Importance of sprayer performance for dose adjustment and plant protection security: The tools allowing to classify sprayers according to safety margins for dose adjustment

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Summary:

- Introduction : *Comparison of dose rates between countries → What does mean dose adjustment?*
- How to assess sprayer performance?
- Presentation of sprayers test bench EvaSprayViti
- Overview of results: Analysis of safety margins for dose adjustment based on sprayer performance and crop parameters.
- Conclusions

Dose rate expression according to countries

	Fixed dose per hectare
	Concentration range, Max Vol/ha (1000 l)
	Concentration range, Max Vol/ha (1000 l)
	Dose per Hectare Evolution of the dose **according to growth stages** **(4 levels from 1 to 4)**
	Dose per Hectare Evolution of the dose **according to growth stages** **(5 levels from 1 to 2,6)**

Study 2011: Comparison of 17 fungicides <u>with the same recipe</u> at EU level

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

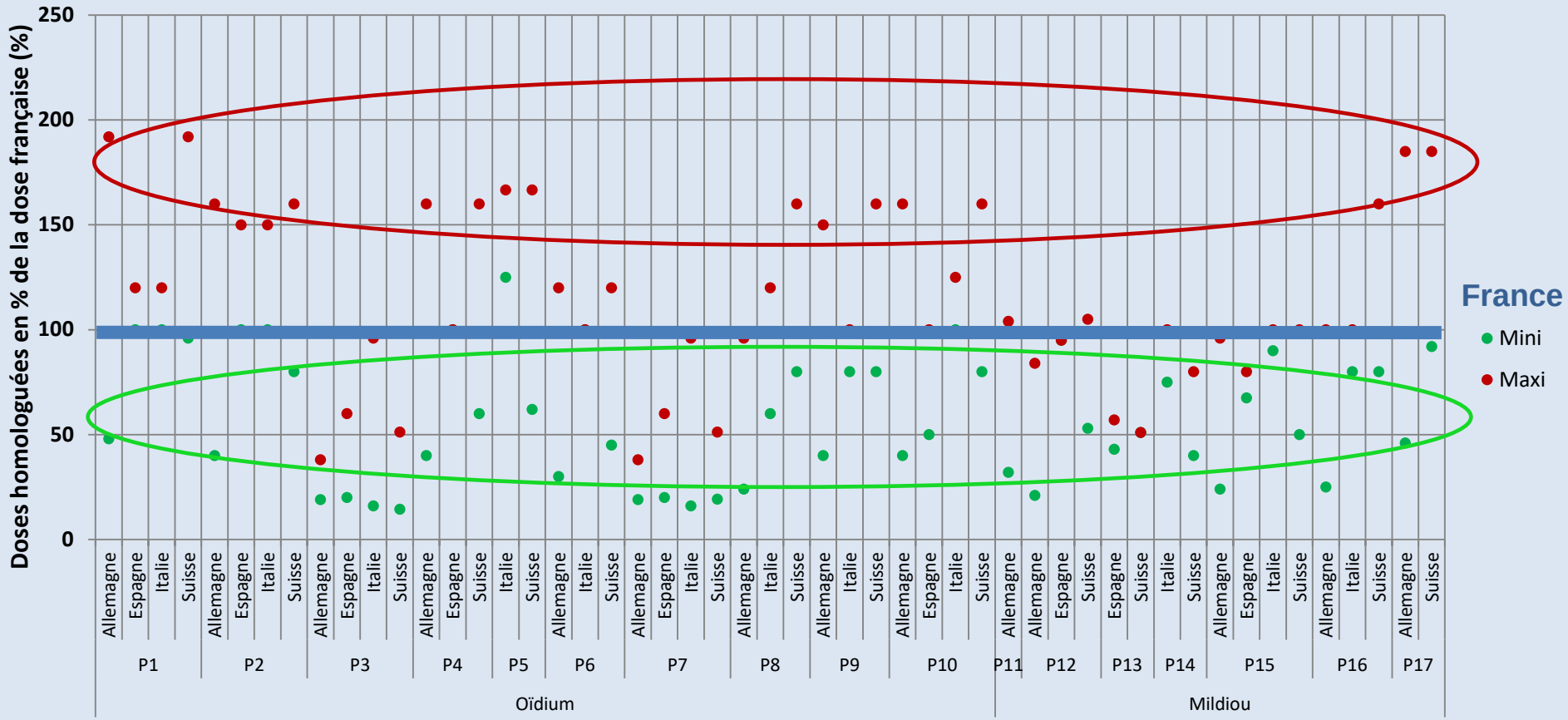
European comparison of 17 fungicides (study 2011)

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)



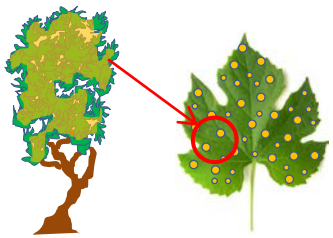
For each product, the dose rate is expressed as a percentage of the French fixed dose.

