

Dose Expression Workshop



UNIVERSITAT POLITÈCNICA DE CATALUNYA

Universitat Politècnica de Catalunya, Barcelona
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Harmonization of dose expression is the key to dose adjustment

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PPP label

Dose



ANCILLARY PANEL	MAIN PANEL	ANCILLARY PANEL
 Hazard statements Precautionary statements First aid & medical advice Accidental spills advice	Product Name Common name, concentration and formulation type, any other GHS product identifiers Description of product and field of use READ THE LABEL BEFORE USE KEEP LOCKED AWAY AND OUT OF REACH OF CHILDREN  Signal word Registration number (user category) Manufacturer Distributor, agent, registrant Release date (shelf life) Batch number: Net content	[Statutory heading] Directions for use Storage & disposal Legal responsibility

COMMISSION REGULATION 547/2011
labelling requirements for plant protection products

ANNEX I

Maximum dose per hectare per application
shall be included on the packaging of plant
protection products:



Field crops vs 3D crops

What is the target ?

Field crops:

ground area = treated crop area



kg/ha ground = kg/ha treated crop area



Orchards / vineyards / plantations:

ground area $\neq$ treated plant area



kg/ha ground $\neq$ kg/ha treated crop area



Field crops vs 3D crops

What is the target ?

Field crops:

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kg/ha ground = kg/ha treated crop area



Orchards / vineyards / plantations:

ground area $\neq$ treated plant area



kg/ha ground $\neq$ kg/ha treated crop area



3D crops

Calibration formula

$$\text{Spray volume} = \frac{\text{nozzle flow rate} * \text{number of nozzles} * 600}{\text{working width} * \text{travel velocity}}$$



3D crops

Calibration formula

$$\text{Spray volume} = \frac{\text{nozzle flow rate} * \text{number of nozzles} * 600}{\text{working width} * \text{travel velocity}}$$

treated canopy height

row spacing



3D crops

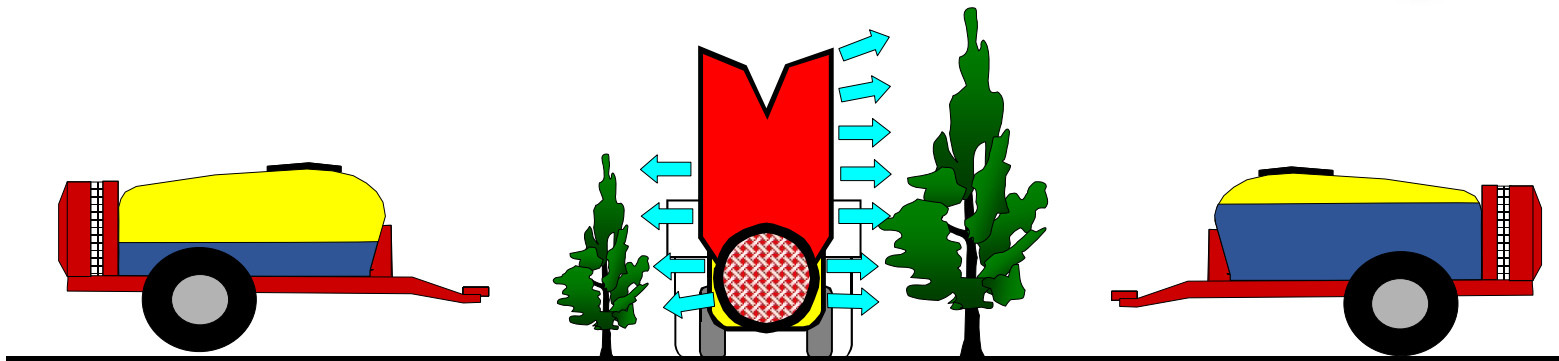
Calibration formula

$$\text{Spray volume} = \frac{\text{nozzle flow rate} * \text{treated canopy height} * \text{number of nozzles} * 600}{\text{working width} * \text{travel velocity} * \text{row spacing}}$$

Constant spray liquid deposit

Spray volume_{LOW TREES} < Spray volume_{HIGH TREES}

Spray volume_{WIDE SPACING} < Spray volume_{NERROW SPACING}



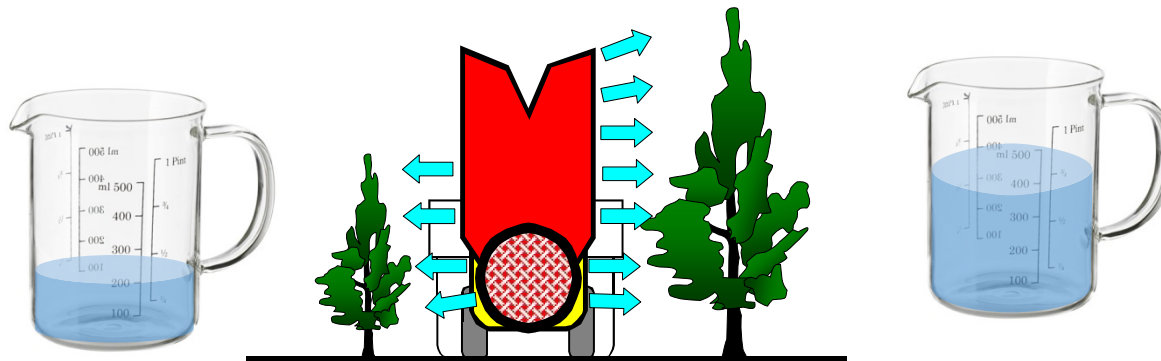
3D crops

Dose recommendation



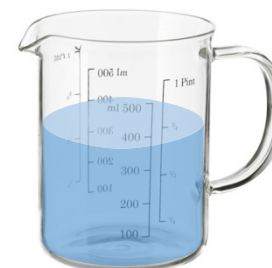
Constant PPP initial deposit

PPP dose/ha ground _{LOW TREES} < PPP dose/ha ground _{HIGH TREES}
PPP dose dose/ha ground _{WIDE SPACING} < PPP dose dose/ha ground _{NERROW SPACING}



