Vine Sprayers’ classification according to standard deposition measurements.
Vine sprayers classification according to standard deposition measurements.

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**Introduction**

- **ÉCOPHYTO**
  - French National Action Plan: *-50% of pesticides use.*
  - Pneumatic arch sprayer represents 70 to 80% of the ongoing machines in large vineyard.
  - IFV and Irstea were ordered to classify sprayers model according to their ability to contribute to the plan EcoPhyto objectives.

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Medium and Long term lever: orientate the sprayer’s fleet renewal towards more performing machines.
I. MATERIALS AND METHODS
All the evaluations of sprayer’s performance were carried out in standardized conditions, on the artificial vine EvaSprayViti.

4 ten meters long rows composed by edge rows and collection rows.
EvaSprayViti : 3 different growth stage

**Early growth stage**
LAI = 0.24 ha/ha

**Middle growth stage**
LAI = 0.88 ha/ha

**Full growth stage**
LAI = 1.68 ha/ha
Spraying a tartrazine (E 102) solution in EvaSprayViti at early growth stage.
**Analysis compartments of deposition according to the growth stage.**

**Early growth stage**: Row depth: 4 delimitations. Row height: no delimitation
→ **4 compartments**

**Middle growth stage**: Row depth: 4 delimitations. Row height: 3 delimitations
→ **12 compartments**

**Full growth stage**: Row depth: 3 delimitations. Row height: 3 delimitations
→ **9 compartments**
Two indicators of spray deposition quality:

- Average deposition
- Coefficient of variation over the different compartments

Unit = ng/dm² for 1 g of product sprayed / ha
Vine sprayers classification according to standard deposition measurements.

<table>
<thead>
<tr>
<th>Sprayers assessed:</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumatic Arch Sprayer</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Airblast sprayer (tangential)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Airblast sprayer (axial)</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Airblast sprayer (multi fan)</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Pneumatic side by side sprayer</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Hoop sprayer (no air assistance)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Air assisted side by side sprayer</td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Air assisted shielded sprayer</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>
Foreword: Synthetic representation of the results

One performance assessed is represented by one point which coordinates are:
(average deposit; - coefficient of variation)
Vine sprayers classification according to standard deposition measurements.

Possible discordance between the 2 indicators

Sprayer C as a better performance than sprayer B according to homogeneity indicator but a worse one according to average deposition indicator.
Synthetic indicator proposed to classify sprayers: **Normalized Corrected Deposition (NCD)**

\[ \text{NCD} = \text{normalized average deposition} - \text{standard deviation} \]

Equivalent to:

\[ \text{NCD} = \text{average deposition} \times (1 - \frac{\text{CV}}{100}) \]
Vine sprayers classification according to standard deposition measurements.

Positioning of classification thresholds:

- Definition of the Reference level (RL) of NCD, Average performance of pneumatic arch sprayers.
  - First threshold: RL
  - Second threshold: RL/0.7 “70% of full dose rate would provide reference level of deposition”
  - Third threshold: RL/0.5 “50% of full dose rate would provide reference level of deposition”
**Vine sprayers classification according to standard deposition measurements.**

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**3 thresholds → 4 classes classification**

<table>
<thead>
<tr>
<th>NCD</th>
<th>Class name</th>
<th>Dose rate optimization potential according to sprayer’s performances indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>RL/0.5 ≤ NCD</td>
<td>A+</td>
<td>-50%</td>
</tr>
<tr>
<td>RL/0.7 ≤ NCD &lt; RL/0.5</td>
<td>A</td>
<td>-30%</td>
</tr>
<tr>
<td>RL ≤ NCD &lt; RL/0.7</td>
<td>B</td>
<td>No dose rate optimization allowed by sprayer’s performances.</td>
</tr>
<tr>
<td>NCD &lt; RL</td>
<td>C</td>
<td>Risky situation even at full dose rate.</td>
</tr>
</tbody>
</table>
Vine sprayers classification according to standard deposition measurements.

Graphical representation of the classification: reference level

Full growth stage

Average deposition (ng/dm² pour 1 g/ha)

CV (%)
Graphical representation of the classification: reference level and second threshold.
Vine sprayers classification according to standard deposition measurements.

Graphical representation of the classification
Vine sprayers classification according to standard deposition measurements.

Graphical representation of the classification

Full growth stage

Average deposition (ng/dm² pour 1 g/ha)

CV (%)
**Conclusion**

- Several machines proposed on the market offers significant perspective of progress towards French national action plan EcoPhyto.
- This classification is intended to all stockholders: authorities (regulation, subsidies?), advisers, farmers (choice of new sprayer).
- Ongoing trials to validate dose rate reduction proposals.
- In the next future, drift mitigation potential will be included, ongoing works to get a standard artificial wind.