A <u>real</u> <u>real</u> need for harmonization.

How to assess spray efficacy?

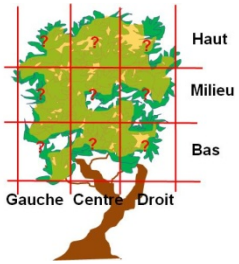
Deposit / unit area of canopy

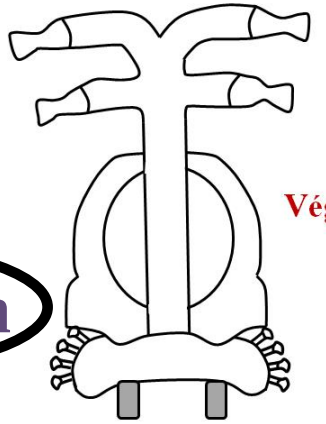
Quantity



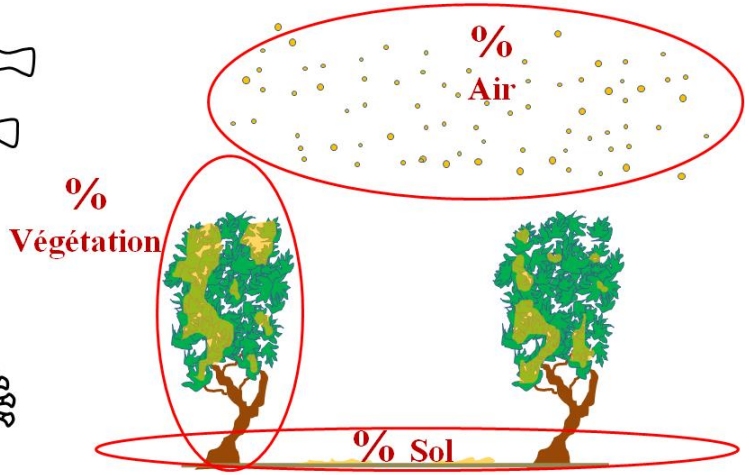
Unit = ng/dm²
for 1 g of product sprayed / ha