3D crops

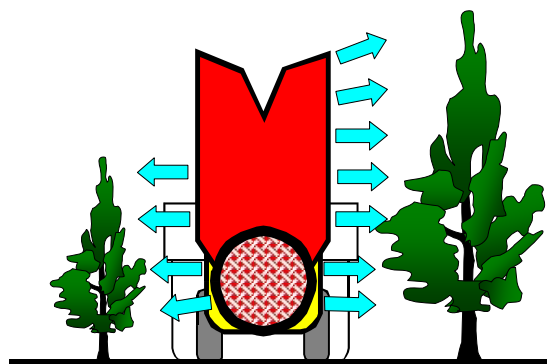
Dose recommendation



Constant dose/ha ground

PPP initial deposit_{LOW TREES} > PPP initial deposit_{HIGH TREES}

PPP initial deposit_{WIDE SPACING} > PPP initial deposit_{NERROW SPACING}



Reference units in the EU:

• ground area	[kg/ha]	DK, FI, SE, LT, CZ, HU, PL, SI, SK, UK, FR
• spray volume	[concentration %]	ES, GR, HR, IT, PT, DK, FI, LT, NL
• canopy height - CH	[kg/ha/m _{CH}]	DE, AT, (PL, SI, SE)
• leaf wall area - LWA	[kg/10000 m ² _{LWA}]	BE, (LT, PL, SI, AT)
• tree row volume - TRV	[kg/10000 m ³ _{TRV}]	CH
• plant row	[kg/100 m _{row}]	NO

Regulation (EC) 1107/2009 => PPP registration issues:

- zonal efficacy evaluation (collective evaluation of trials within the EPPO zones)
- mutual recognition of PPP authorizations
- labeling (with dose expression as used in the RR and max dose [kg-L/ha]) at national level

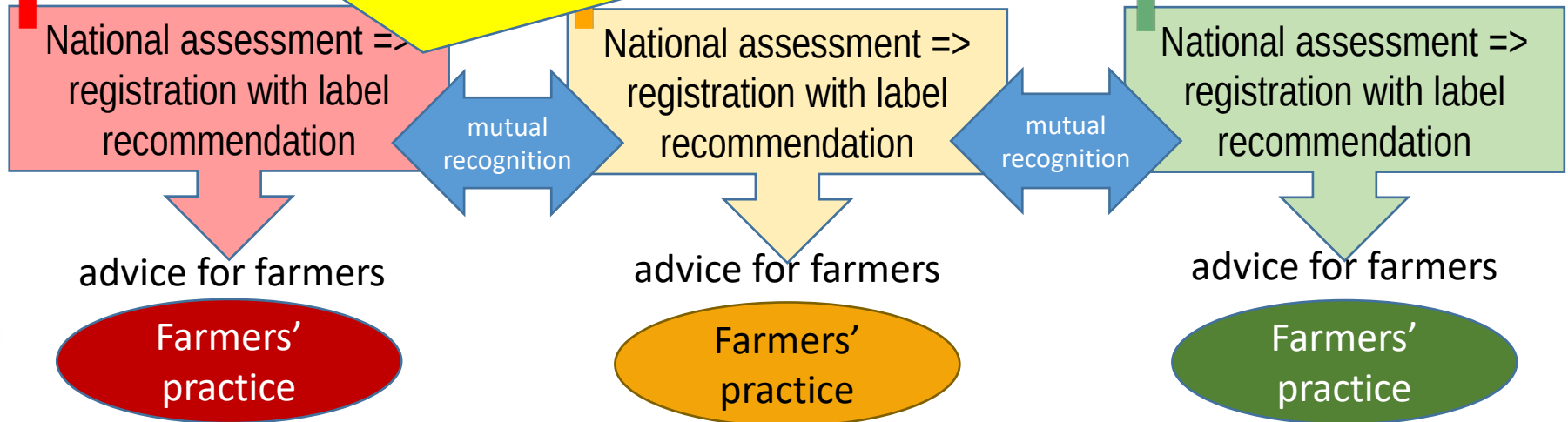
need for HARMONIZATION

CZSC: As of 1 January 2018, efficacy trials in the Central Zone for pome fruit, grapes, and high-growing vegetables must use LWA as the efficacy unit of dose expression.

CZSC: From 1 January 2020, application dossiers for new products and new uses for these crops will only be accepted when the trials use LWA as the unit of dose expression.

Zonal efficacy evaluation (BAD / dRR) => RR & Final Conclusion

CZSC: The conclusion does not affect national dose expression terms on product labels, and the rate per unit of ground area must still be given as this is required for risk assessments in other specialist areas.



