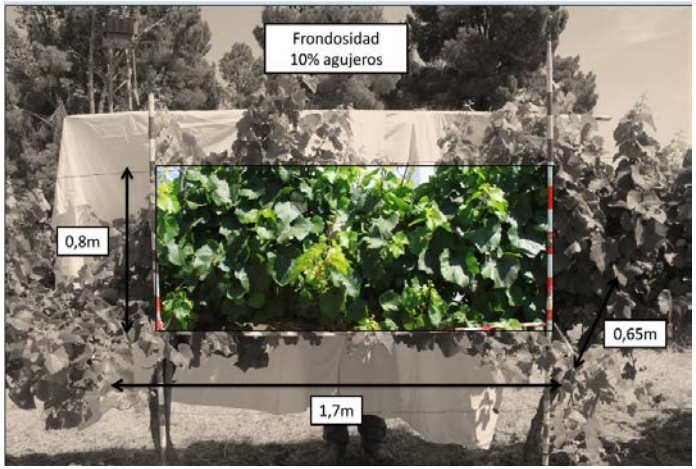
LIDAR data recording for structures characterization (more than 55 orchards & vineyards)



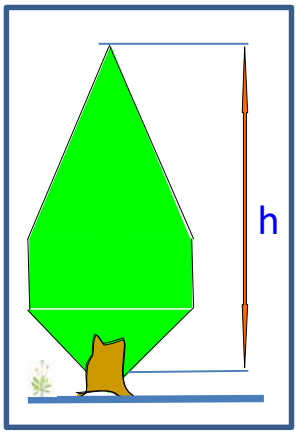
OPTIDOSA Project (2007-10)
Real LAI measuring & crop parameters correlation

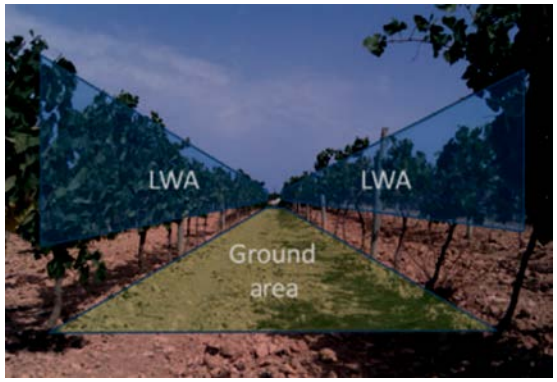
Picking-up
leaves to measure
leaf area index (LAI)

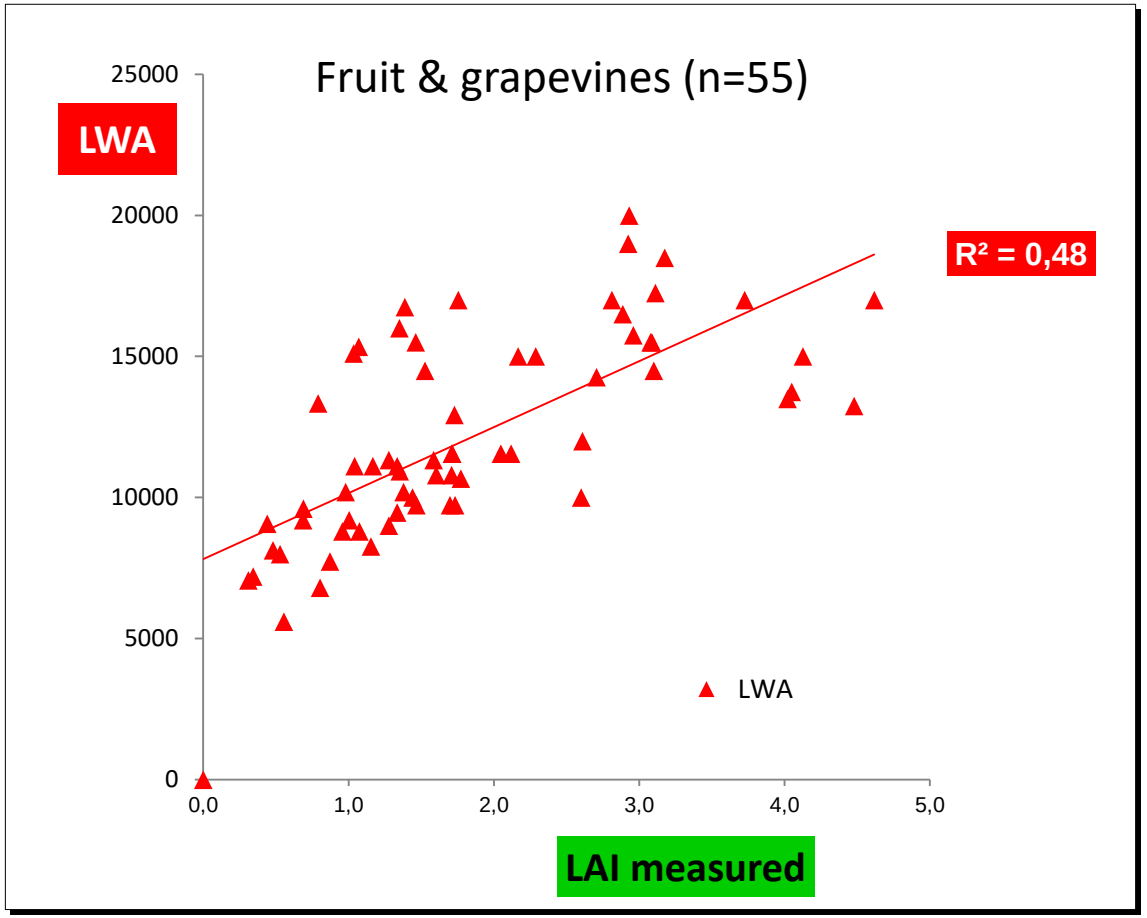
Pear (n=17)
Apple (n=18)
Peach (n=1)
Grapevine (n=19)



Leaf Wall Area (LWA)

