Dose rate expression and adjustment for vine

Stakes for a new model of dose expression in viticulture: advantages and points to be taken into consideration

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

Vienna, 2016-10-18/20
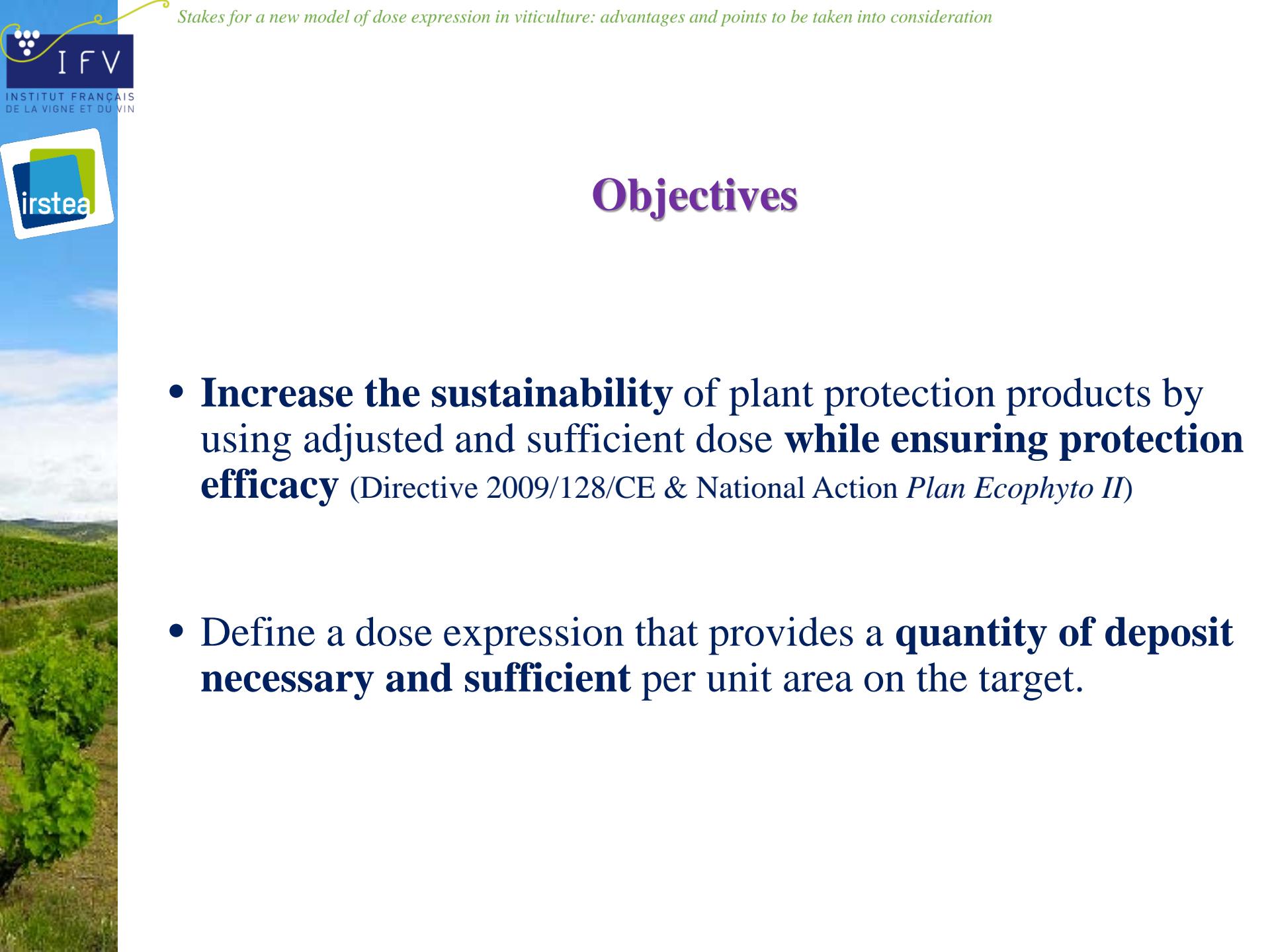
Objectives

- **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*)

- Define a dose expression that provides a **quantity of deposit necessary and sufficient** per unit area on the target.
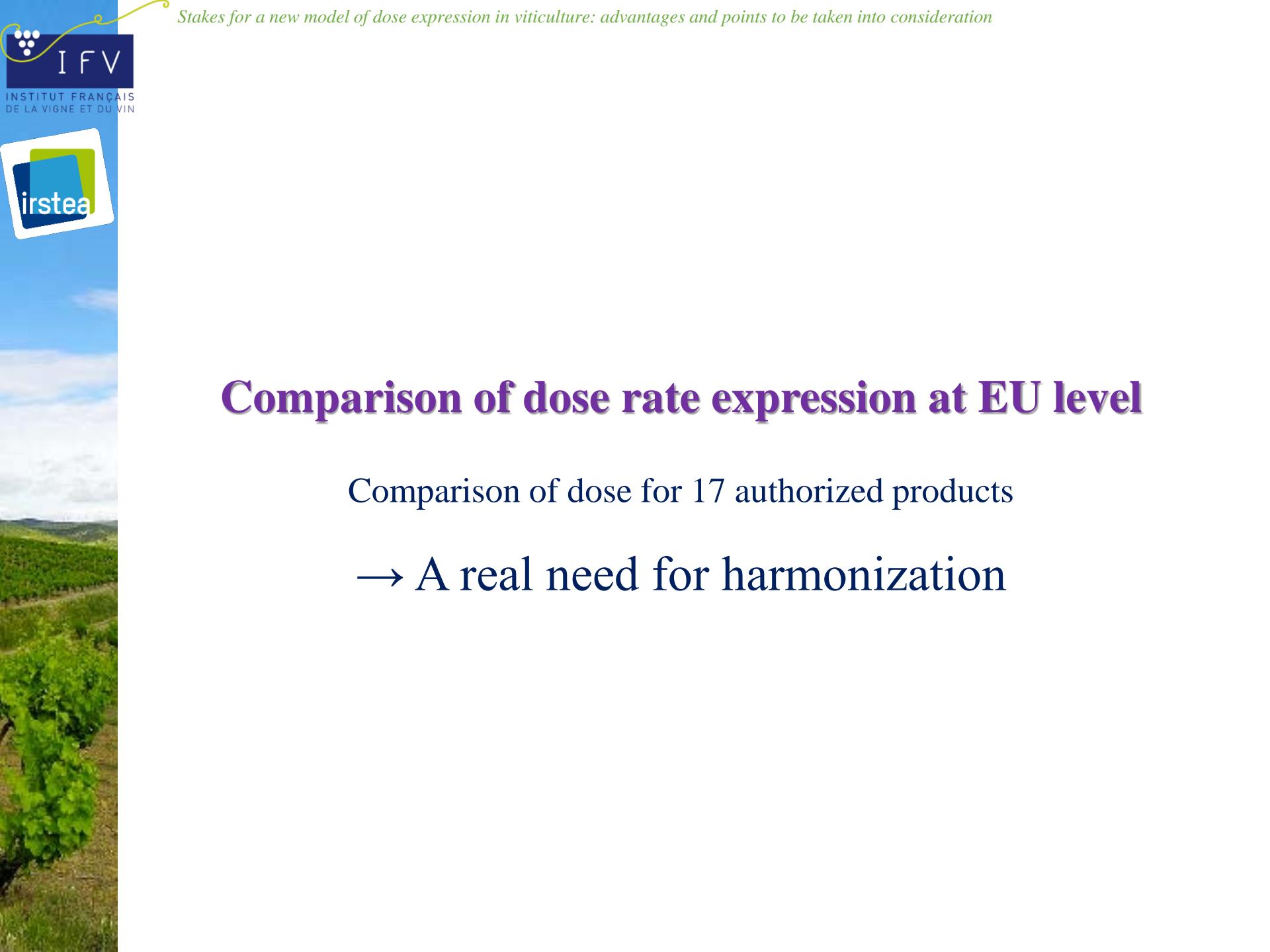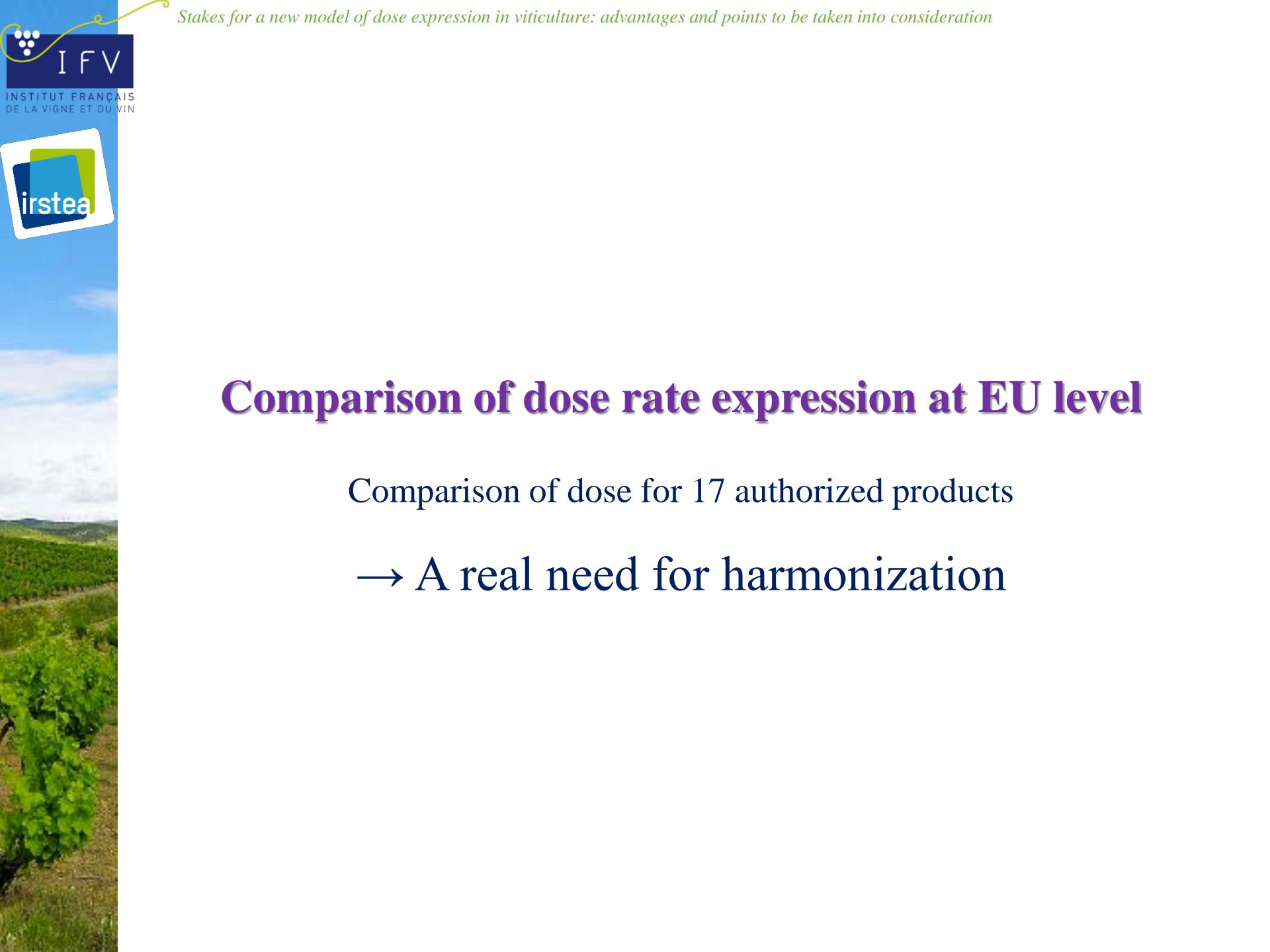
Comparison of dose rate expression at EU level