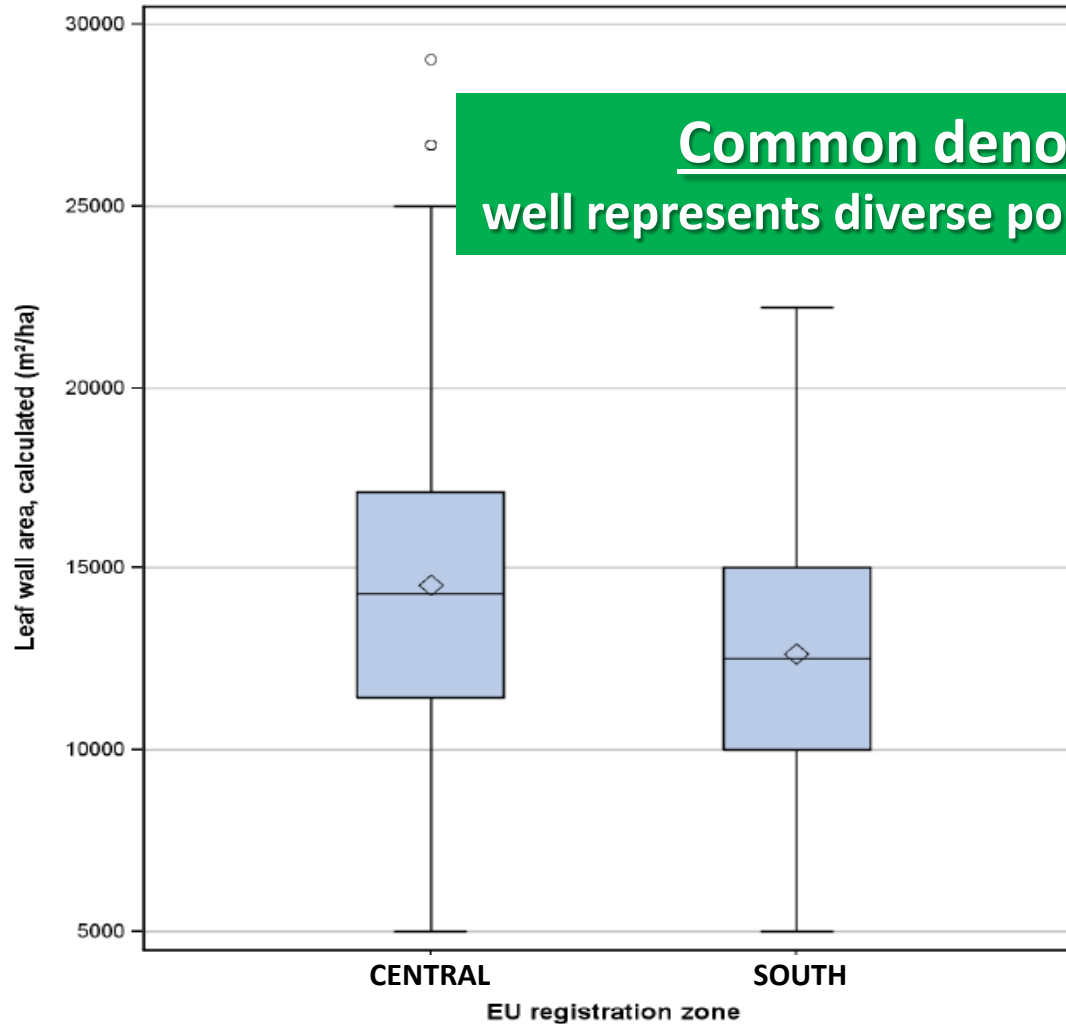
national legislation * local practice * growers' awareness and preferences

Dose expression

Why LWA ?

Industry data (WOHLHAUSER, R., 2012 after Bayer CropScience AG)

Apple + pear: distribution of LWA in the EU registration zones



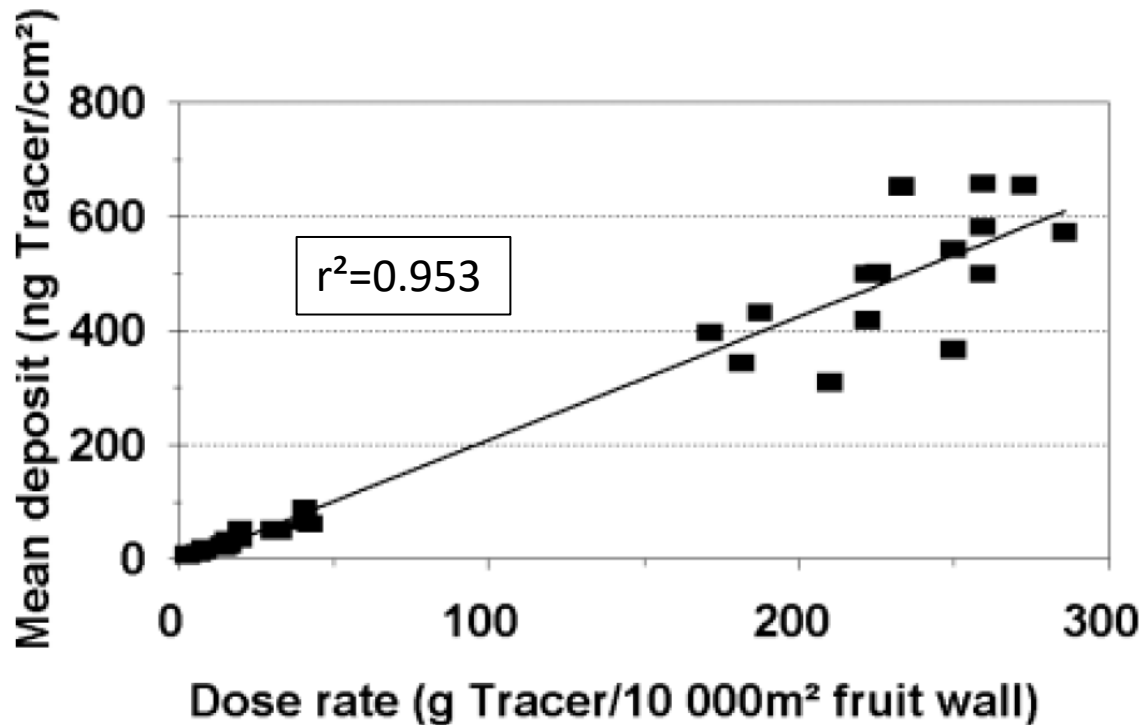
Common denominator
well represents diverse pome fruit structures

Dose expression

Why LWA ?