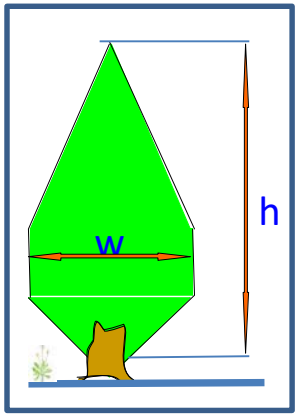


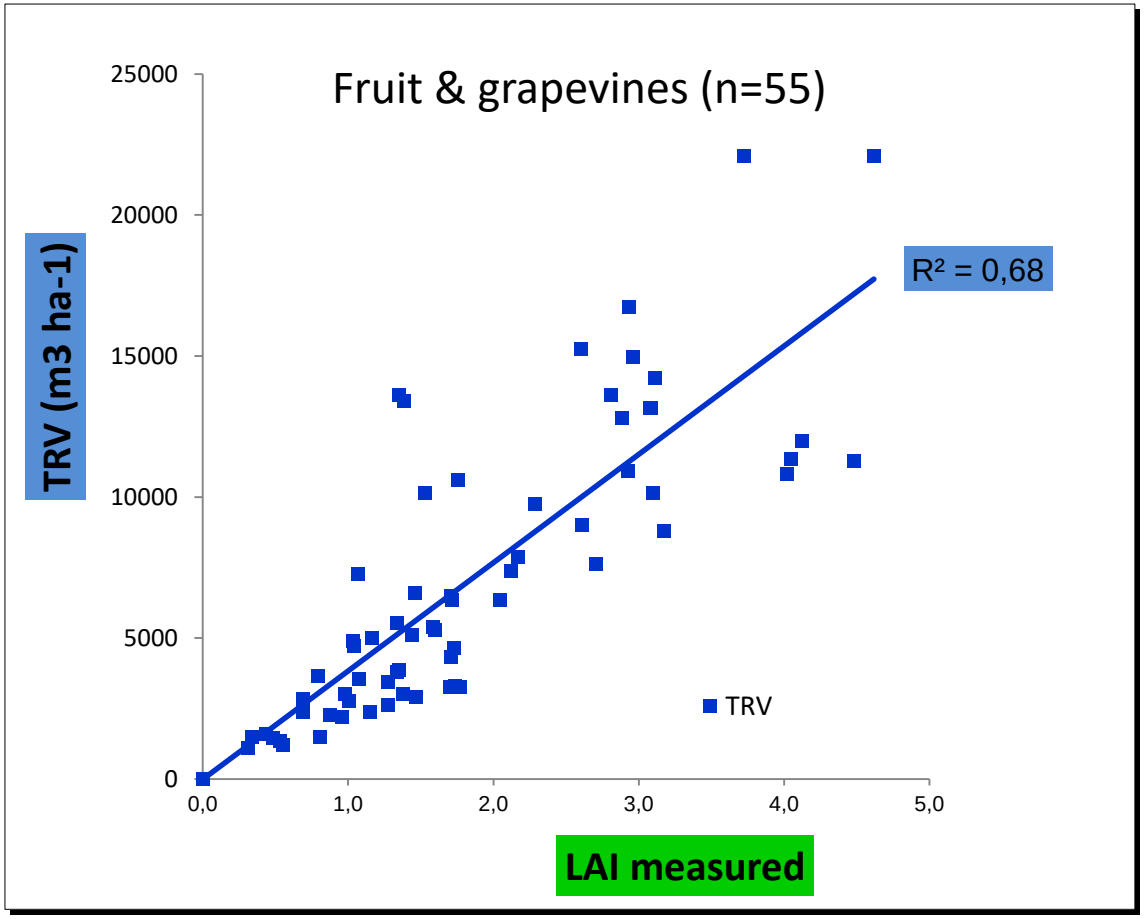




OPTIDOSA Project (2007-10)

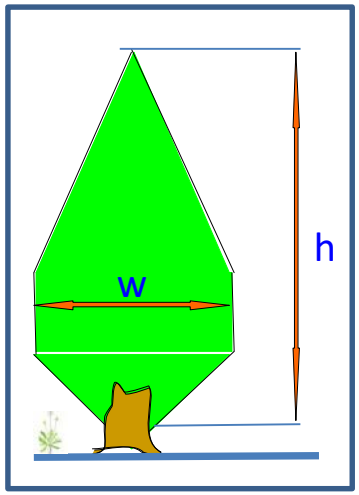
Tree Row Volume (TRV)





OPTIDOSA Project (2007-10)

Canopy solid housing (CSH)



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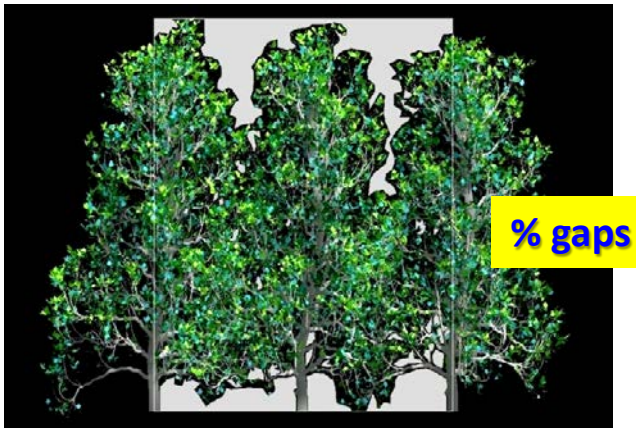
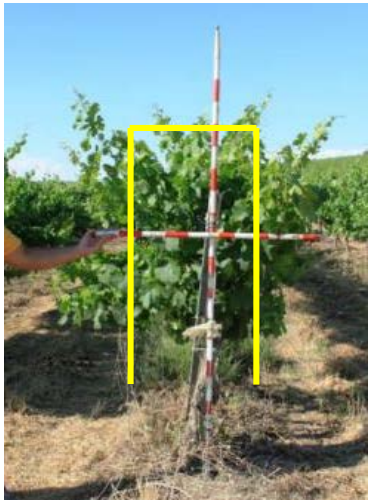
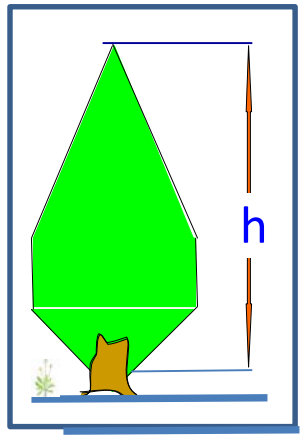
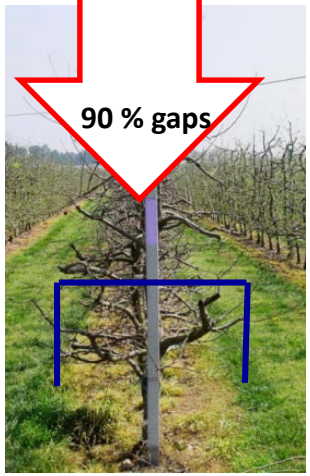




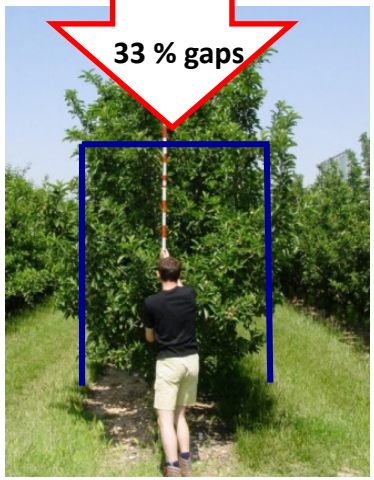
Canopy solid housing (CSH) $h_z = h * (100- \% gaps)$



