Harmonization of dose expression

Dose conversion and adjustment

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on behalf of Expert Working Group:

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**Field crops:**

ground area = treated crop area

L/ha ground = L/ha treated crop area

**Orchards / vineyards / plantations:**

ground area ≠ treated plant area

L/ha ground ≠ L/ha treated crop area
**Field crops:**

ground area = treated crop area

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**Orchards / vineyards / plantations:**

ground area ≠ treated plant area

L/ha ground ≠ L/ha treated crop area
Fruit growing – 3D crops

Calibration formula:

\[
\text{Spray volume} = \frac{\text{nozzle flow rate} \times \text{number of nozzles} \times 600}{\text{working width} \times \text{travel velocity}}
\]
Fruit growing – 3D crops

Calibration formula:

\[
\text{Spray volume} = \frac{\text{nozzle flow rate} \times \text{numerator of nozzles} \times 600}{\text{working width} \times \text{travel velocity}}
\]

* treated canopy height
* numerator of nozzles
* working width
* travel velocity
* row spacing
Fruit growing – 3D crops

Calibration formula:

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

Constant spray liquid deposit

Spray volume \text{ LOW TREES} < Spray volume \text{ HIGH TREES}
Spray volume \text{ WIDE SPACING} < Spray volume \text{ NERROW SPACING}
Fruit growing – 3D crops

Dose recommendation:

PPP dose/ha ground _LOW TREES_< PPP dose/ha ground _HIGH TREES_
PPP dose/ha ground _WIDE SPACING_< PPP dose/ha ground _NARROW SPACING_

Constant PPP initial deposit
Fruit growing – 3D crops

Dose recommendation:

Constant dose/ha ground

PPP initial deposit \textsubscript{LOW TREES} > PPP initial deposit \textsubscript{HIGH TREES}

PPP initial deposit \textsubscript{WIDE SPACING} > PPP initial deposit \textsubscript{NERROW SPACING}
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, pest/pathogen pressure, climatic factors)

➢ minimum variation in PPP deposit across a wide range of crop structures,
dose expression

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

Reference units in the EU:

• ground area
• spray volume (concentration %)
• canopy height - CH
• leaf wall area - LWA
• tree row volume - TRV
• plant row
dose expression
PPP mass or volume unit (kg or L) linked to a certain reference unit

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- ground area
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kg or L/ha ground
dose expression
PPP mass or volume unit (kg or L) linked to a certain reference unit

Reference units in the EU: DK, FI, LT ● NL ● ES, GR, HR, IT, PT

• ground area
• spray volume (concentration)
• canopy height - CH
• leaf wall area - LWA
• tree row volume - TRV
• plant row

kg or L/100 L spray volume (%) + spray volume (max) and/or + max dose/ha ground
dose expression

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

Reference units in the EU:

- ground area
- spray volume (concentration)
- canopy height - CH
- leaf wall area - LWA
- tree row volume - TRV
- plant row

kg or L/ha ground and m CH
dose expression

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

Reference units in the EU: (LT) • BE, (PL), (SI), (AT) • -

• ground area
• spray volume (concentration)
• canopy height - CH
• leaf wall area - LWA
• tree row volume - TRV
• plant row

\[
LWA = 2 \times \frac{\text{canopy height [m]}}{\text{row spacing [m]}} \times 10\,000 \, m^2
\]
dose expression

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

Reference units in the EU: CH

- ground area
- spray volume (concentration)
- canopy height - CH
- leaf wall area - LWA
- tree row volume - TRV
- plant row

\[
\text{TRV} = \frac{\text{canopy height [m]} \times \text{canopy width [m]}}{\text{row spacing [m]}} \times 10,000 \text{ m}^2
\]
Dose expression
PPP mass or volume unit (kg or L) linked to a certain reference unit

Reference units in the EU:

- ground area
- spray volume (concentration)
- canopy height - CH
- leaf wall area - LWA
- tree row volume - TRV
- plant row

NO, SE • - • -

kg or L/100 m tree row
dose expression
PPP mass or volume unit (kg or L) linked to a certain **reference unit**

**Reference units in the EU:**

- ground area               DK, FI, LT, CZ, HU, PL, SI, SK, UK, FR
- spray volume (concentration %)    ES, GR, HR, IT, PT, DK, FI, LT, NL,
- canopy height – CH               DE, AT, (PL, SI)
- leaf wall area – LWA             BE, (LT, PL, SI, AT)
- tree row volume - TRV            CH
- plant row                        NO, SE


- 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 HARMONISATION**
Zonal efficacy trials => Trial reports: reference units and crop structure parameters

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

National assessment => registration with label recommendation

National assessment => registration with label recommendation

National assessment => registration with label recommendation

advice for farmers

advice for farmers

advice for farmers

Farmers’ practice

Farmers’ practice

Farmers’ practice

national legislation * local practice * growers’ awareness and preferences
Harmonisation

**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 listed and discussed
  - ground area
  - spray volume (concentration %)
  - canopy height - CH
  - leaf wall area - LWA
  - tree wall area - LWA
  - 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
Why LWA?

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

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

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**Common denominator** well represents diverse pome fruit structures

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Why LWA?

Mean initial deposits obtained in 31 trials in apple orchards

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

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

Industry data (WOHLHAUSER, R., 2012)

Hard to set accurate dose

Accurate MED setting
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
- perfect tool for direct (systemic) dose adjustment
Why LWA?

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

**Distribution of LWA by crops – all zones**

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

<table>
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<tr>
<th>Crop name</th>
<th>N Obs</th>
<th>Mean</th>
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<th>Upper 95% CL for Mean</th>
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<td>11628</td>
<td>13333</td>
<td>15429</td>
<td>17143</td>
</tr>
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LWA = 18 000 m²/ha ⇔ \[\frac{\text{Canopy Height (CH)}}{\text{Row Spacing (RS)}}\] = 0,9

**CH/RS = 0,9**

MAX dose

LWA = 18 000 m²/ha

**CH/RS = 0,6**

MAX dose - 35%

LWA = 11 400 m²/ha

**CH/RS = 0,45**

MAX dose - 50%

LWA = 9 000 m²/ha
Harmonisation

**EPPO General Standard PP 1/239 (2)**
Efficacy evaluation of plant protection products
*Dose expression for plant protection products*
Dose conversion diagram

*Appendix 1*

*EPPO Standard PP1/239(2) after: Frießleben et al., 2007.*

**Diagram:**
- Tree row volume (kg per 10,000 m³ TRV)
- Mid-width of crown (m)
- Concentration (%)
- Spray volume (L ha⁻¹)
- Dose (kg ha⁻¹)
- Leaf wall area (kg per 10,000 m² LWA)
- Row distance (m)
- Leaf wall height (kg per ha and m CH)
- Canopy height (m)
- Leaf wall height
Excel Tool for dose conversion

- request from Organising Committee of EPPO Workshop:
Excel Tool for dose conversion & adjustment

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Excel Tool for dose conversion & adjustment

Post-Workshop **EWG – Dose Conversion and Adjustment**

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thank you ;-(

EPPO Workshop on harmonized dose expression for the zonal evaluation of plant protection products in high growing crops - Vienna, 18/20 October, 2016