Distribution



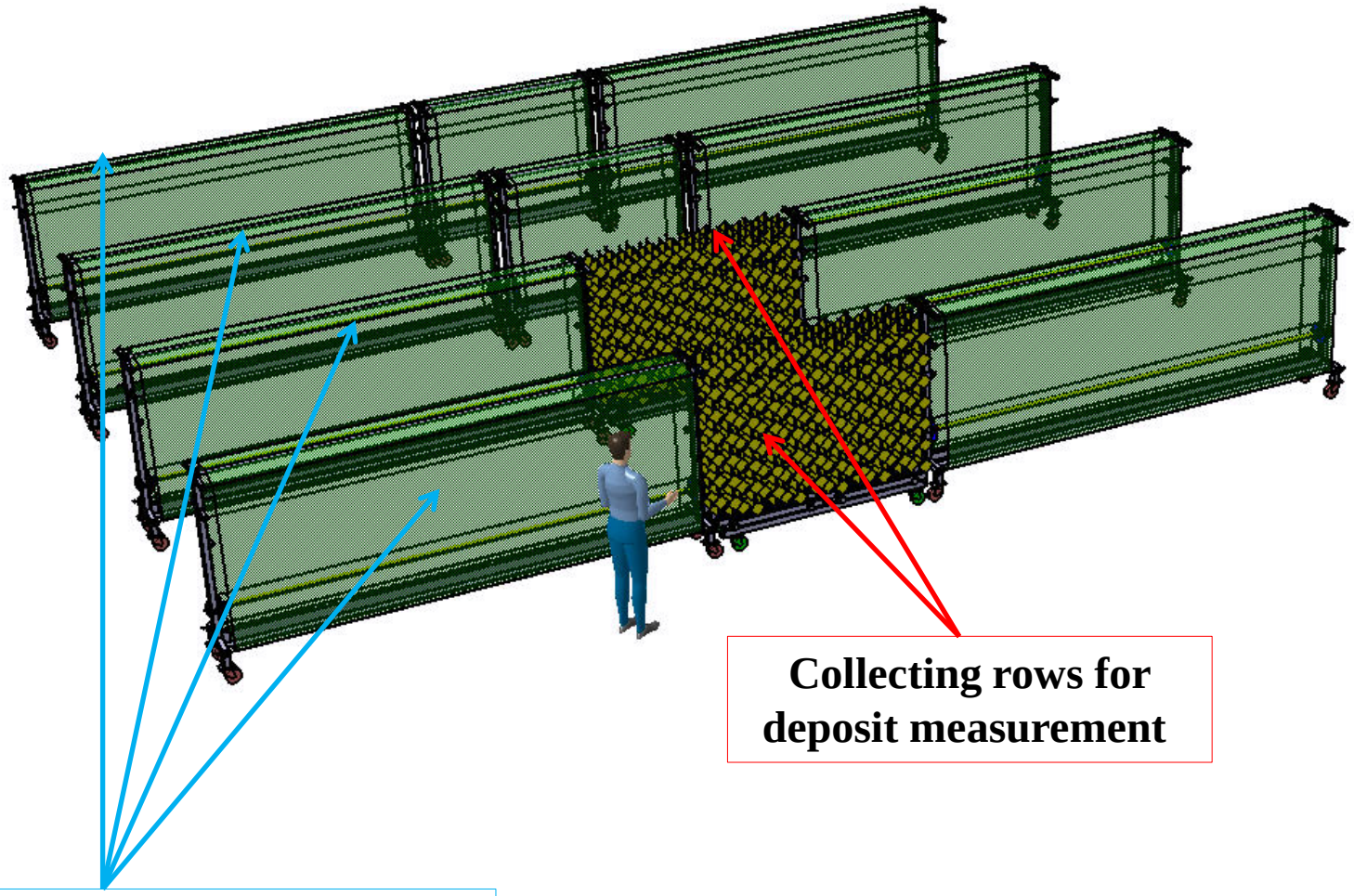


Environmental Assessment



EvaSprayViti test bench

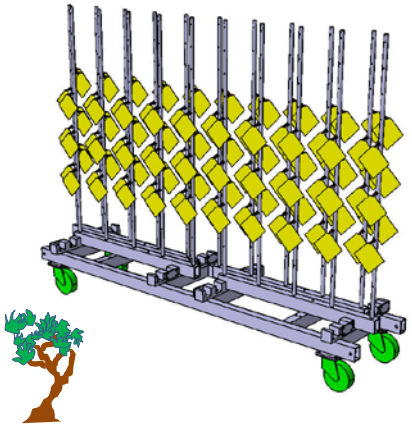
4 artificial rows of vine - 10 m long



EvaSprayViti mimics: 3 growth stages

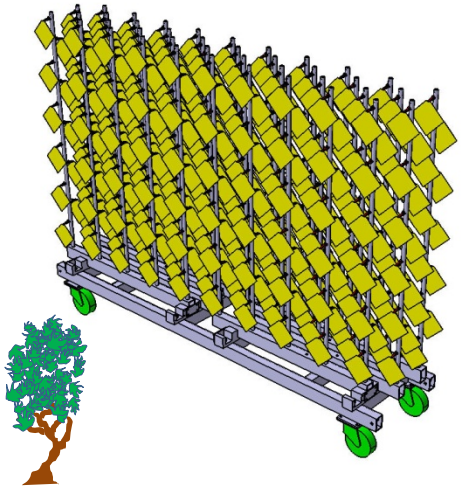
Early growth stage

LAI = 0,24 ha/ha



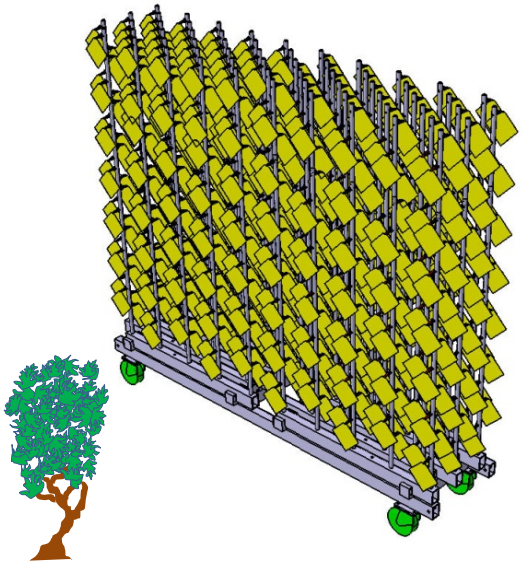
Medium growth stage

LAI = 0,88 ha/ha



Full growth stage

LAI = 1,68 ha/ha