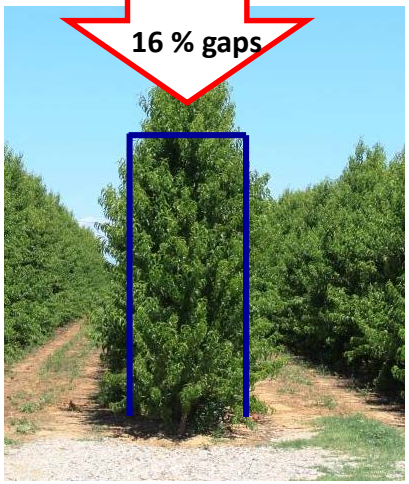
90 % gaps

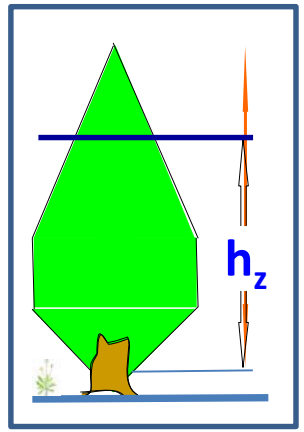


33 % gaps



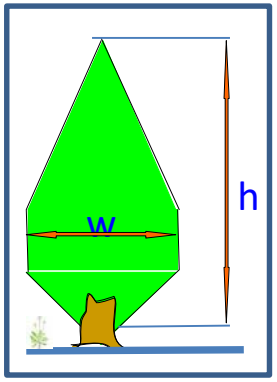
16 % gaps

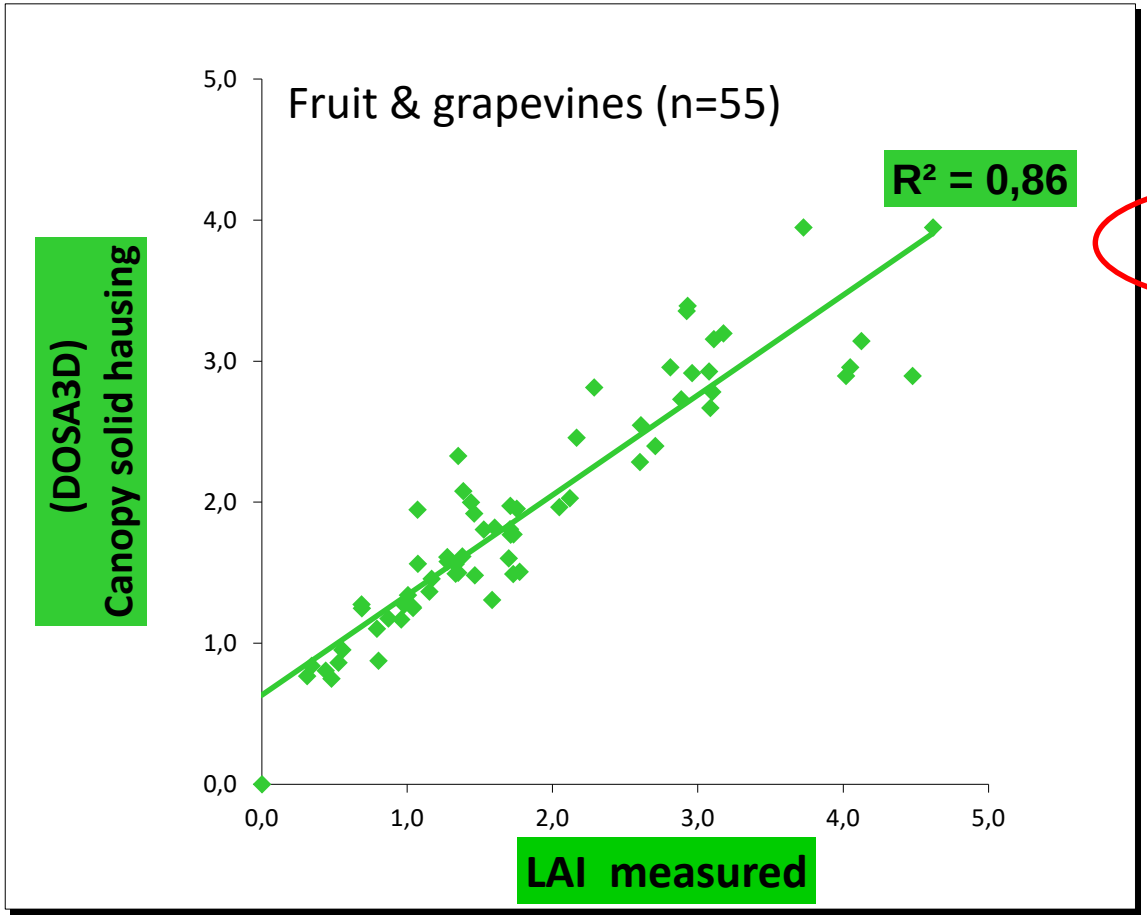




$$LAI = f(height, width, porosity)$$

Canopy solid housing (CSH)





	R^2
LWA	0.48
TRV	0.68
CSH	0.86*

OPTIDOSA Project (2007-10)

Summary

- Cropping structures in SZ: extreme differences
- Spraying equipment & penetrability
- Principles for dose expression and dose adjustment
- **From DOSAFRUT to DOSA3D**
- Conclusions & proposal

DOSAFRUT

Determining the application volume rate of pesticide treatments in fruit orchards

Home | My records (files) | Please help us to improve | Technical documentation | Credits | Log out

1. Application conditions | 2. Sprayer characteristics | 3. Orchard dimensions | 4. Calculations and results

1.1. Orchard to be sprayed | 1.2. Product to be applied | 1.3. Level of difficulty | 1.4. Application parameters | 1.5. Weather conditions

1.1. Orchard to be sprayed

Crop: Pear

Variety:

Framework of plantation:

Row spacing: 4,0 m

Tree spacing: 3,0 m

Orchard density: 833 trees/ha

Plot identification: a

Postal code: 0

Information of interest

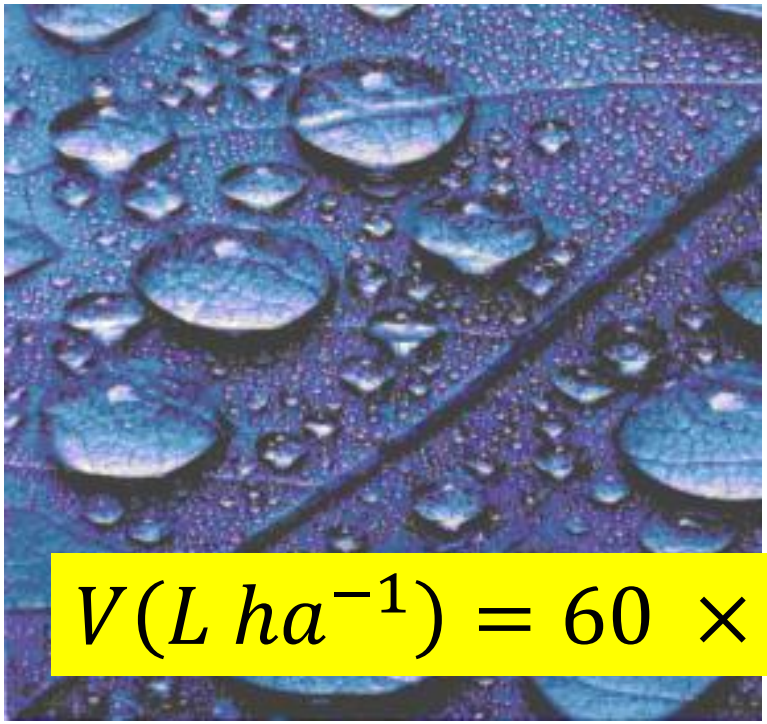
www.dosafrut.es

You can use a reference name or the geographical coordinates.

Hypothesis for effective dose deposition

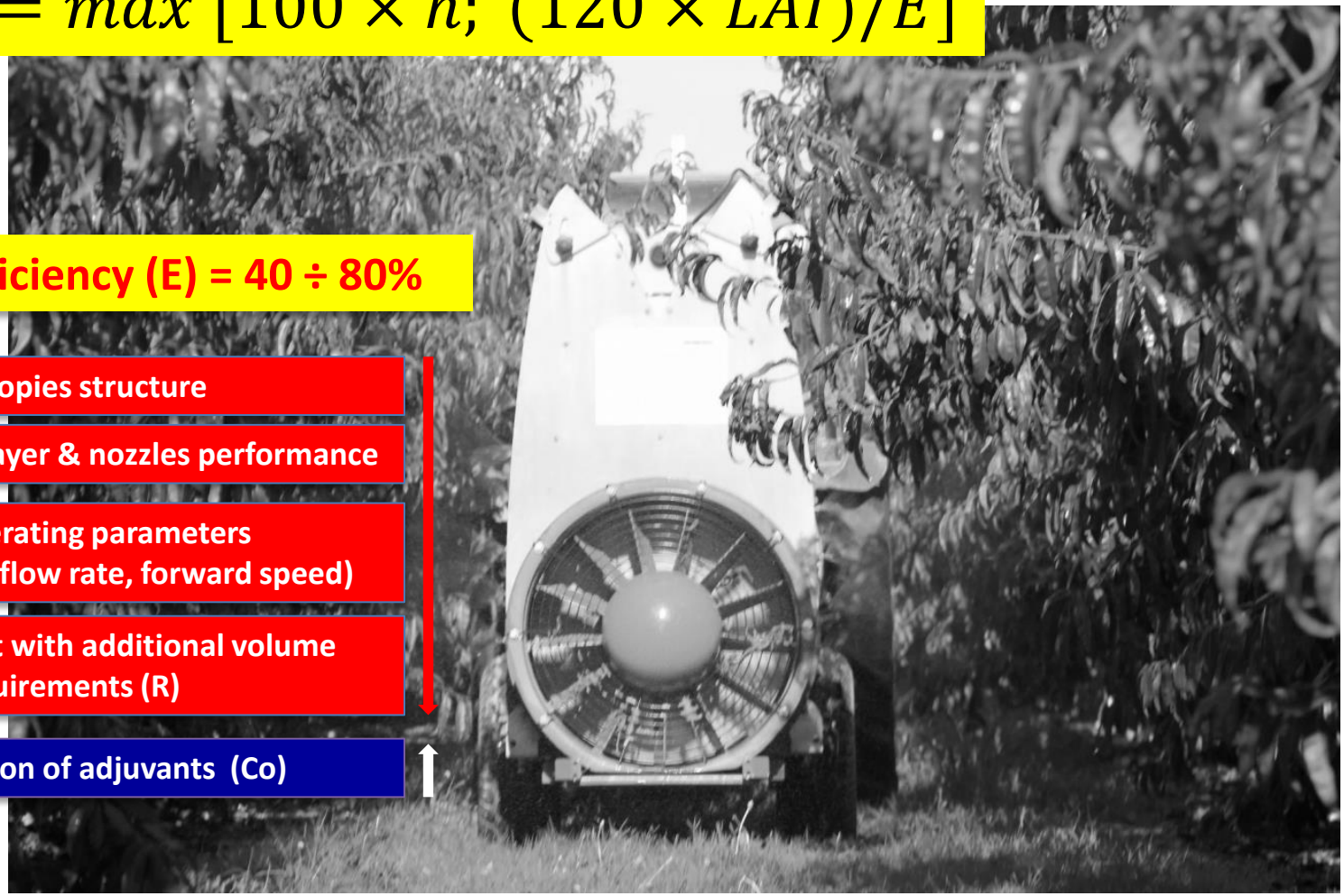
1. High density net: min 100 impacts cm^{-2}
2. Robustness, mean droplet dimension: 225 μm Ø