Comparison of dose for 17 authorized products

→ A real need for harmonization

Vine dose rate expression in France

- Currently, the registered dose rate for the use of PPP in France viticulture is **fixed** and defined in **(g or L) /ha cadastral treated.**

1 fixed dose par hectare

Large vineyard : distance between rows : 2,5 m

Early growth stage | Medium growth stage | Full growth stage

LWA max = 12000 m2/ha

Narrow vineyard : distance between rows : 1,0 m

Early growth stage | Medium growth stage | Full growth stage

LWA max = 20000 m2/ha

This dose does not take into account the structure/shape of the canopy (depending on vigor) neither the training system !

Dose rate expression according to countries

Fixed dose

Flag	Description
🇫🇷 (France)	**Fixed dose per hectare**
🇪🇸 (Spain)	Concentration range, Max Vol/ha (1000 l)
🇮🇹 (Italy)	Concentration range, Max Vol/ha (1000 l)
🇩🇪 (Germany)	Dose per Hectare. Evolution of the dose **according to growth stages (4 levels from 1 to 4)**
🇨🇭 (Switzerland)	Dose per Hectare. Evolution of the dose **according to growth stages (5 levels from 1 to 2,6)**
🇧🇪 (Belgium) Orchard	Dose **according to LWA**

- Modulation +

Adjusted dose

Dose rate expression according to countries

European comparison of 17 fungicides (study 2011)

Action	Product (French name)	🇫🇷 Dose/ha	🇩🇪 1	2	3	4	🇪🇸 Mini	Maxi	🇮🇹 Mini	Maxi	🇨🇭 1	2	3	4	5
powdery mildew	Flint	0,125	0,06	0,12	0,18	0,24	0,13	0,15	0,125	0,15	0,09	0,12	0,15	0,18	0,24
powdery mildew	Legend	0,2	0,08	0,16	0,24	0,32	0,2	0,3	0,2	0,3		0,16	0,2	0,24	0,32
powdery mildew	Microthiol Special Disperss	12,5	3,6	4,8	2,4	3,2	2,5	7,5	2,0	12,0	1,8	3,2	4,0	4,8	6,4
powdery mildew	Quadris Max	2,0	0,8	1,6	2,4	3,2	2,0	2,0			1,2	1,6	2,0	2,4	3,2
powdery mildew	Score	0,12							0,15	0,2	0,075	0,1	0,125	0,15	0,2
powdery mildew	Stroby DF	0,2	0,06	0,12	0,18	0,24				0,2	0,09	0,12	0,15	0,18	0,24
powdery mildew	Thiovit jet	12,5	3,6	4,8	2,4	3,2	2,5	7,5	2,0	12,0	2,4	3,2	4,0	4,8	6,4
powdery mildew	Topaze	0,25	0,06	0,12	0,18	0,24			0,15	0,3	0,3	0,2	0,25	0,3	0,4
powdery mildew	Talendo	0,25	0,1	0,2	0,3	0,375			0,2	0,25		0,2	0,25	0,3	0,4
powdery mildew	Vivando	0,2	0,08	0,16	0,24	0,32	0,1	0,2	0,2	0,25		0,16	0,2	0,24	0,32
mildew	Forum Gold	1,5	0,48	0,96	1,44	1,56									
mildew	Folpan 80 WDG	1,9	0,4	0,8	1,2	1,6	1,8	1,8				1,0	1,25	1,5	2,0
mildew	Polyram DF	3,5					1,50	2,00			1,8				
mildew	Mikal Flash	4,0							3,0	4,0		1,6	2,0	2,4	3,2
mildew	Panthéos	2,0	0,48	0,96	1,44	1,92	1,35	1,60	1,8	2,0		1,0	1,25	1,5	2,0
mildew	Vincare	2,0	0,5	1,0	1,5	2,0			1,6	2,0		1,6	2,0	2,4	3,2
mildew	Odena UD	1,3	0,6	1,2	1,8	2,4						1,2	1,5	1,8	2,4

Dose rate range for 17 fongicides used in vineyard

Dose rate expression according to countries

European comparison of 17 fungicides (study 2011)

Action	Product (French name)	Dose/ha	1	2	3	4	Mini	Maxi	Mini	Maxi	1	2	3	4	5
powdery mildew	Flint	0,125	0,06	0,12	0,18	0,24	0,13	0,15	0,125	0,15	0,09	0,12	0,15	0,18	0,24
powdery mildew	Legend	0,2	0,08	0,16	0,24	0,32	0,2	0,3	0,2	0,3		0,16	0,2	0,24	0,32
powdery mildew	Microthiol Special Disperss	12,5	3,6	4,8	2,4	3,2	2,5	7,5	2,0	12,0	1,8	3,2	4,0	4,8	6,4
powdery mildew	Quadris Max	2,0	0,8	1,6	2,4	3,2	2,0	2,0			1,2	1,6	2,0	2,4	3,2
powdery mildew	Score	0,12							0,15	0,2	0,075	0,1	0,125	0,15	0,2
powdery mildew	Stroby DF	0,2	0,06	0,12	0,18	0,24				0,2	0,09	0,12	0,15	0,18	0,24
powdery mildew	Thiovit jet	12,5	3,6	4,8	2,4	3,2	2,5	7,5	2,0	12,0	2,4	3,2	4,0	4,8	6,4
powdery mildew	Topaze	0,25	0,06	0,12	0,18	0,24			0,15	0,3	0,3	0,2	0,25	0,3	0,4
powdery mildew	Talendo	0,25	0,1	0,2	0,3	0,375			0,2	0,25		0,2	0,25	0,3	0,4
powdery mildew	Vivando	0,2	0,08	0,16	0,24	0,32	0,1	0,2	0,2	0,25		0,16	0,2	0,24	0,32
mildew	Forum Gold	1,5	0,48	0,96	1,44	1,56									
mildew	Folpan 80 WDG	1,9	0,4	0,8	1,2	1,6	1,8	1,8				1,0	1,25	1,5	2,0
mildew	Polyram DF	3,5					1,50	2,00			1,8				
mildew	Mikal Flash	4,0							3,0	4,0		1,6	2,0	2,4	3,2
mildew	Panthéos	2,0	0,48	0,96	1,44	1,92	1,35	1,60	1,8	2,0		1,0	1,25	1,5	2,0
mildew	Vincare	2,0	0,5	1,0	1,5	2,0			1,6	2,0		1,6	2,0	2,4	3,2
mildew	Odena UD	1,3	0,6	1,2	1,8	2,4						1,2	1,5	1,8	2,4

Dose rate range for 17 fongicides used in vineyard

Dose rate expression according to countries

European comparison of 17 fungicides (study 2011)

For each product, the dose rate is expressed as a percentage of the French fixed dose.