(KOCH, H. and WEISSER, P., 1995)

Mean initial deposits obtained in 31 trials in apple orchards

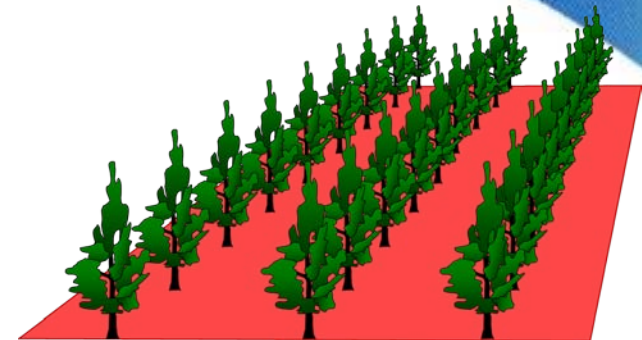
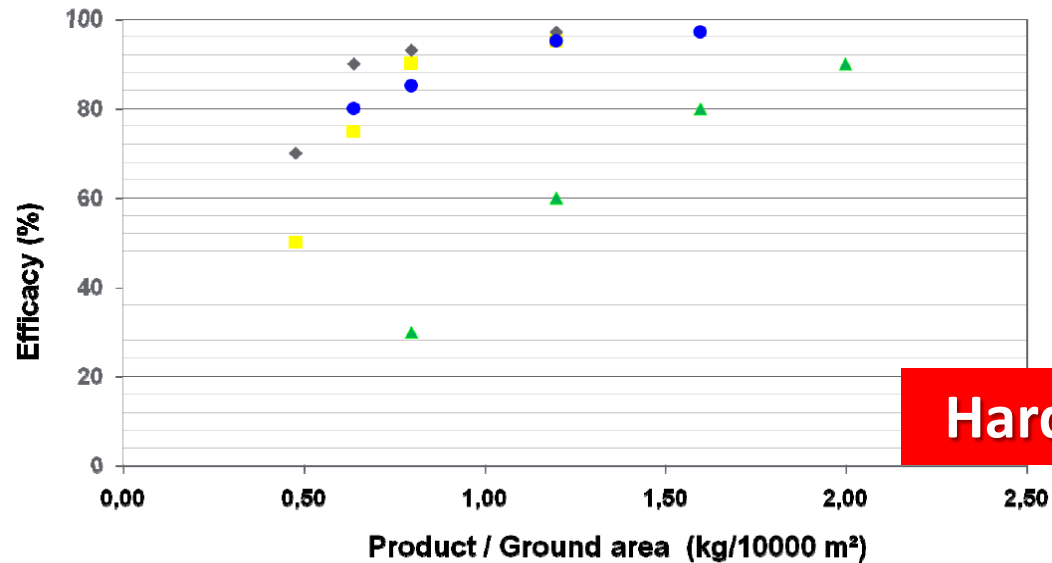


Strong positive linear correlation
between dose per unit area and deposit on targets in orchards

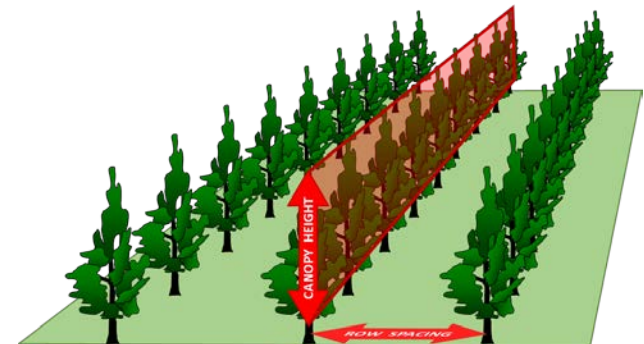
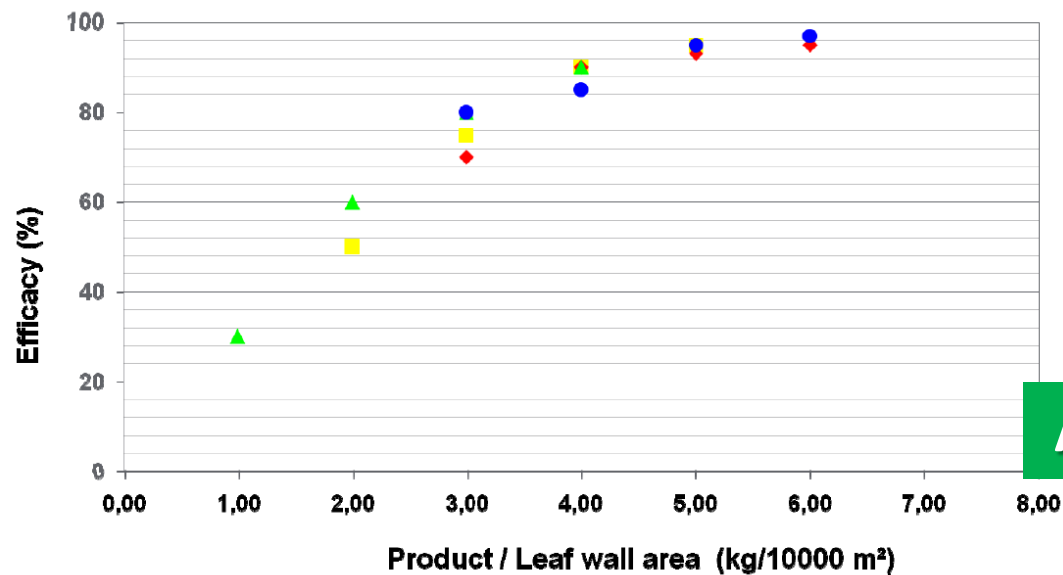
Dose expression

Why LWA ?

