Towards a new model of dose expression in viticulture: Presentation of an experimental approach based on deposition measurement to test the relevance of different scenarios.

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Introduction : context and stakes

• **Increase the sustainability** of plant protection products by using adjusted and sufficient dose **while ensuring protection efficacy** *(Directive 2009/128/CE, National Action Plan Ecophyto II)*

• **National Action plan Ecophyto II** : “The procedures for plant protection products registration will be reviewed in order to define differentiated doses based on crop development”- Purpose for 2020

• Define a dose expression that provides a **quantity of deposit necessary and sufficient** per unit area on the target.
### Dose rate expression according to countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Dose rate expression</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>Fixed dose per hectare</td>
<td>Concentration (%)&lt;br&gt;Max Vol/ha (1000 l)</td>
</tr>
<tr>
<td>Spain</td>
<td>Variable dose per hectare</td>
<td>Evolution of the dose according to growth stages&lt;br&gt;(4 levels : range from 1 to 4)</td>
</tr>
<tr>
<td>Italy</td>
<td>Variable dose per hectare</td>
<td>Evolution of the dose according to growth stages&lt;br&gt;(5 levels : range from 1 to 2,6)</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Variable dose per hectare</td>
<td>Evolution of the dose according to growth stages&lt;br&gt;(5 levels : range from 1 to 2,6)</td>
</tr>
<tr>
<td>EU</td>
<td>Adjusted dose</td>
<td>Dose according to LWA for efficacy trials during registration process (EPPO Workshop October 2016)</td>
</tr>
</tbody>
</table>

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Vine dose rate expression in France

- A fixed dose defined in \((g\ or\ L) / ha\) treated.

→ High variation of deposits per unit area (from 1 to more than 5) depending on the amount of vegetation to be protected.
Requirements for a new dose expression:

An ideal dose expression would:

- be defined according to crop parameters,
- lead to constant and sufficient deposits per unit area on the target,
- ensure protection efficacy,
- be easy to implement by grower.
The relevance of the different models of dose expression (LWA, TRV, adjustment dose rate tools, …) can be tested using a database of deposit measurements obtained at field level in a wide range of conditions.

Work on progress !!! we intend to develop this approach in a wider range of field conditions.
How to assess and compare protection efficacy?

Measurement of spray deposition per unit area of canopy

→ Analysis of the amount of product deposited per unit area on the canopy

unit: ng/dm² for 1 g applied /ha

(ISO 22522: 2007)
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How to assess and compare protection efficacy?

Measurement of spray deposition per unit area of canopy

→ Analysis of the **amount of product deposited per unit area** on the canopy

→ Analysis of the **distribution of the deposits** within the canopy

• Average
• Standard deviation
• Coefficient of Variation : CV, %

(ISO 22522: 2007)
Questions:

• Which crop parameter measurable by farmer is better related to deposit in order to predict deposition and express dose rate?

Our study (on progress) aims to identify the best combination of crops parameters on which a new dose expression could be based.
Materials and methods

- Measurement of deposits at 4 dates (T1, T2, T3, T4)

From early growth stage

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>28th April 2016</td>
</tr>
<tr>
<td>T2</td>
<td>25th May 2016</td>
</tr>
<tr>
<td>T3</td>
<td>23rd June 2016</td>
</tr>
<tr>
<td>T4</td>
<td>18th July 2016</td>
</tr>
</tbody>
</table>

To full growth stage
Materials and methods

- Measurement of deposits at 4 dates (T1, T2, T3, T4)

- Study carried out on 5 plots with different vigor (low-medium vigor)
Materials and methods

- Measurement of deposits at 4 dates (T1, T2, T3, T4)
- Study carried out on 5 plots with different vigours
- On each plot, deposit measurement on 4 trees /plot
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Materials and methods

- Measurement of deposits at 4 dates (T1, T2, T3, T4)
- Study carried out on 5 plots with different vigours
- On each plot, deposit measurement on 4 trees /plot

- Measurement of the deposit per unit area (ng/dm² for 1g/ha applied) using collectors on a grid (10 cms width * 20 cms height) : individual analysis on each collector
Measurement of the deposit per unit area: in ng/dm² for 1 g of product sprayed per ha.