A real need for harmonization. Which dose expression should be used ?
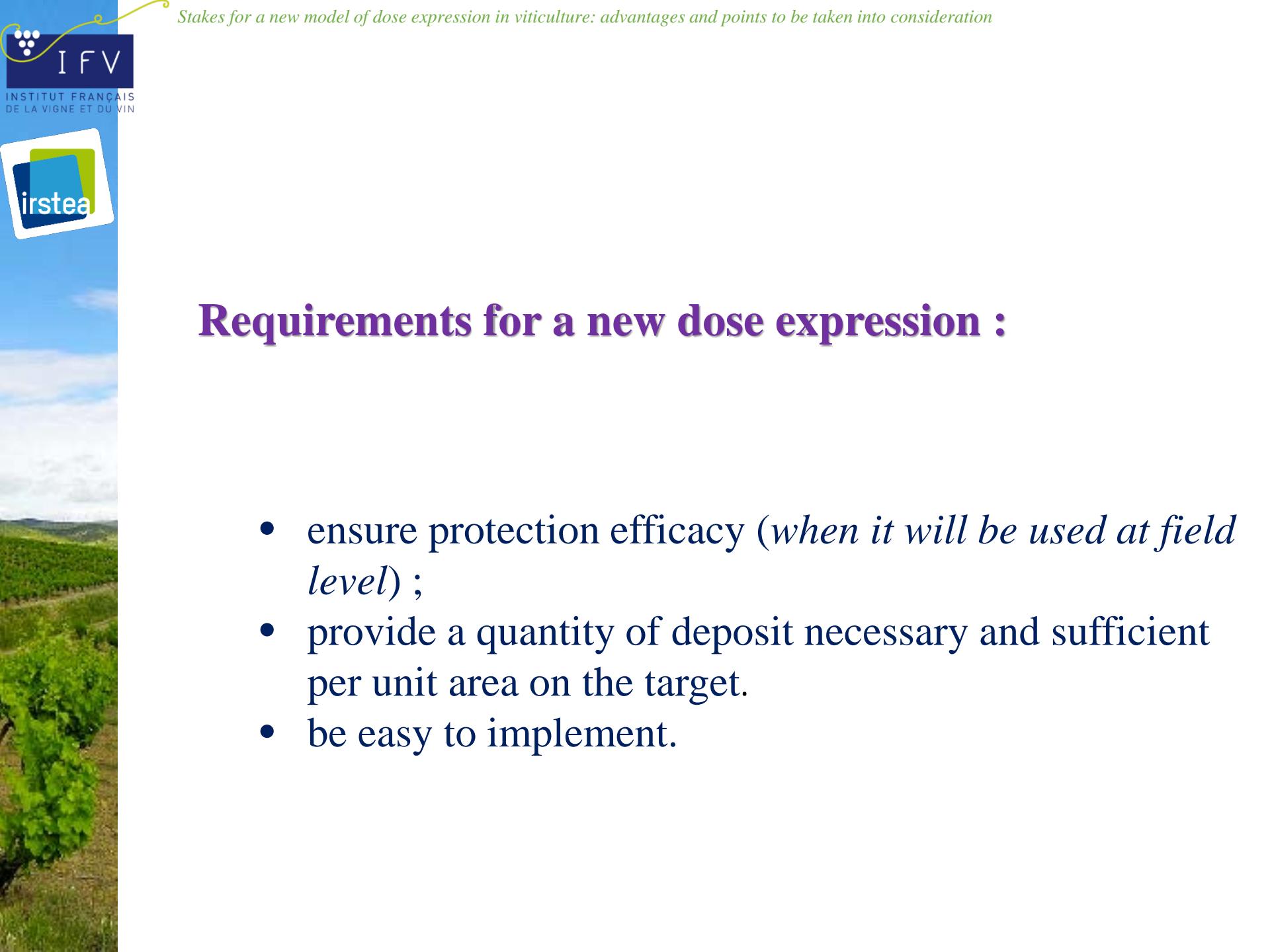
Requirements for a new dose expression :

- ensure protection efficacy (*when it will be used at field level*) ;
- provide a quantity of deposit necessary and sufficient per unit area on the target.
- be easy to implement.

Presentation of a new approach to test and evaluate scenario for new dose expression

- The relevance of the different models of dose expression (LWA, TRV, CH, adjustment dose rate tools, …) can be tested using a database of **deposit measurements** obtained at field level in a wide range of conditions.

A **work on progress** that we intend to develop 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
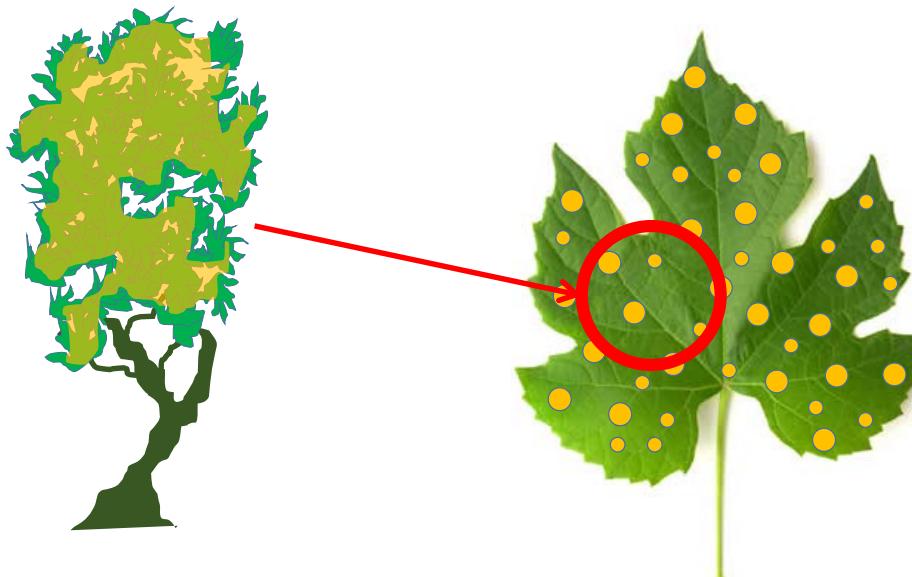
unit : **ng/dm² for 1 g applied /ha**

(ISO 22522: 2007)

How to assess and compare protection efficacy ?

Measurement of the deposit per unit area :
in ng/dm² for 1 g of product sprayed per ha
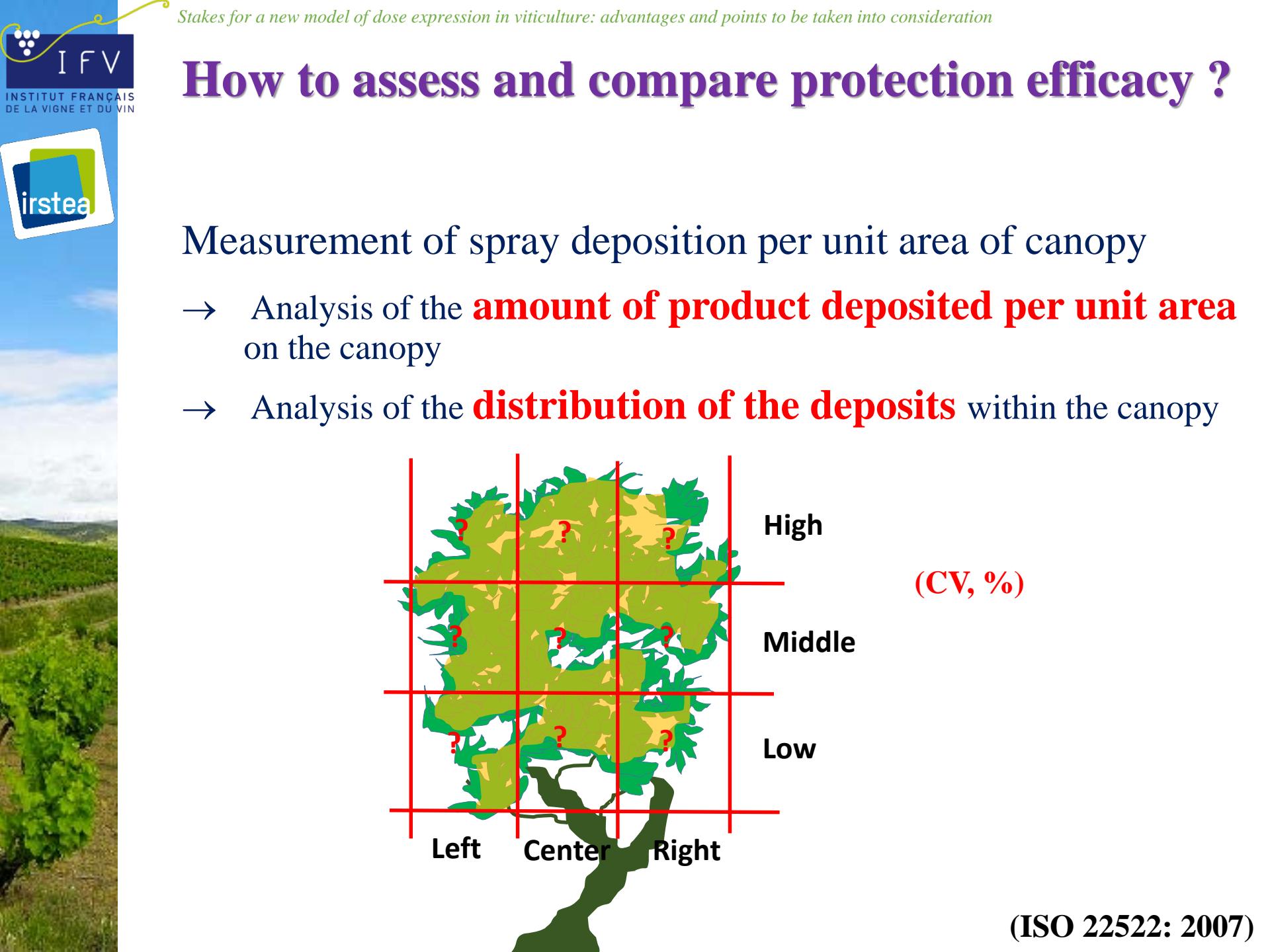
(ISO 22522: 2007)