=> Base dosing: 0.6 μL cm^{-2} = 60 L ha^{-1}



$$V(L\ ha^{-1}) = 60\ \times 2 \times LAI = 120 \times LAI$$

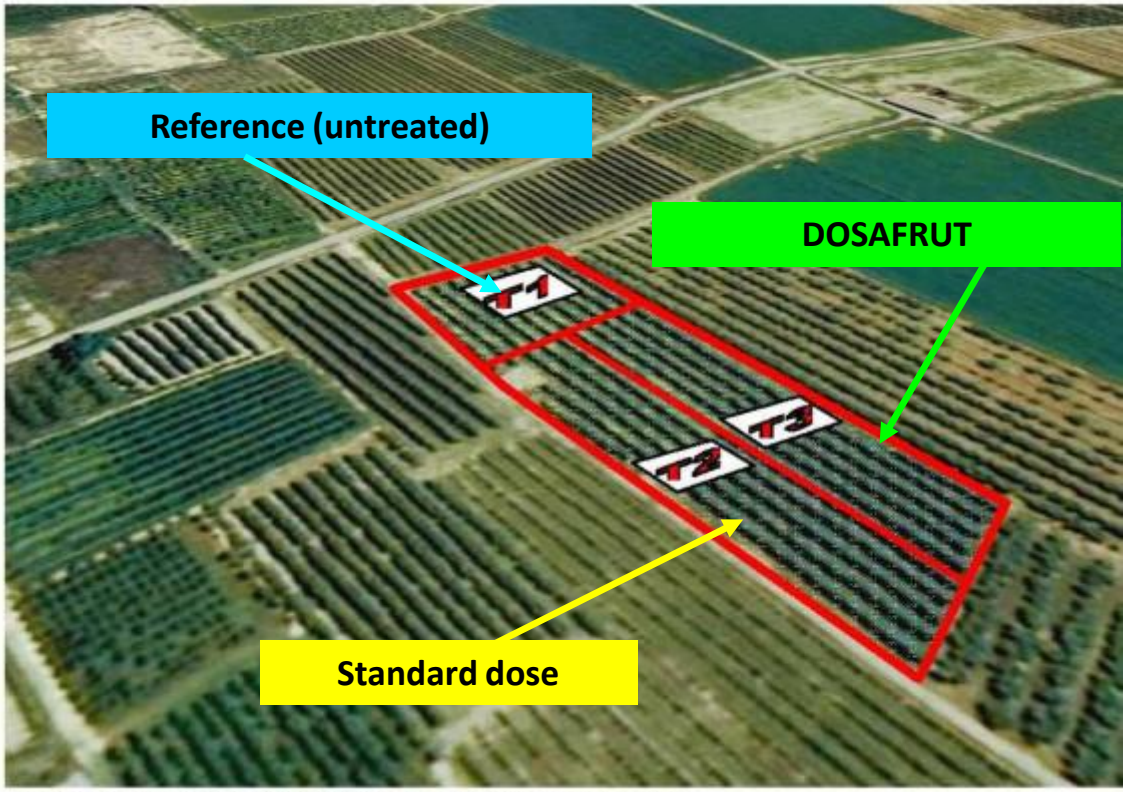
$$V = max\,[100 \times h;\ (120 \times LAI)/E]$$



Efficiency (E) = 40 ÷ 80%

- Canopies structure
- Sprayer & nozzles performance
- Operating parameters (air flow rate, forward speed)
- Pest with additional volume requirements (R)
- Action of adjuvants (Co)

DOSAFRUT validation trials (2009 -2016)
Bioefficacy (27) & chemical residues on fruits (7)



Fruit.Net

nufri

SANUFRUITS

Fruits de Ponent
SCCL

CODORNÍU

Universitat de Lleida

Generalitat de Catalunya
Departament d'Agricultura, Ramaderia, Pesca, Alimentació i Medi Natural