Industry data (WOHLHAUSER, R., 2012)



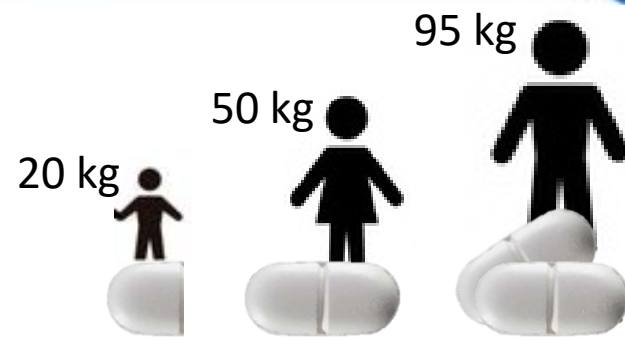
Hard to set accurate dose



Accurate MED setting

Dose expression

Why LWA ?



- logical and commonly accepted rule:
dose related to the target
- good representation of diverse crop structures
- good correlation with deposit
- accurate determination of MED.
- easy comparison of efficacy data from individual trials
- simple and intuitive – fair chance to be accepted by applicators
- the first step to direct, systemwise dose adjustment

Dose expression

Why LWA ?

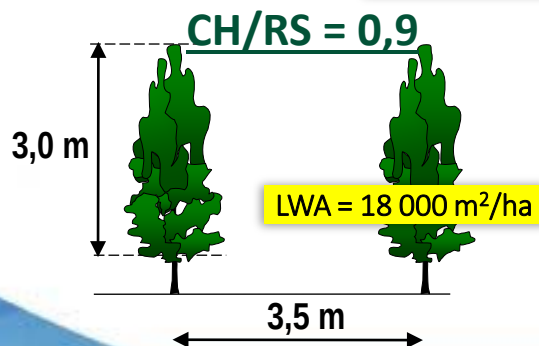
max dose/ha ground on PPP label = dose / 18 000 m² LWA (r.w.c.)

Distribution of LWA by crops – all zones

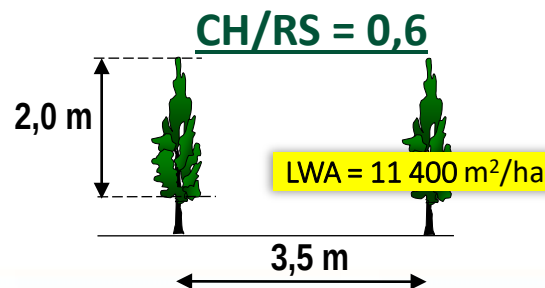
Industry data (WOHLHAUSER, R., 2012 after Bayer CropScience AG)

Analysis Variable : LWA_calc Leaf wall area, calculated (m ² /ha)									
Crop name	N Obs	Mean	Lower 95% CL for Mean	Upper 95% CL for Mean	25th Pctl	50th Pctl	75th Pctl	90th Pctl	95th Pctl
Apple	900	13462	13226	13697	11000	13143	15000	18462	20000
Pear	321	13465	13023	13908	10476	13333	15333	18400	20000
Apricot	39	9200	8461	9939	7500	9020	11429	12000	12941
Nectarine	59	8770	7994	9546	7200	8000	10000	13333	15000
Peach	238	9565	9246	9885	8000	9798	10800	12500	14222
Cherry	149	11353	10722	11984	8889	11628	13333	15429	17143
Plum	1	11353	10722	11984	8889	11628	13333	15556	17143

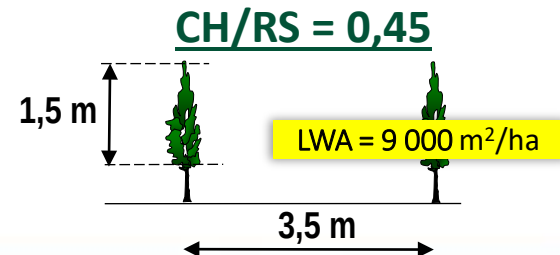
$$\text{LWA} = 18\,000 \text{ m}^2/\text{ha} \Leftrightarrow \frac{\text{Canopy Height (CH)}}{\text{Row Spacing (RS)}} = 0,9$$



MAX dose



MAX dose - 35%



MAX dose - 50%

Dose expression and Dose adjustment

dose expression

PPP mass or volume unit (kg or L) linked to a certain **reference unit**



dose adjustment

determination (reduction or increase) of the PPP dose to obtain:

- sufficient level of PPP deposit to achieve an expected efficacy under specific circumstances (canopy size and density, application method, controlled organism, climatic factors)
- minimum variation in PPP deposit across a wide range of crop structures,



Dose expression

Harmonization



EPPO General Standard PP 1/239 (2)

Efficacy evaluation of plant protection products

Dose expression for plant protection products

- „... dose should be expressed in a format that is readily understood by users”
- reference units for 3D crops described and discussed
 - ☐ ~~ground area~~
 - ☐ ~~spray volume (concentration %)~~
 - ☐ canopy height - CH
 - ☐ leaf wall area - LWA
 - ☐ tree row volume - TRV
 - ☐ plant row
- crop structure parameters that need to be measured and recorded
 - cropping system (single or multiple rows);
 - distance **between rows**
 - distance **between plants** in the row
 - treated foliage **height**
 - **mid-width** of the canopy
 - BBCH **growth stage** at application
 - as well as:
 - actual applied **spray volume**
 - information on the **application equipment**
- **interconvertability between dose expressions for mutual recognition**