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
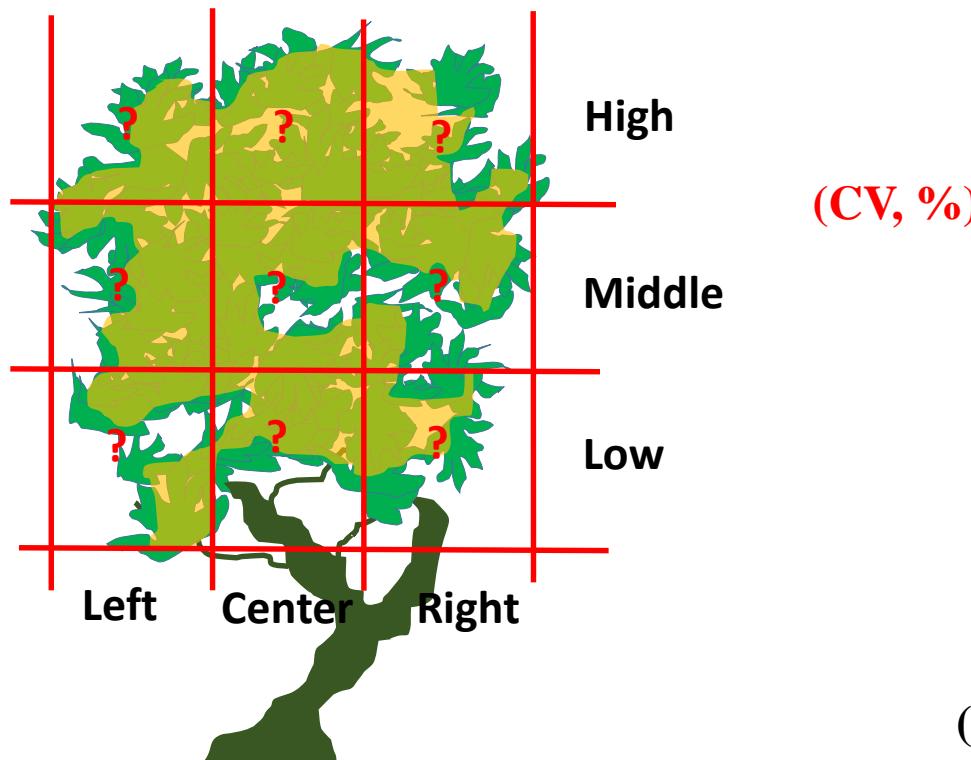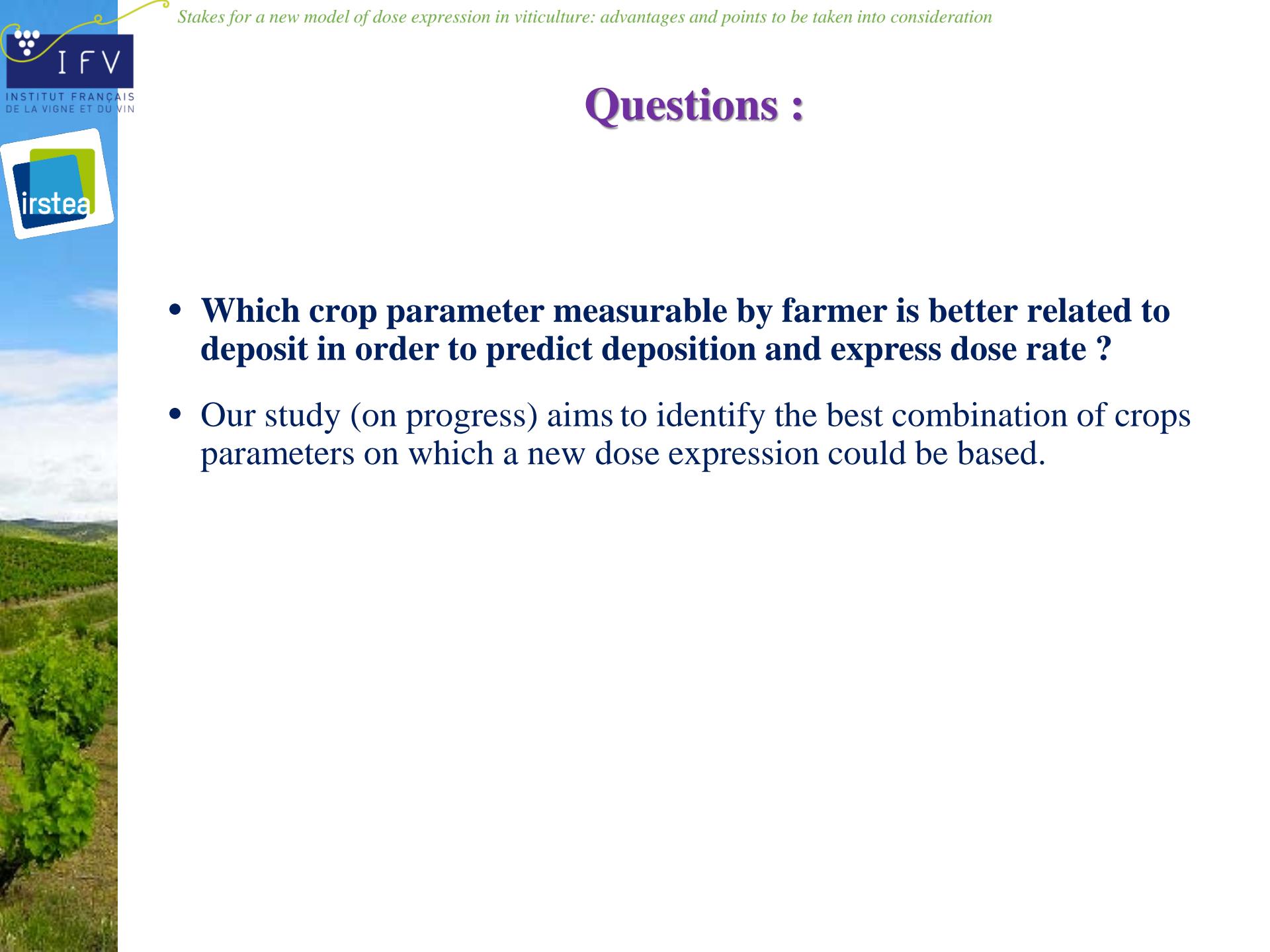
(CV, %)

(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)

T1 : 28th April 2016 **early growth stage**
T2 : 25th May 2016
T3 : 23rd June 2016
T4 : 18th July 2016 **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** (estate in the Montpellier area (FR), distance between rows : 2,5 and 3,0 m 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**

- **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

Materials and methods

Measurement of spray deposition
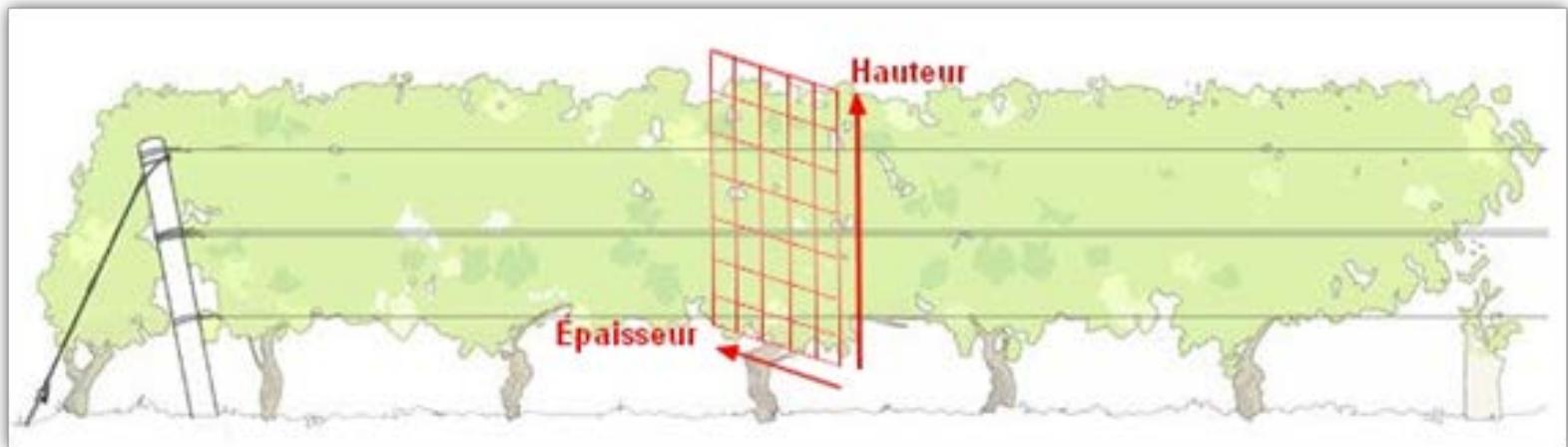
- Size of the matrix : **one cell for 20 cms height and 10 cms width**

- **one collector per cell of the matrix**

- Individual analysis of the deposit on the collector
- **3052 deposit analysis in 2016**
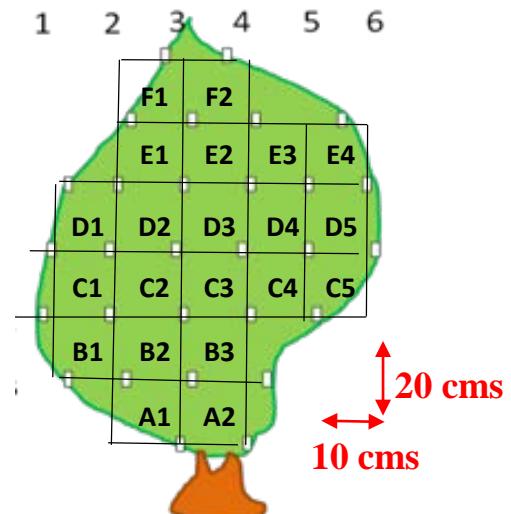
Matrix used for deposit measurement sampling