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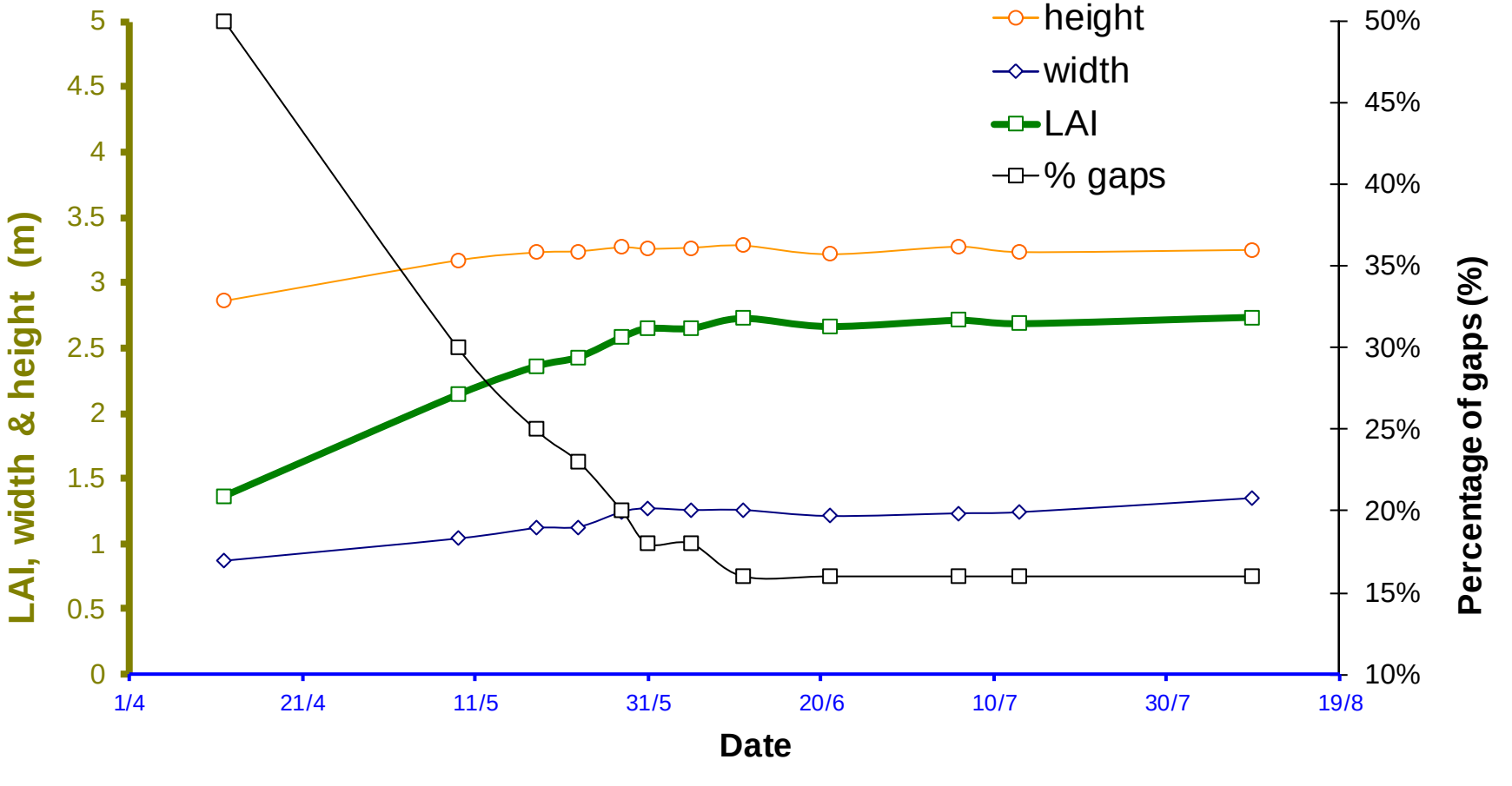
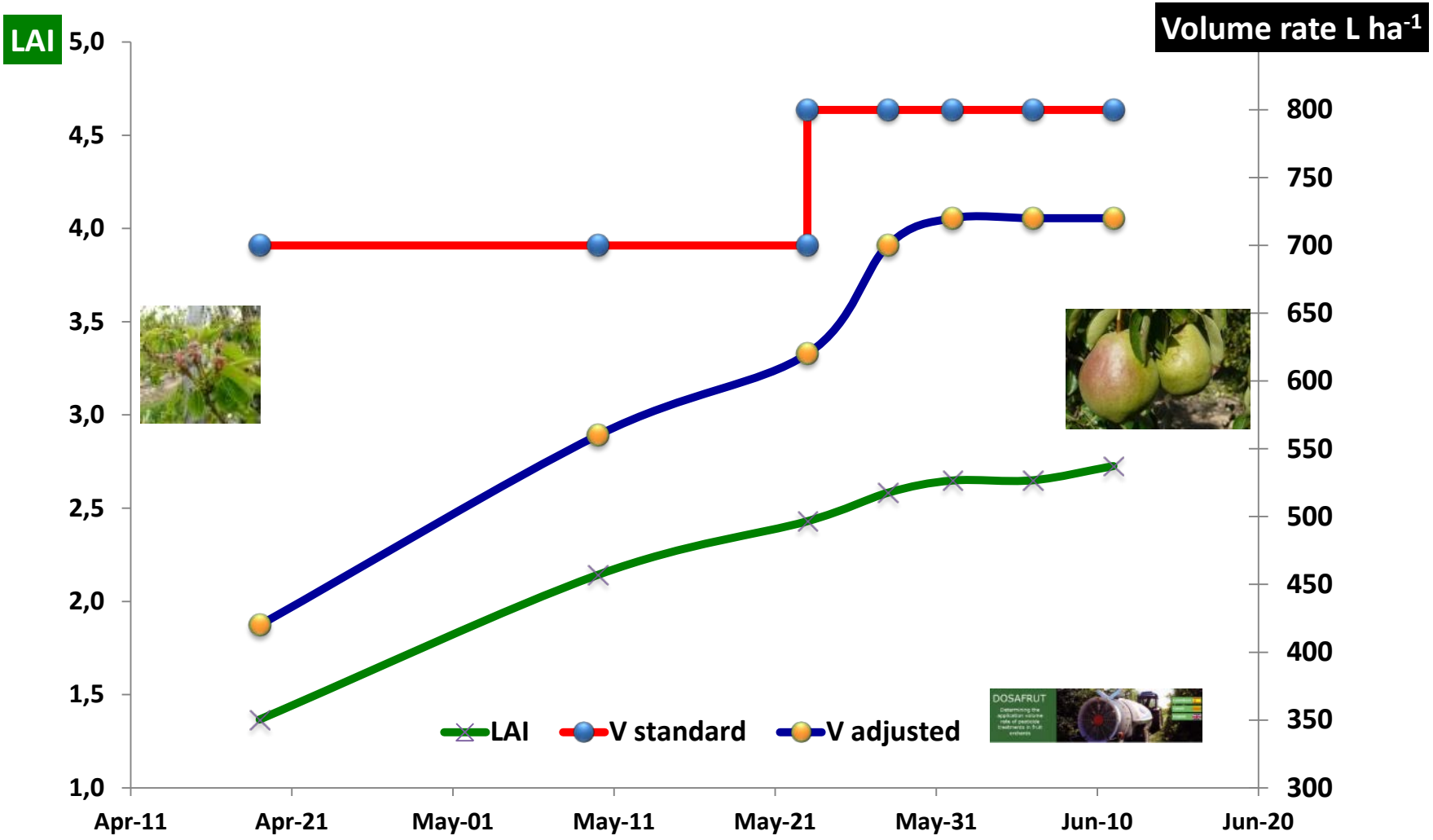
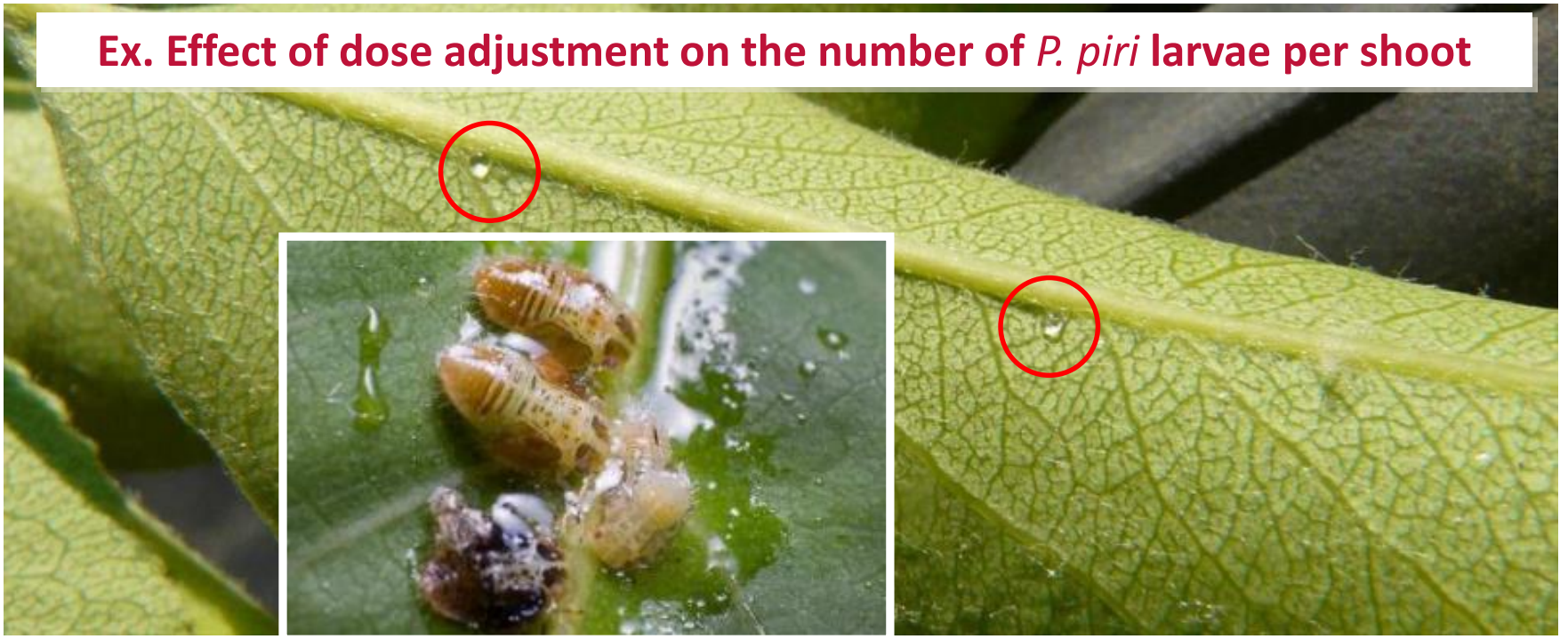
Crop dimensions and leafiness *(pear orchard, cv. Williams)*