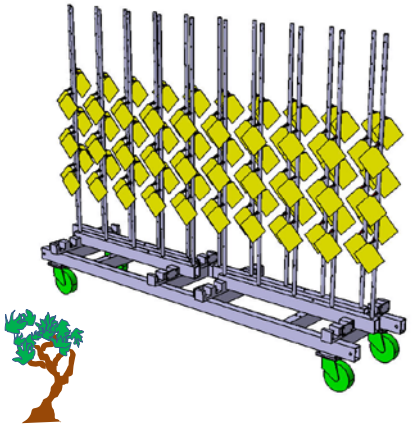
Collecting rows : « leaves »

EvaSprayViti mimics:
3 growth stages for <u>2 training systems</u>

large vineyard ir = 2,5m and narrow vineyard ir = 1,1m

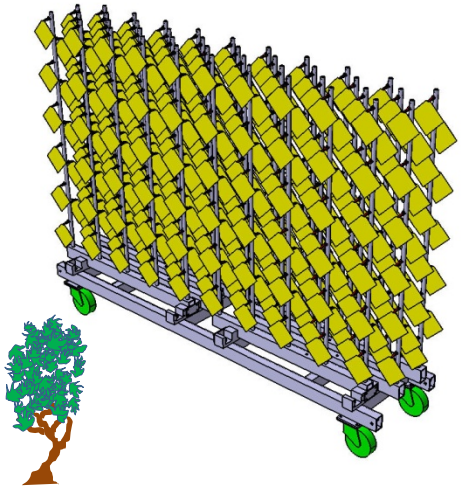
Early growth stage

LAI = 0,24 ha/ha



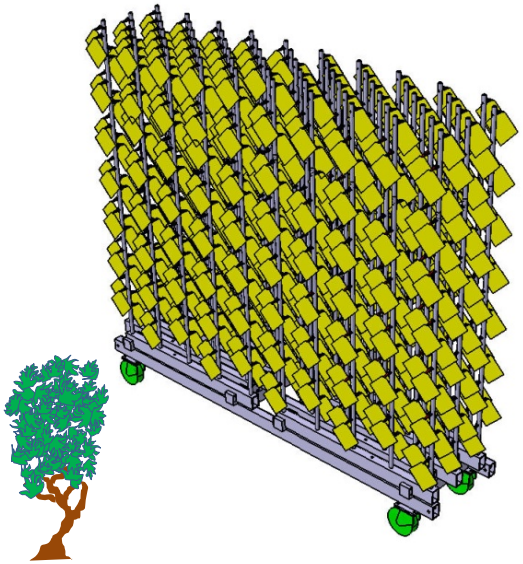
Medium growth stage

LAI = 0,88 ha/ha



Full growth stage

LAI = 1,68 ha/ha



Collecting rows :
« leaves »