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
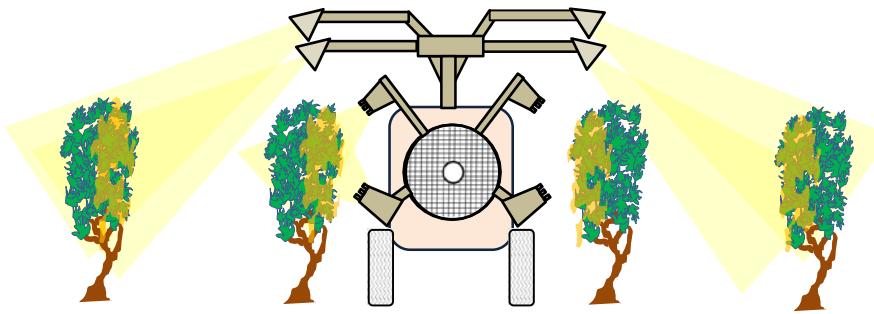
**High performance sprayer :** air assisted sprayer side by side
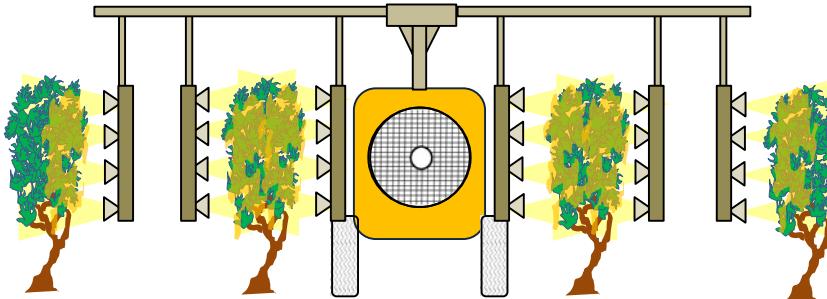
# Results the relations obtained in real field conditions - Year 2016

Results

Relations between average deposition and crop pamameters : **LWA**

- High perf sprayer
- Low perf sprayer

R² = 0,8525

R² = 0,8595

Average deposition (ng/dm² for 1g/ha)

LWA (m² /ha)
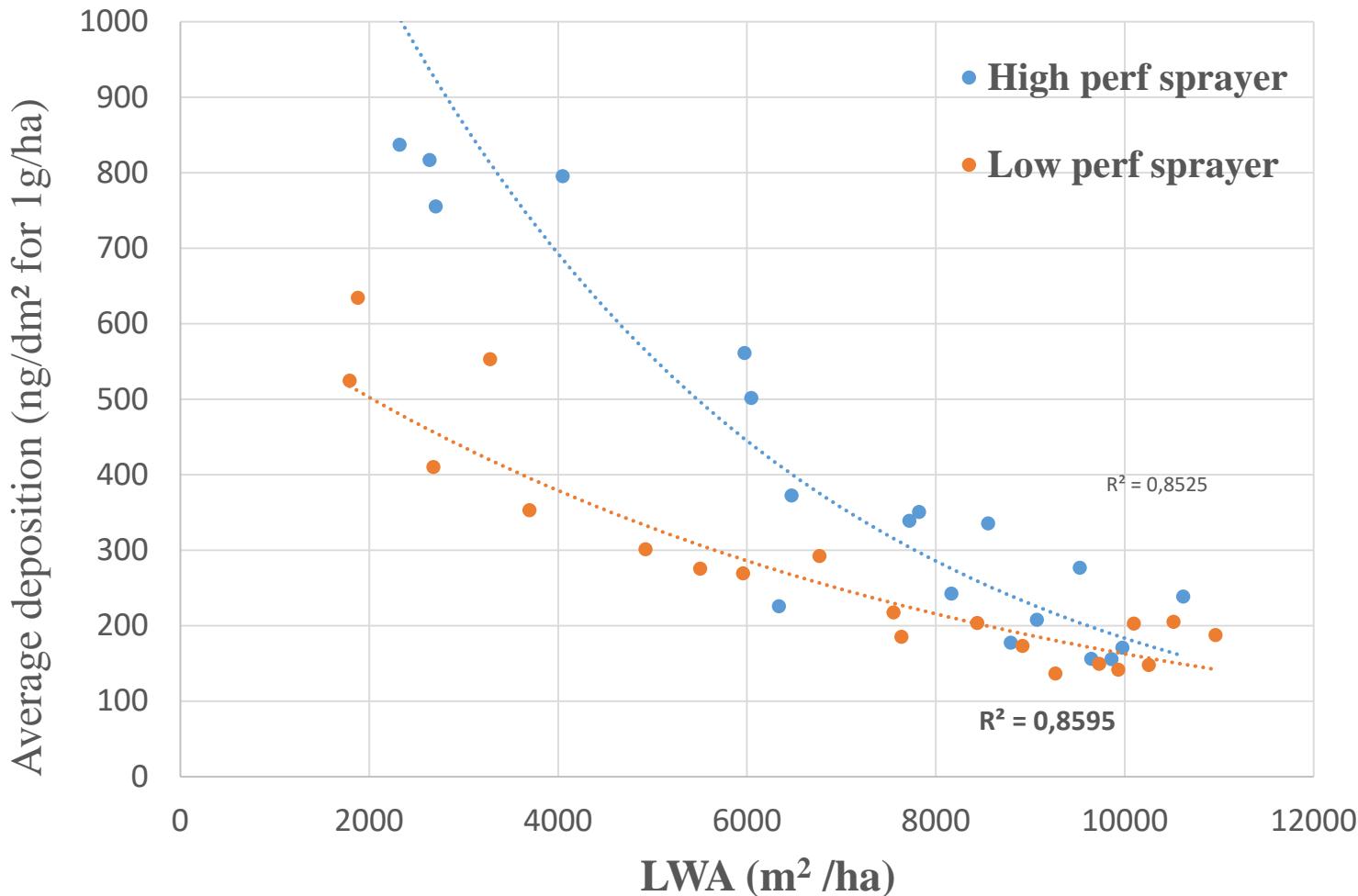
Results

Relations between average deposition and crop pamameters : **TRV**

% of dose necessary to ensure this minimum depositif for each treatment
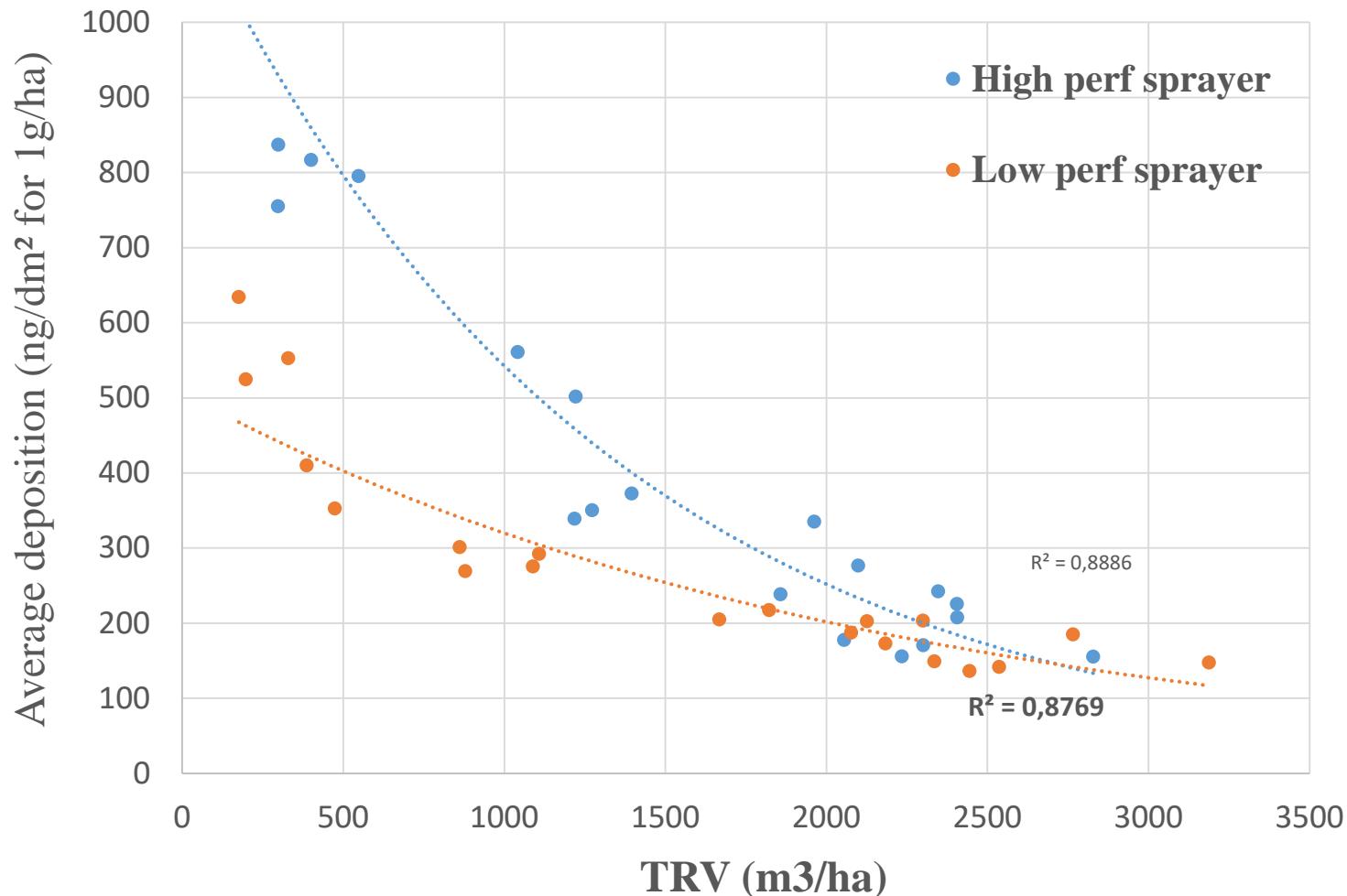
Results

Relations between average deposition and crop pamameters

Assumption : **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 :

- medium vigor : LWA max = 10000 m^2/ha

- the minimum average deposit is around 135 ng/dm^2 for 1g/ha at full growth stage.