Ex.: Spray applications (7) during the growing season*(pear orchard, cv. Williams)*



Ex. Effect of dose adjustment on the number of *P. piri* larvae per shoot

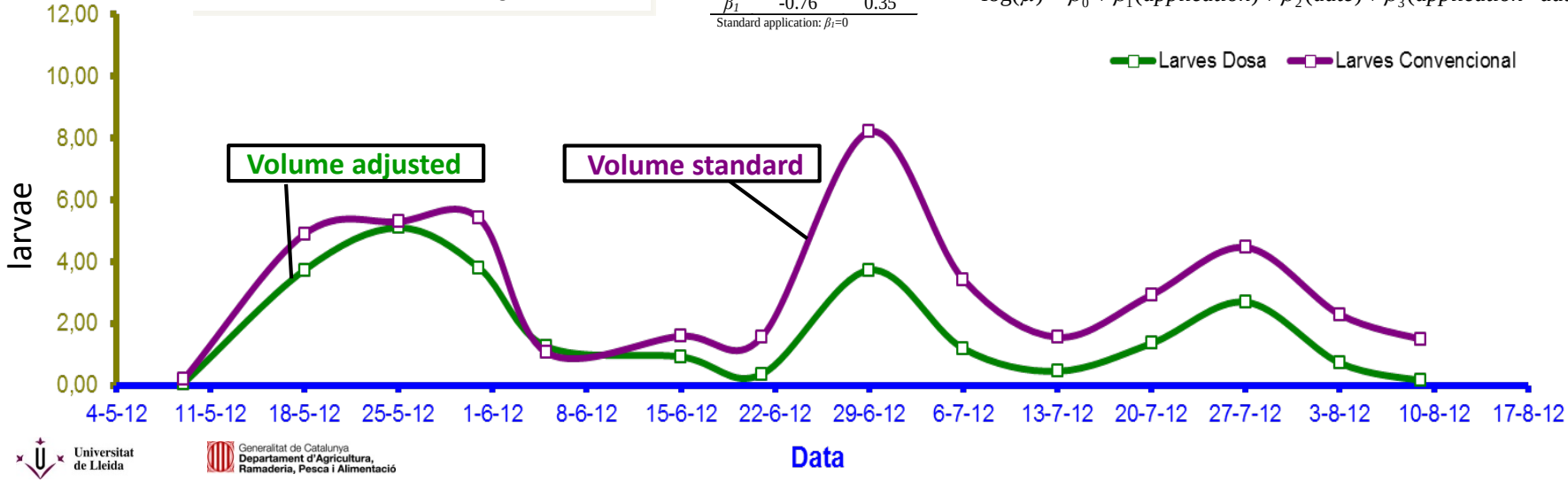


Generalised linear model with longitudinal data

	Estimation	P value
β_1	-0.76	0.35

Standard application: $\beta_1=0$

$$\log(\mu) = \beta_0 + \beta_1(application) + \beta_2(date) + \beta_3(application * date)$$