Dose expression

Harmonization

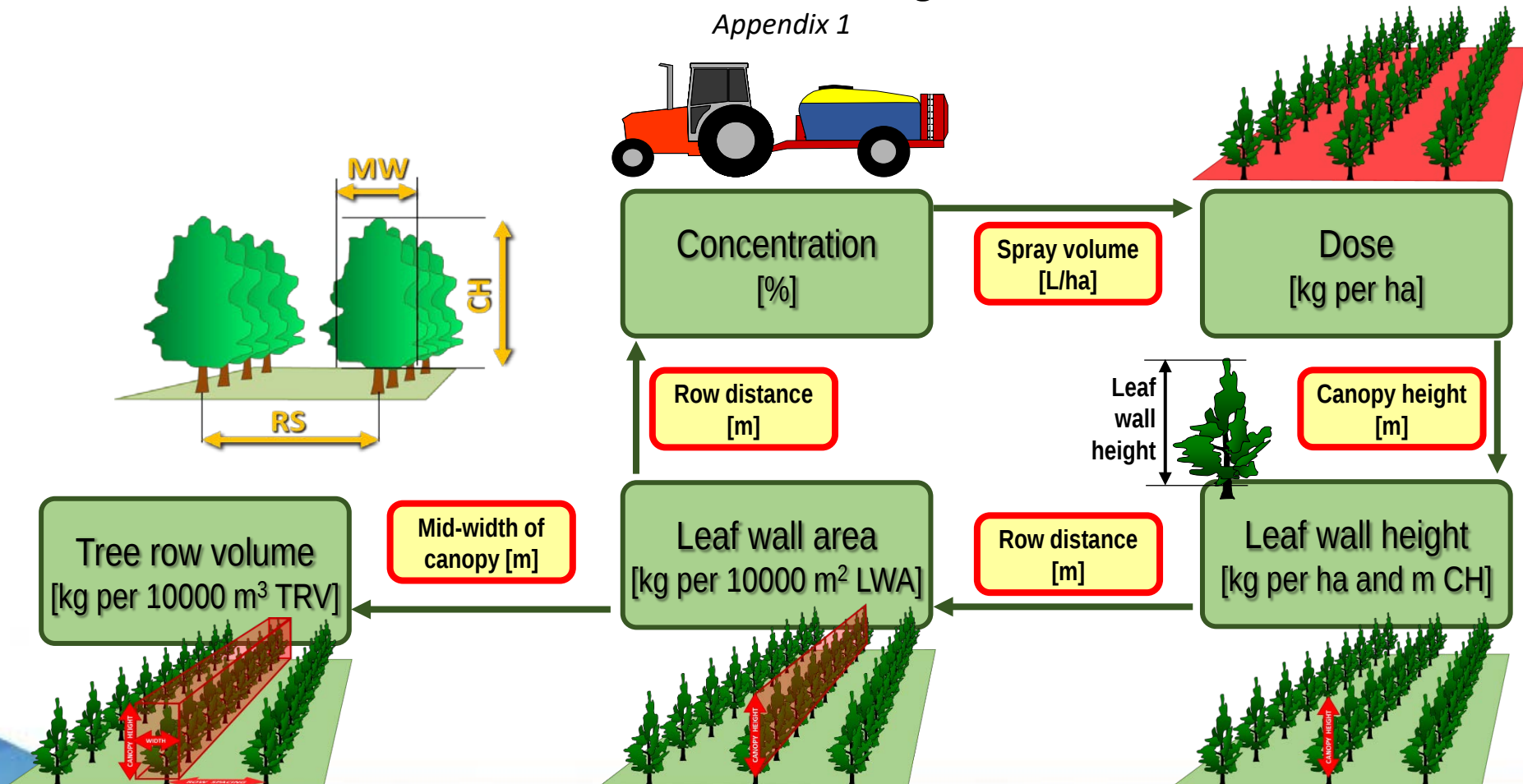
EPPO General Standard PP 1/239 (2)

Efficacy evaluation of plant protection products

Dose expression for plant protection products

Dose conversion diagram

Appendix 1



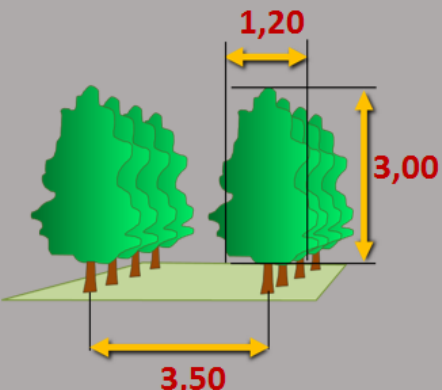
Dose expression

Excel Tool for dose conversion

- request from Organising Committee of EPPO Workshop:

Dose converter

Spray volume [l/ha] 300,00



Concentration [%]	Ground Dose [kg/ha]	CH Dose [kg/ha/mCH]	LWA Dose [kg/10000m ² LWA]	TRV Dose [kg/10000m ³ TRV]
0,15	0,450	0,150	0,263	0,438
0,15	0,450	0,150	0,263	0,438
0,15	0,450	0,150	0,263	0,438
0,15	0,451	0,150	0,263	0,438
0,15	0,451	0,150	0,263	0,438

RESET

Post-Workshop EWG – Dose Conversion and Adjustment

Frank Meier-Runge

Santiago Planas

Patricia Chueca

Antonio Miranda Fuentes

Sébastien Codis

Paolo Marucco

Elena Gutiérrez

Evangelos Ch. Karanasios

Maria da Assunção Prates

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- ECPA

- Univ. de Lleida, ES

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- Univ. de Córdoba, ES

- VigneVin, FR

- DISAFA, IT

- INIA, ES

- BPI, GR

- DGAV, PT

- Regione E-R, IT

- InHort, PL



Dose expression

Excel Tool for dose conversion & adjustment

- request from Organising Committee of EPPO Woprkshop

DoConAd
DOSE CONVERSION & ADJUSTMENT TOOL

Select AUTHORIZATION ZONE: **2 - Central** (SE, CE, DE, IE, LU, NL, AT, PL, RO, SI, SK, UK)

Select APPLICATION TECHNIQUE: **DEFLECTOR** (high deflectors - cross-flow discharge system)