2 questions:

→ **What would have been the % of dose necessary to ensure this minimum depositif for each treatment** ?

→ **Is there a relation with TRV LWA and is it a linear relation ?**

Results

% of dose necessary to ensure this minimum deposition for each treatment according to TRV

Results

% of dose necessary to ensure this minimum deposition for each treatment according to TRV

$y = 0{,}0002x + 0{,}2267$

$R^2 = 0{,}8865$

Low perf sprayer

% of full dose

TRV (m3/ha)

Results

% of dose necessary to ensure this minimum deposition for each treatment according to TRV

Results

% of dose necessary to ensure this minimum deposition for each treatment according to LWA


Chart: % of full dose vs LWA (m²/ha) for Low perf sprayer.

$y = 7E{-}05x + 0{,}1016$

$R^2 = 0{,}8075$
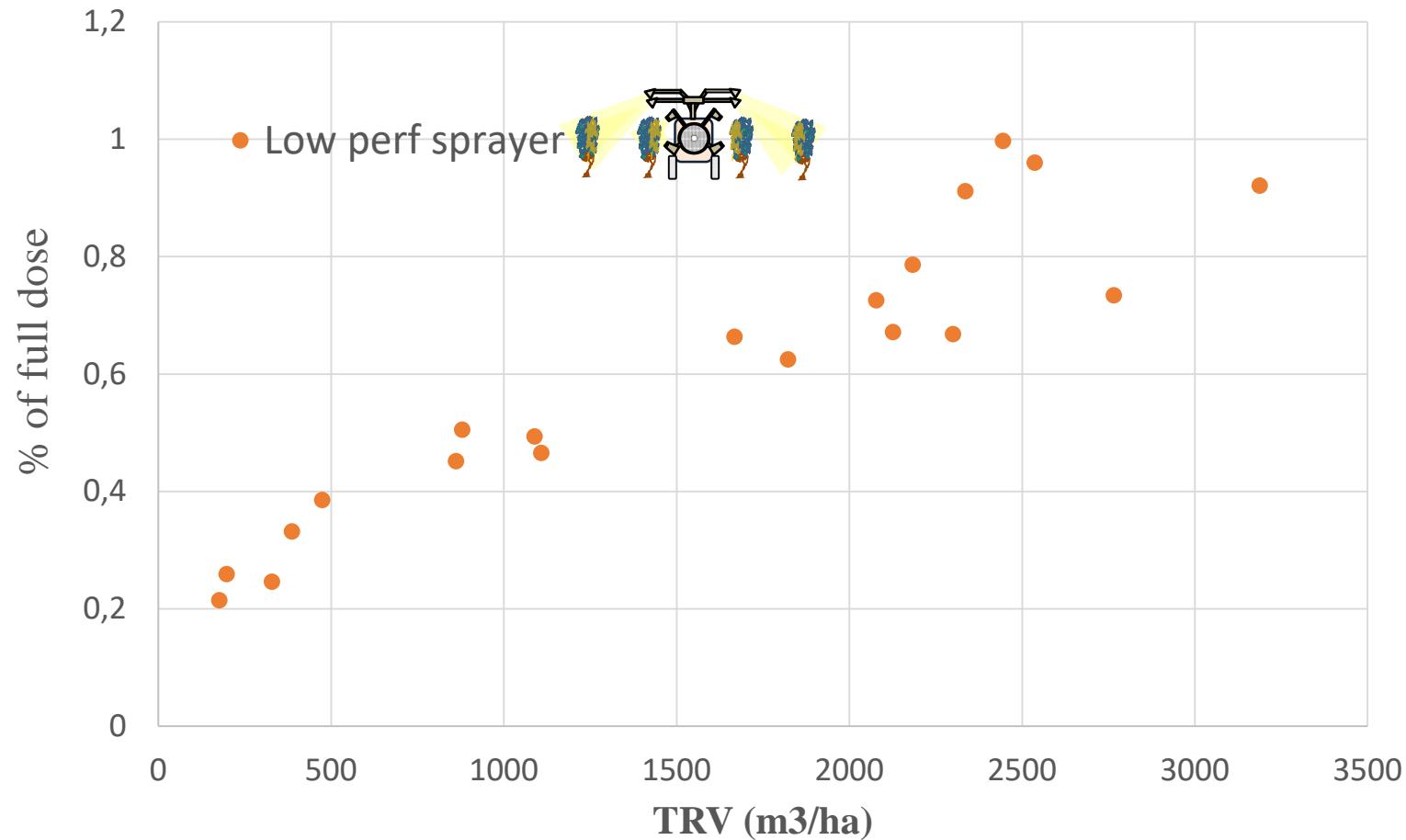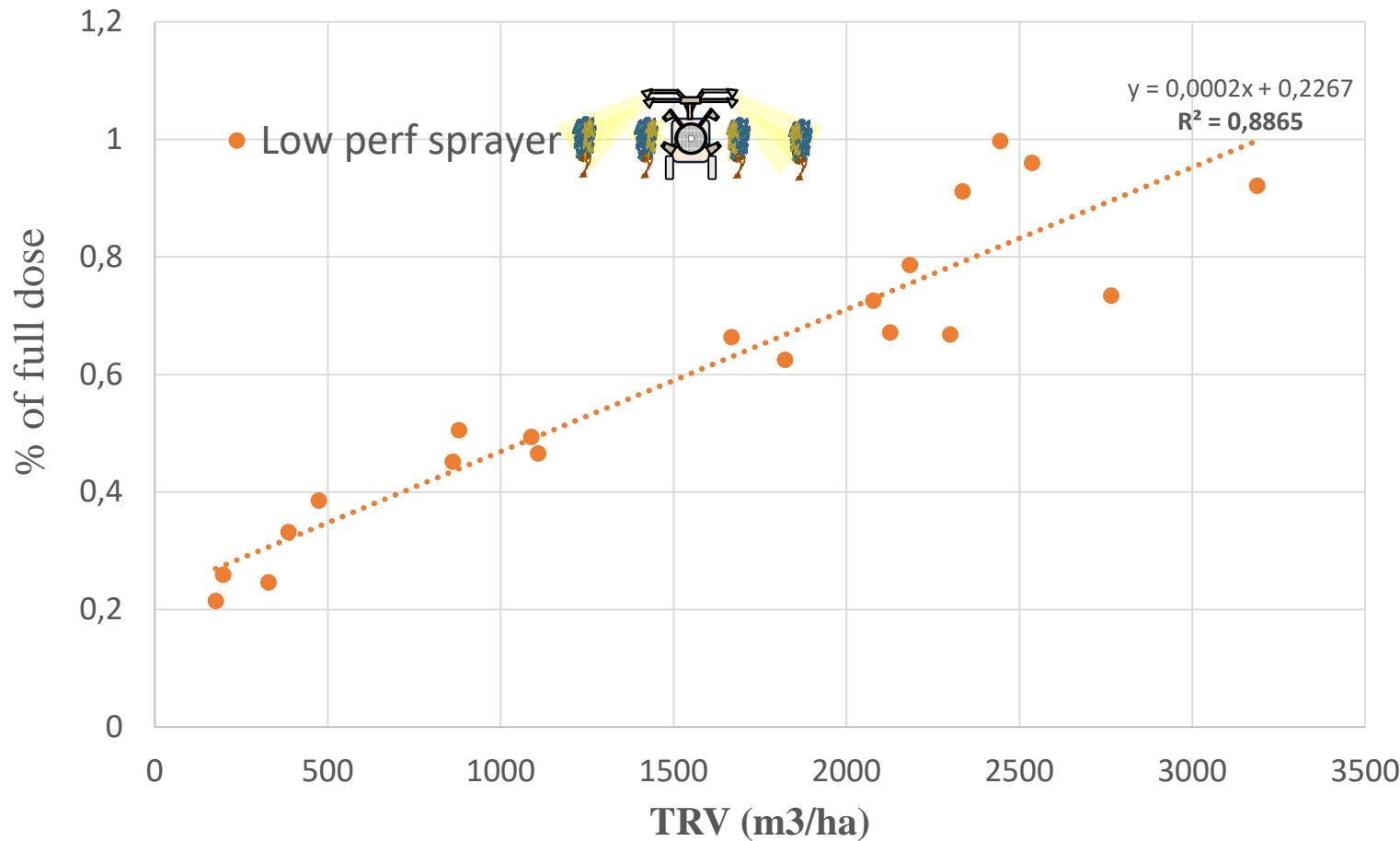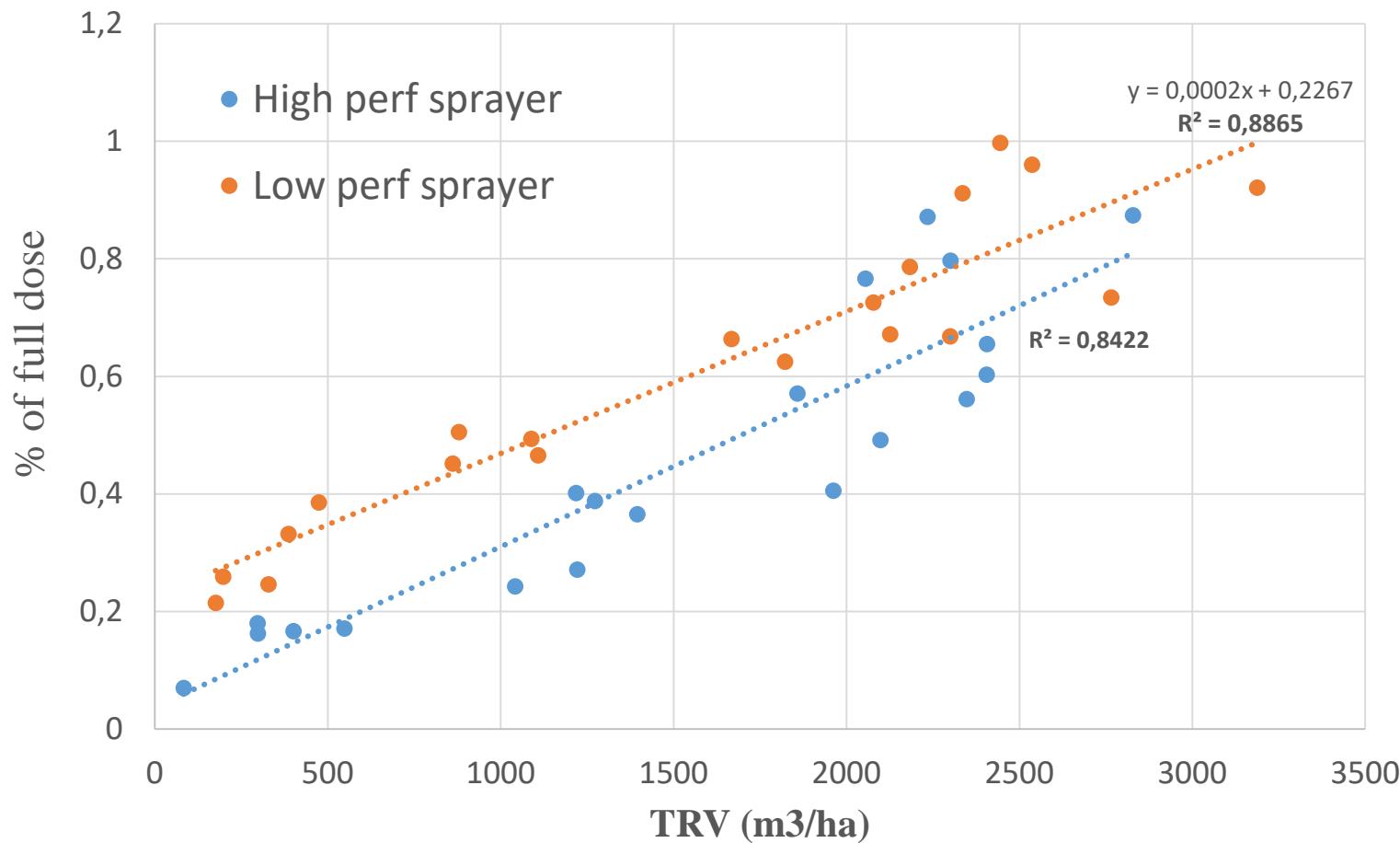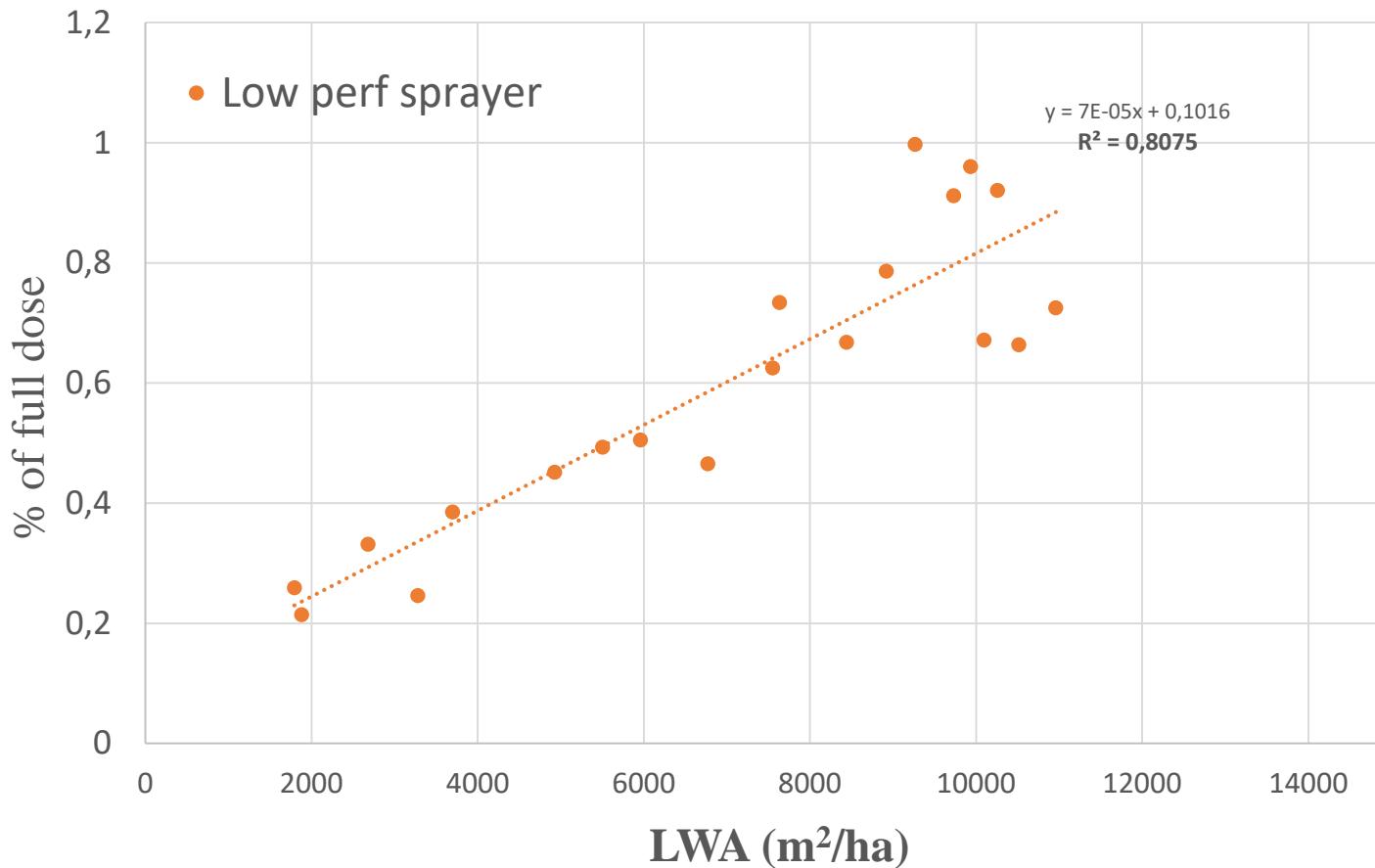
Results