One collector per cell of the matrix.
Individual analysis of the deposit on each collector.
3052 deposit analysis in 2016.
Materials and methods

• Measurement of deposits at 4 dates (T1, T2, T3, T4)

• Study carried out on 5 plots with different vigours

• On each plot, measurement of the deposit on 4 trees /plot

• Measurement of the deposit per unit area (ng/dm² for 1g/ha applied) on a grid (10 cms width *20 cms height) : individual analysis on each collector

• 2 sprayers were used and represent the range of performance that the growers can use (low and high performance)
Materials and methods

2 sprayers:

Low performance sprayer: pneumatic arch sprayer used every 4 rows

High performance sprayer: air assisted sprayer side by side
Materials and methods

- Measurement of deposits at 4 dates (T1, T2, T3, T4)
- Study carried out on 5 plots with different vigours
- On each plot, measurement of the deposit on 4 trees /plot
- Measurement of the deposit per unit area (ng/dm² for 1g/ha applied) on a grid (10 cms width *20 cms height) : individual analysis on each collector
- 2 sprayers are used and represent the range of performance that the growers can use (low and high performance)
- Crop parameters (TRV manual, LWA manual)
First results: relations obtained in real field conditions - Year 2016
Towards a new model of dose expression in viticulture: Presentation of an experimental approach based on deposition measurement to test the relevance of different scenarios

First results 2016

Relation between average deposition and crop parameters: LWA

Each point represents one sprayer on a plot and a date

Graph showing the relation between average deposition (ng/dm² for 1g/ha) and LWA (m²/ha) for high and low perf sprayers. The graph includes two trend lines, one for high perf sprayer with an R² of 0.8525 and another for low perf sprayer with an R² of 0.8595.
First results 2016

Relation between average deposition and crop parameters: TRV

Each point represents one sprayer on a plot and a date

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Assumption based on empiricism (growers’ practices):

- The low performance sprayer (one of the most common sprayer in the vineyard) insures protection efficacy at full dose rate.
- In the conditions of this experiment, the minimum average deposition is around 135 ng/dm² for 1g/ha (full growth stage).

What would have been the % of full dose necessary to ensure this minimum deposition for each treatment?
First results 2016

Relation between average deposition and crop parameters: TRV

Each point represents one sprayer on a plot and a date.

Minimum deposit: 135 ng/dm² for 1g/ha
% of full dose necessary to ensure this minimum deposition (135ng/dm²) for each treatment according to TRV

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First results 2016
Towards a new model of dose expression in viticulture: Presentation of an experimental approach based on deposition measurement to test the relevance of different scenarios

First results 2016

% of full dose necessary to ensure this minimum deposition (135ng/dm²) for each treatment according to TRV

\[ y = 0.0002x + 0.2267 \]

\[ R^2 = 0.8865 \]

\[ y = 0.0002x + 0.2267 \]

\[ R^2 = 0.8422 \]
Conclusions and perspectives

A new experimental approach in order to define:

- a relevant dose expression,
- tables of coefficient for dose adjustment,
- evaluate risks for farmers when using adjusted dose in their conditions (training system, growth stage, …).

An approach which allows to test all the possible scenario and define best options.

This work will be developed and carried out in others vineyards in order to define the best ways to express doses.

<table>
<thead>
<tr>
<th>Dose Rate in kg/ha</th>
<th>Growth stage (BBCH scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>From 12 to 53</td>
</tr>
<tr>
<td>Early growth stage to blooming stage</td>
<td>From 53 to 69</td>
</tr>
<tr>
<td>1,00 to 1,60 m</td>
<td>1 kg/ha</td>
</tr>
<tr>
<td>1,60 to 2,5 m</td>
<td>0,7 kg/ha</td>
</tr>
<tr>
<td>2,80 to 3,00 m</td>
<td>0,5 kg/ha</td>
</tr>
</tbody>
</table>
Thank you for your attention !!