Select CROP: **Apple - dwarf and hedgerow systems**

Select GROWTH STAGE: **Post-blossom & fruit development - TR65, TR75 / V102, TR75**

ENTER data regarding crop structure:

Tree height (m) - TH: **3,50**
 $LWA = \frac{2 * (TH-GC) * 10000}{R}$

Canopy to canopy distance - GC: **0,50**
 $TRV = \frac{(TH-GC) * W * 10000}{R}$

Row spacing - R: **3,50**

Row width of canopy - W: **1,20** **RESET**

ENTER data regarding PPP application:

Area to be sprayed - P [ha]: **13,60**

FIXED spray volume - Q [l/ha]: **300,00** **CLEAR if you want spray volume to be ADJUSTED**

NOT ADJUSTED spray volume - Q [l/ha]: **300,00** By LWA

Sprayer tank capacity - V [l]: **1000,00** **RESET**

Dose calculator

APPLICATION FACTOR - AF ***: **0,85** ☒ Correct dose by APPLICATION FACTOR

CANOPY FACTOR - CF ***: **0,70** ☒ Correct dose by CANOPY FACTOR

*** AF takes into account application technique
*** CF takes into account the growth stage and canopy density of the defined crop

	CH - Canopy Height [m]	LWA - Leaf Well Area [m²/ha]	TRV - Tree Row Volume [m³/ha]
	3,00	17 142,86	10 285,71

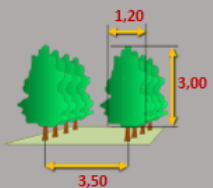
	Concentration [%]	Ground Dose [kg/ha]	CH Dose [kg/ha/mCH]	LWA Dose [kg/10000m² LWA]	TRV Dose [kg/10000m³ TRV]
ENTER dose from the PPP label	0,150	0,450	0,150	0,263	0,438
Final Ground Dose [kg/ha]	0,450	0,450	0,450	0,451	0,451
Ground Dose Corrected by AF and CF [kg/ha]	0,268	0,268	0,268	0,268	0,268
Final Concentration [%]	0,089	0,089	0,089	0,089	0,089
Total amount of PPP to be used [kg]	3,641	3,641	3,641	3,648	3,646
Amount of PPP per sprayer tank [kg]	4 x 0,893 + 0,071	4 x 0,893 + 0,071	4 x 0,893 + 0,071	4 x 0,894 + 0,072	4 x 0,894 + 0,071

Dose converter

Spray volume [l/ha]: **300,00**

	Concentration [%]	Ground Dose [kg/ha]	CH Dose [kg/ha/mCH]	LWA Dose [kg/10000m² LWA]	TRV Dose [kg/10000m³ TRV]
	0,15	0,450	0,150	0,263	0,438
	0,15	0,450	0,150	0,263	0,438
	0,15	0,450	0,150	0,263	0,438
	0,15	0,451	0,150	0,263	0,438
	0,15	0,451	0,150	0,263	0,438

RESET



Select AUTHORISATION ZONE B - Central: BE, CZ, DE, IE, LU, HU, NL, AT, PL, RO, SI, SK, UK

Select APPLICATION TECHNIQUE DEFLECTOR: high deflectors - cross-flow discharge system

Select CROP Apples - dwarf and hedgerow systems

Select GROWTH STAGE Post-blossom & Fruit development - TREES: 71-75 / VINE: 71-79

ENTER data regarding crop structure:

TREE HEIGHT (total) - TH [m] 3,50

GROUND to CANOPY distance - GC [m] 0,50

ROW spacing - R [m] 3,50

Mid-WIDTH of CANOPY - W [m] 1,20

$$LWA = \frac{2 * (TH - GC) * 10000}{R}$$

$$TRV = \frac{(TH - GC) * W * 10000}{R}$$

RESET

ENTER data regarding PPP application:

Area to be sprayed - P [ha] 13,60

FIXED spray volume * - Q [l/ha] 300,00

NOT ADJUSTED spray volume - Q [l/ha] 300,00

Sprayer tank capacity - V [l] 1000,00

CLEAR if you want spray volume
TO BE ADJUSTED

by LWA

RESET

Dose calculator

APPLICATION FACTOR - AF **

0,85

☐ Correct dose by APPLICATION FACTOR

CANOPY FACTOR - CF ***

0,70

☐ Correct dose by CANOPY FACTOR

** AF takes into account application technique

*** CF takes into account the growth stage and
canopy density of the defined cropConcentration
[%]Ground Dose
[kg/ha]CH Dose
[kg/ha/mCH]LWA Dose
[kg/10000m²LWA]TRV Dose
[kg/10000m³TRV]

ENTER dose from the PPP label

0,150

0,450

0,150

0,265

0,438

RESET

Final Ground Dose [kg/ha]

0,450

0,450

0,450

0,454

0,451

Ground Dose NOT Corrected [kg/ha]

0,450

0,450

0,450

0,454

0,451

Final Concentration [%]

0,150

0,150

0,150

0,151

0,150

Total amount of PPP to be used [kg]

6,120

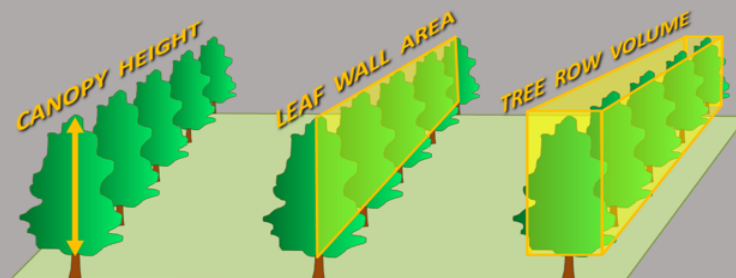
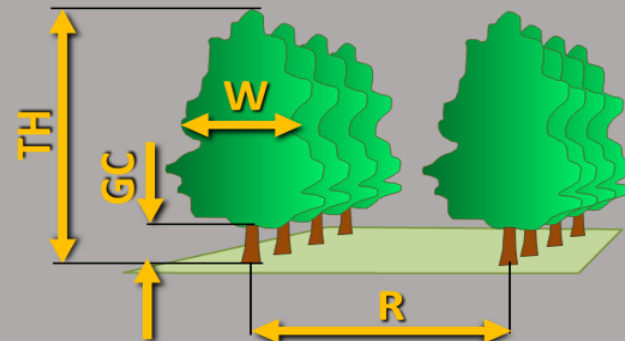
6,120