Application of full dose rate with Low perf sprayer at each treatment (The Full dose rate is fixed and constant per ground area).

**Deposit Distribution – deposit in ng/dm² for 1g/ha**
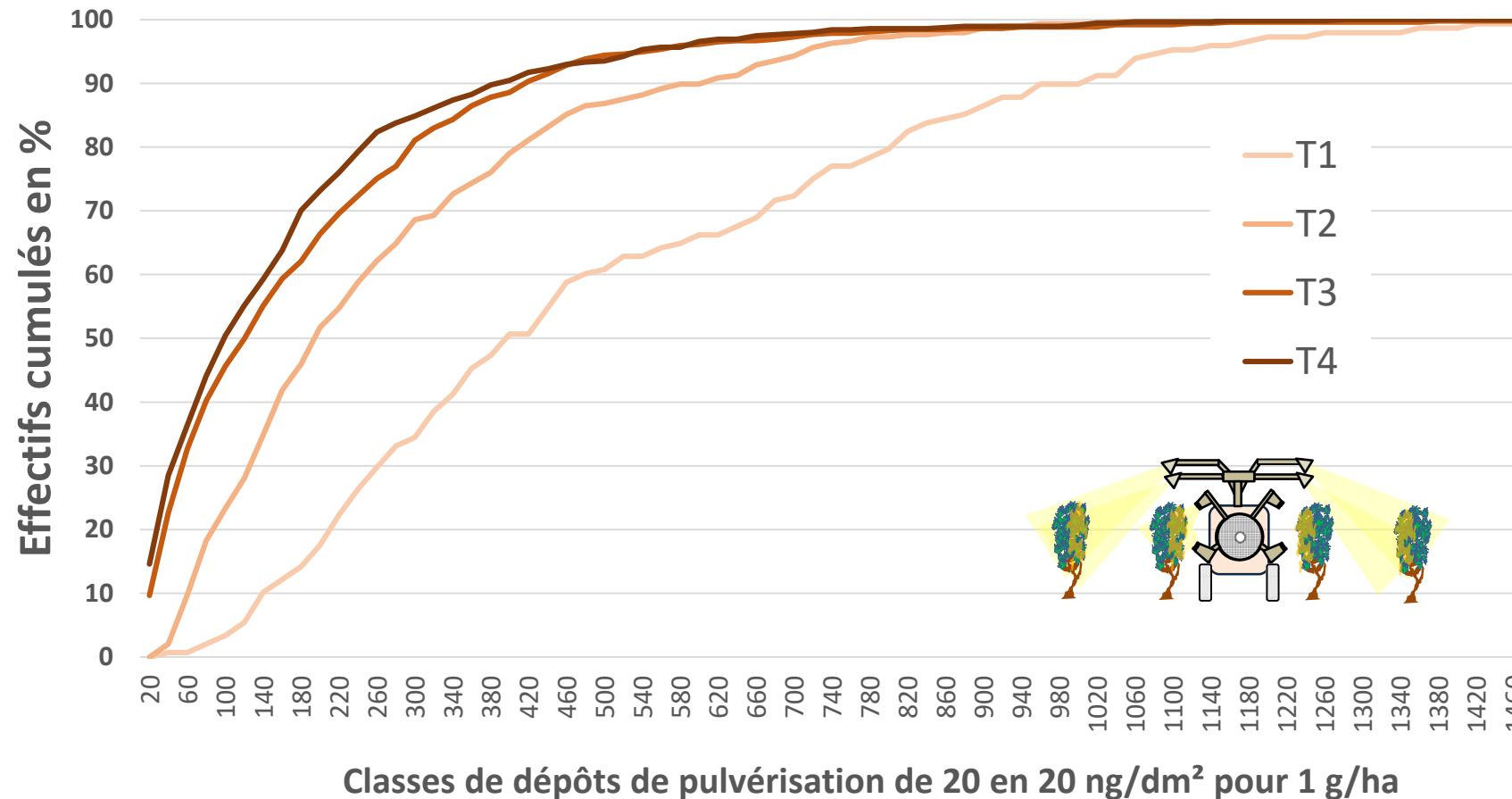
Y-axis: **Effectifs cumulés en %**