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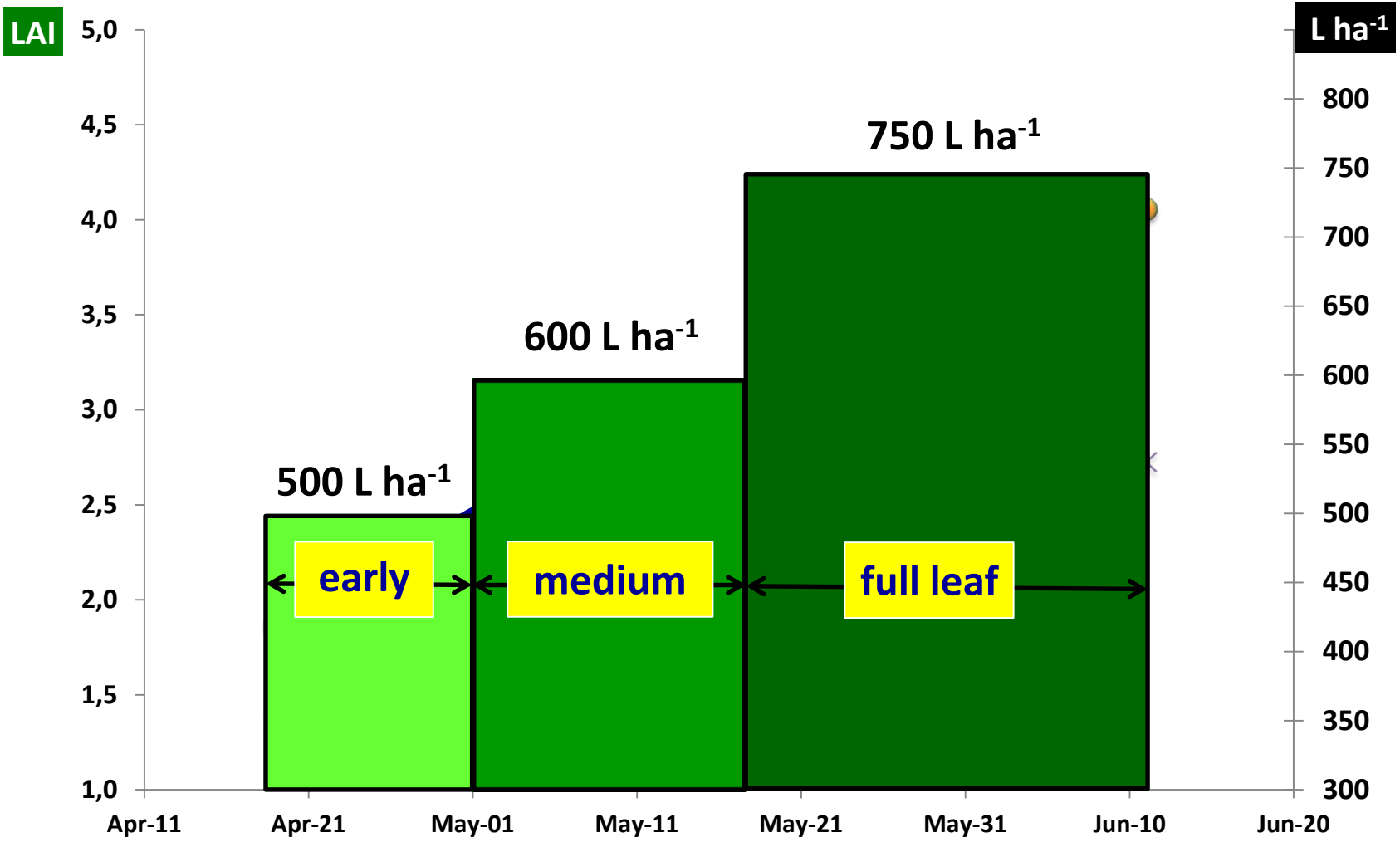
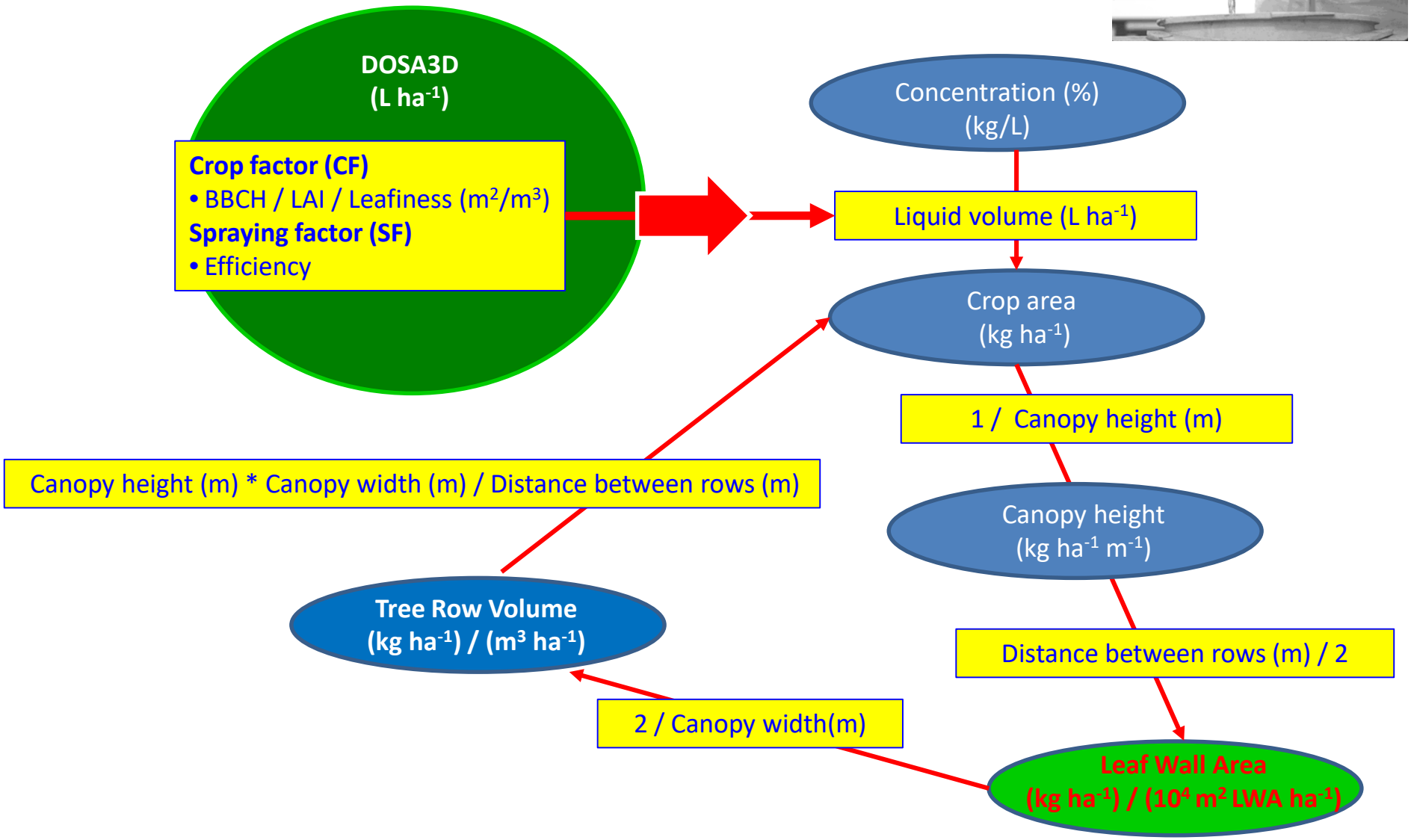
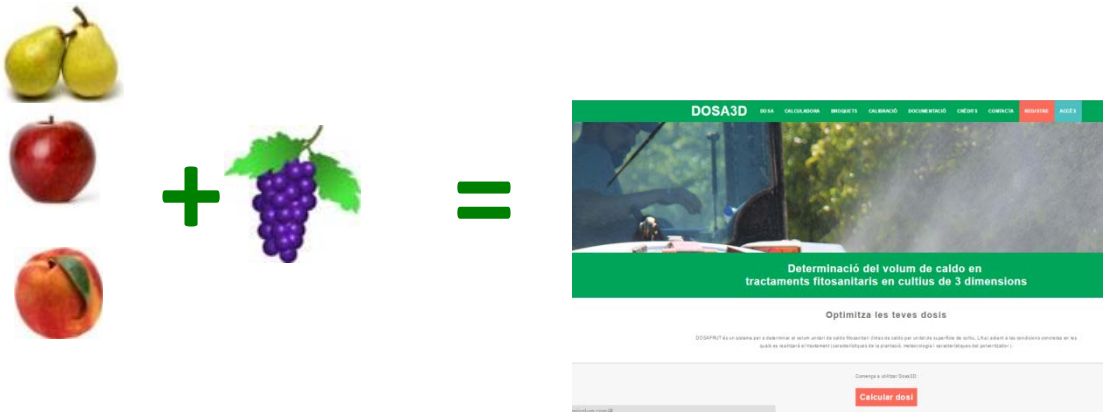


Conversion between models of dose expression



Example of label for one product	
Concentration on the liquid tank: **0.05%**	
Volume rate: adjust to the **crop stage** and **spraying efficiency**	
Canopy width	**Volume rate (L ha-1) for each 1 m of canopy height**
< 1.0 m	150-330
1.0 - 2.0 m	225-400
>2.0 m	300-450
For more accurate adjustment use officially recognized tools	



Conclusions & proposal

LWA can be useful in the NZ & CZ where very narrow structures predominate

To be reflexive before the introduction in the SZ: not the only method

In the SZ, to recommend the dose by means:

- **Concentration (%) + Volume rate (L ha^{-1})**

& adjusting the volume rate to:

- **mid height**
- **mid width**
- **leafiness (growing stage or estimated porosity)**

For more accurate adjusting (spraying efficiency)

- **Use officially recognized tools on internet / App mobile (ongoing)**

Thanks!!!


DOSA3D
DOSA
CALCULADORA
BROQUETS
CALIBRACIÓ
DOCUMENTACIÓ
CRÈDITS
CONTACTA
REGISTRE
ACCÉS
Determinació del volum de caldo en
tractaments fitosanitaris en cultius de 3 dimensions