6,120

6,178

6,127

Amount of PPP per sprayer tank [kg]

4 x 1,500
+ 0,1204 x 1,500
+ 0,1204 x 1,500
+ 0,1204 x 1,514
+ 0,1214 x 1,502
+ 0,120DoConAd
DOSE CONVERSION & ADJUSTMENT TOOL

Dose adjustment

Factors determining dose adjustment

Target

- **Dimensions of target**

- height
- width
- row spacing

- **Canopy density**

- LAI [m^2/m^2]
- projected area [%]
- area density [m^2/m^3]
- pictogram

- **Growth stage**

- BBCH
- selected from list of options

- **Specie / Variety of crop**

- **Controlled pest or pathogen**

- level of infection risk
- level of infection or infestation
- stage of development
- dynamics of development
- behaviour
- place and mode of feeding

Plant Protection Product

- **Type of product**

- fungicide
- insecticide
- acaricide

- **Purpose of treatment**

- preventive
- curative

- **Mode of action**

- contact
- systemic
- translaminar

Application technique

- **Sprayer type**
- **Nozzle type**

Weather Conditions

- Air temperature
- Relative humidity
- Wind velocity
- Cloud cover
- Haze

Dose adjustment

Decision support tools

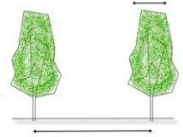


Dosaviña

Dosaviña® is a tool for determining the optimal volume rate for pesticide spray application in trellis vines based on the adapted method of Leaf Wall Area (LWA).

Start

Crop



Enter a representative height and width of the entire plantation. Take several measurements in different places and calculate the average value.

Canopy height: 1.5 ft
Distance between rows: 3.0 ft
Canopy width: Less than 1.6 ft

Next

Calibration

Forward speed: 0.0 mph
Spray application volume: 0.0 gal/acr

Calculation of the working width

Distance between rows: 3.0 ft
Number of rows: 1 rows
Working width: 3.0 ft

Go to recommendation

Go to manual selection



Accueil | EPICure | B.S.V. | Optidose

Module de calcul des doses

* champs obligatoires

Stade phénologique: 27 - Nouaison (J)

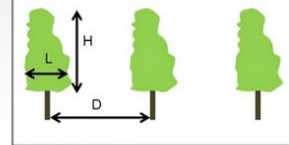
Inter-rang: 1.2 m
Hauteur de feuillage: 1.0 m
Largeur de feuillage: 0.45 m

Volume de haie foliaire (TRV): 3750 m³/ha

Risque mildiou: Faible
Risque oidium: Moyen

Calcul de la dose

MILDIOU: Selon le module Optidose, l'IFV vous recommande
OIDIUM: Selon le module Optidose, l'IFV vous recommande



Légende du schéma ci-dessus:
D inter-rang
H hauteur de feuillage
L largeur de feuillage

A TITRE INDICATIF, RISQUE SUR UNE COMMUNE DONNÉE
département: GIRONDE
commune: PAULLAC
risque -> veuillez sélectionner une commune, merci.

Dose adjustment calculator

Set farm reference sprayer adjustments

Standards: Apple1. Dessert and Culinary
Row spacing (m): 3.0
Number of nozzles: 18 Std tree height = 3.2 m

Assess the need to spray and select pesticide

Orchard: ID05_ Spray date:
Pesticide: PB (pre-blossom dose)
Done ☒

Assess whether dose-rate reduction is appropriate

Done ☒

Click to proceed

Reduce dose for low canopy density

Growth-stage: Pre-blossom
Branching-density: Std
Row spacing (m): 3.0

Reduce dose for low tree height

Number of nozzles: 16 for low tree height of 2.8 m.

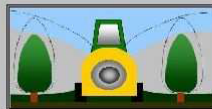
Results of dose adjustment

Update Restore Delete

09/09/2009 ID05_PB 16 0.88 1.00 1.00 0.88 88%

[View results on separate page](#)

Pre-blossom Post-blossom, Full-leaf




Guide to branching-density/growth-stage assessment

- DOSAVIÑA
- OPTIDOSE
- PACE
- DOSAGE ADAPTE



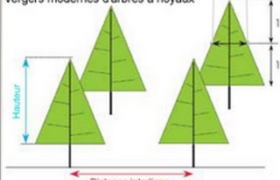
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Agroscope - Agrometeo

VITICULTURE



Arbres à pépins et Vergers modernes d'arbres à noyaux



ARBORICULTURE



1. SÉLECTIONNER LE TYPE D'ARBRE

☒ Arbres à pépins et Vergers modernes d'arbres à noyaux
☐ Arbres fruitiers à forme ouverte et buisson

2. CALCUL DU VOLUME FOLIAIRE (TRV)

Hauteur (m):
Largeur moyenne (m):
Interligne (m):
Surface (m²):
CALCULER

3. CHOIX DES PRODUITS

Produit 1:
Concentration (%) ou Quantité (kg/l/ha):
Produit 2:
Concentration (%) ou Quantité (kg/l/ha):
Produit 3:
Concentration (%) ou Quantité (kg/l/ha):

4. AFFICHER LES RÉSULTATS

AU FORMAT PDF