X-axis: **Classes de dépôts de pulvérisation de 20 en 20 ng/dm² pour 1 g/ha**

Legend: T1, T2, T3, T4

Results

Simulation of deposit distribution due to a linear adaptation of dose rate to LWA with LWA max = 15 000 m² Low perf sprayer

**Deposit Distribution – deposit in ng/dm² for (LWA$_{plot}$ / 15000) g/ha**
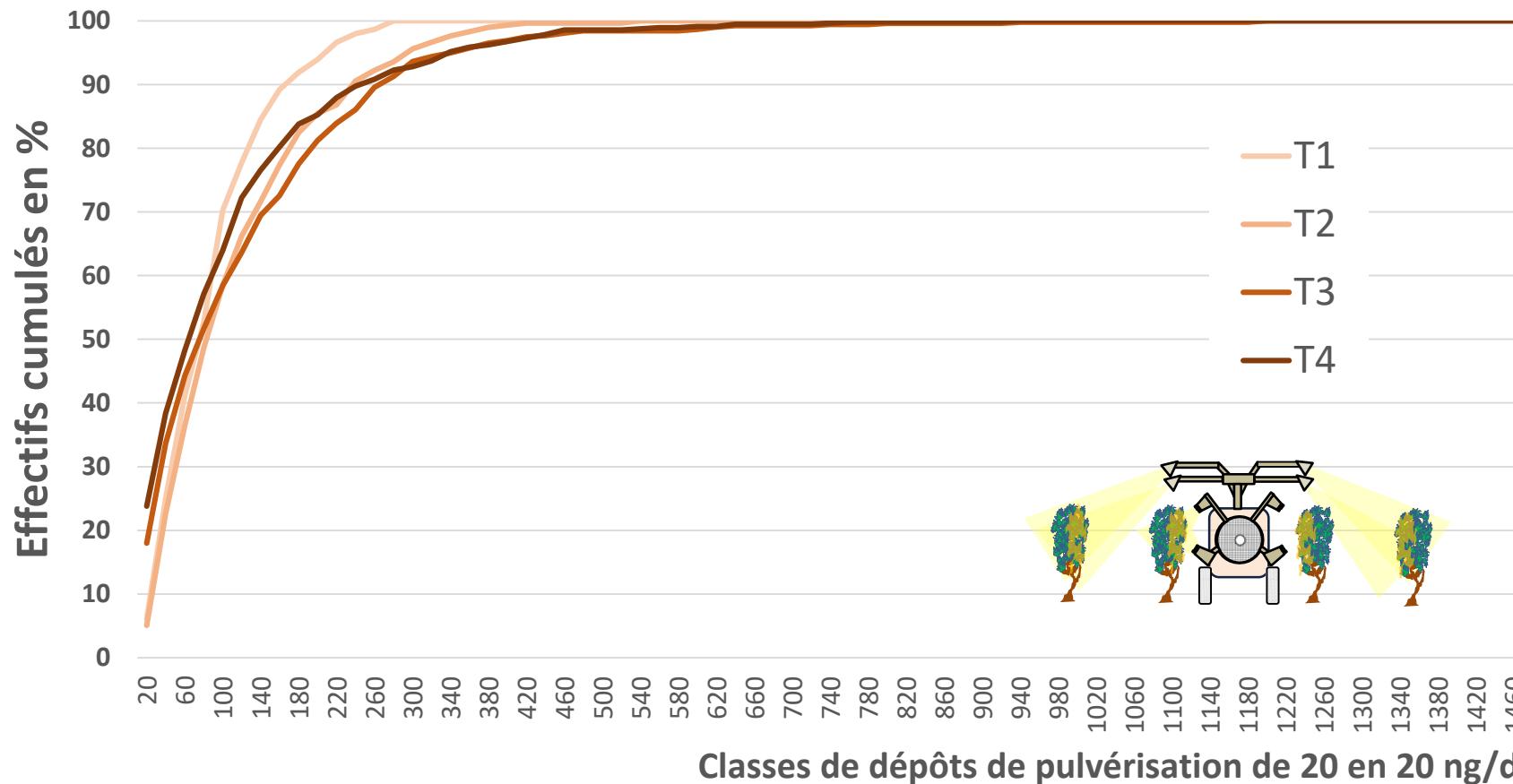
Results

Simulation of deposit distribution due to a linear adaptation of dose rate to LWA with LWA max = 15 000 m² High Perf sprayer

Deposit Distribution – deposit in ng/dm² for (LWA$_{plot}$ / 15000) g/ha
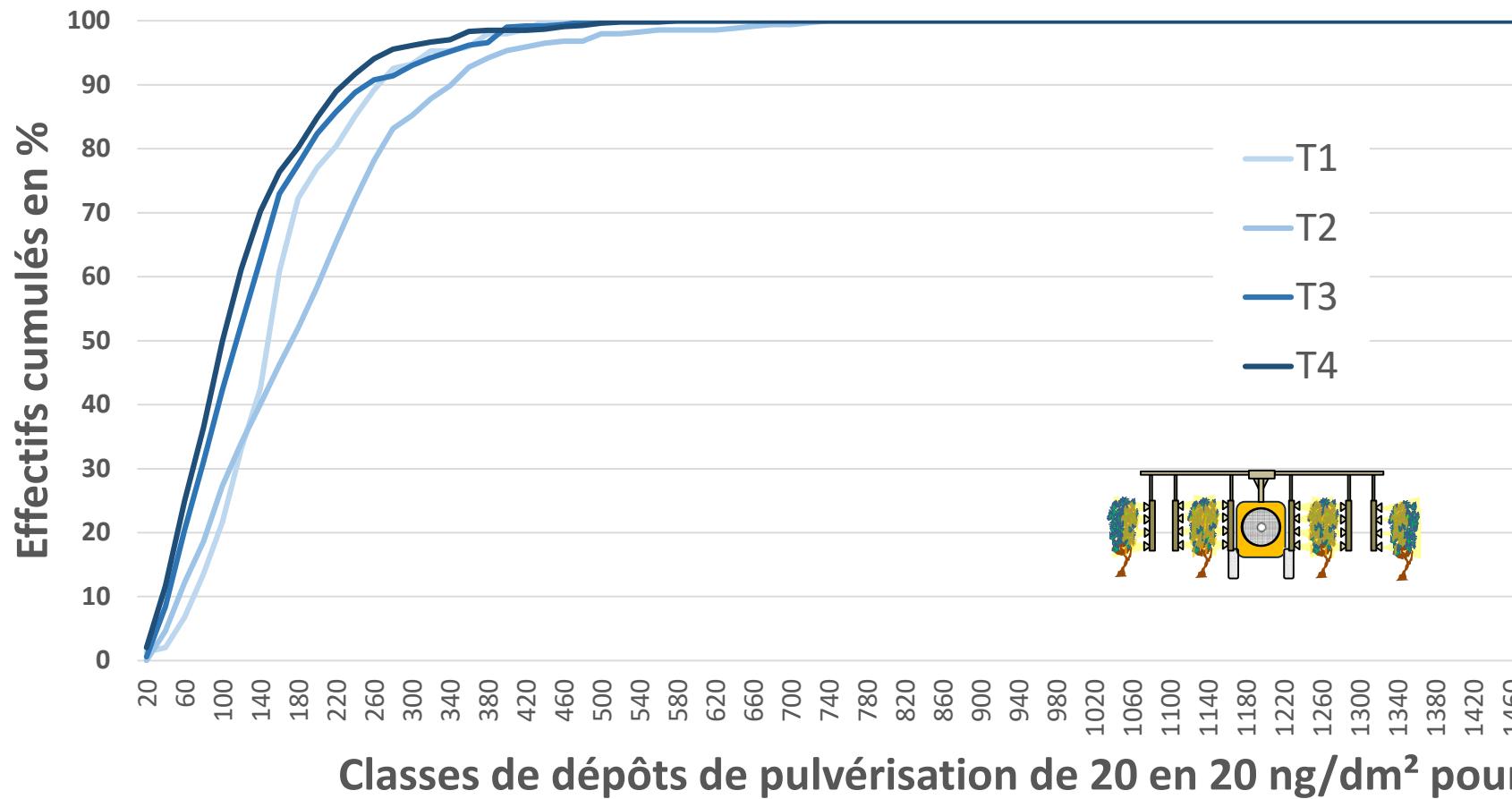
Perspectives

An 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 scenario possible 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.

Dose Rate in kg/ha		Growth stage (BBCH scale)		
		12 à 53 Début de végétation à début floraison	**53 à 69** Début à fin floraison	**71 à 77** Fin floraison à début véraison
Distance between rows	1,00 à 1,60m	1 kg/ha	1,3 kg/ha	2 kg/ha
	1,60 à 2,5 m	0,7 kg/ha	1,1 kg/ha	1,8 kg/ha
	2,80 à 3 m	0,5 kg/ha	0,9 kg/ha	1,6 kg/ha

Thanks for your attention !!