Early growth stage


Medium growth stage


Full growth stage

Presentation of EvaSprayViti test bench

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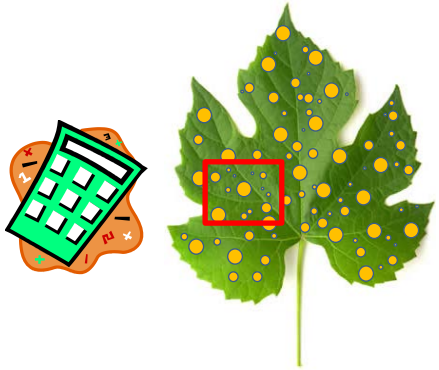
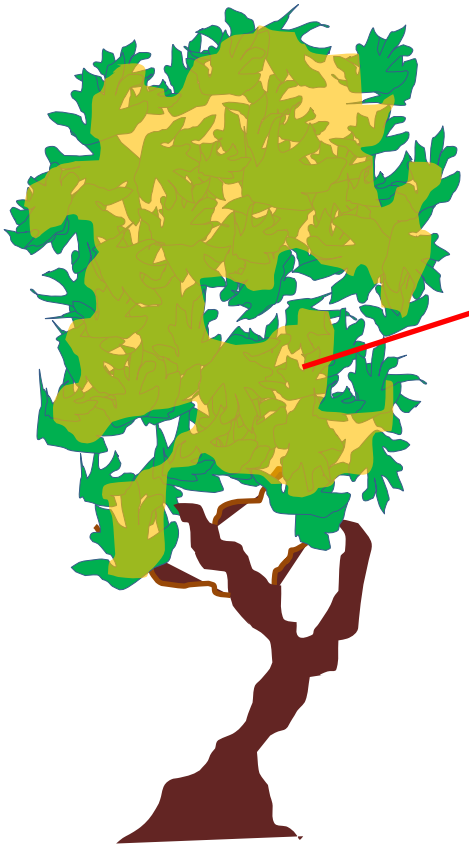
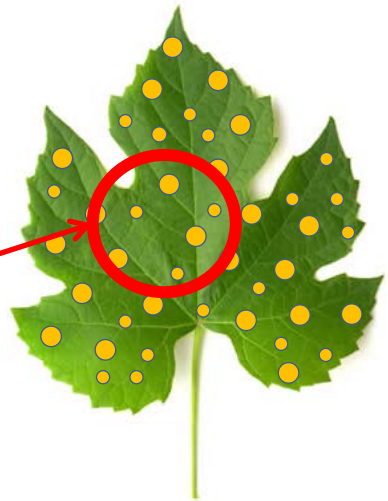


Calculation of spray quality indicators





Indicator n° 1 :

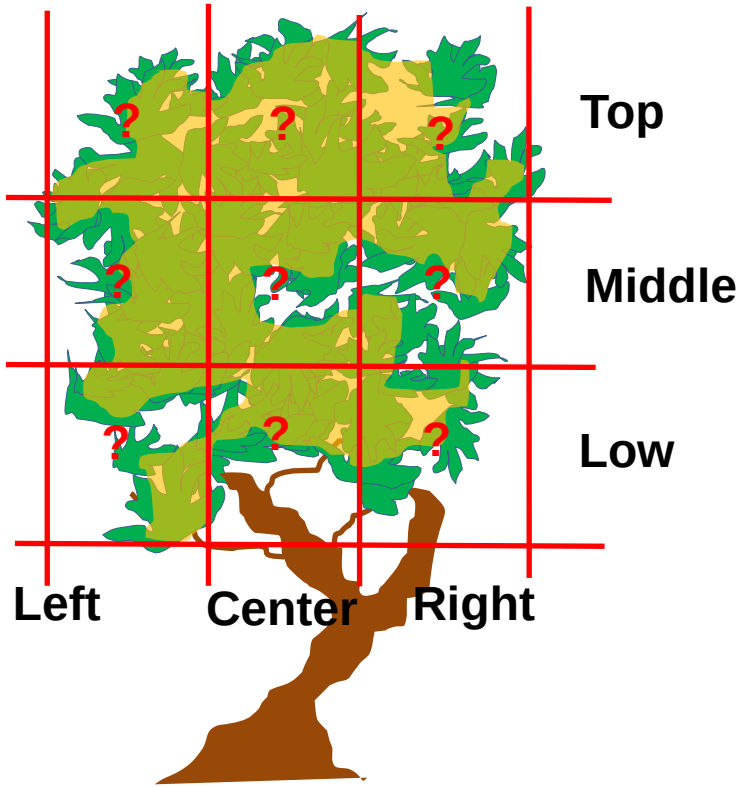
Effective Dose

Average deposition per unit area of leaves on the canopy

= average of the deposit values of each compartment

<u>Reference Unit:</u> = ng/dm² for 1 g of product sprayed per ha

Calculation of spray quality indicators



Indicator n° 2 :

Homogeneity of deposit distribution in the different compartments

$$CV\ (\%) = \frac{\text{standard deviation of deposition}}{\text{average deposition}} * 100$$

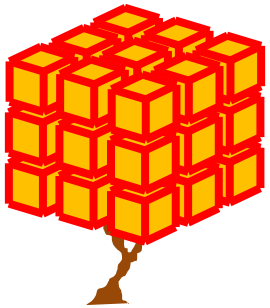
(ISO 22522: 2007)

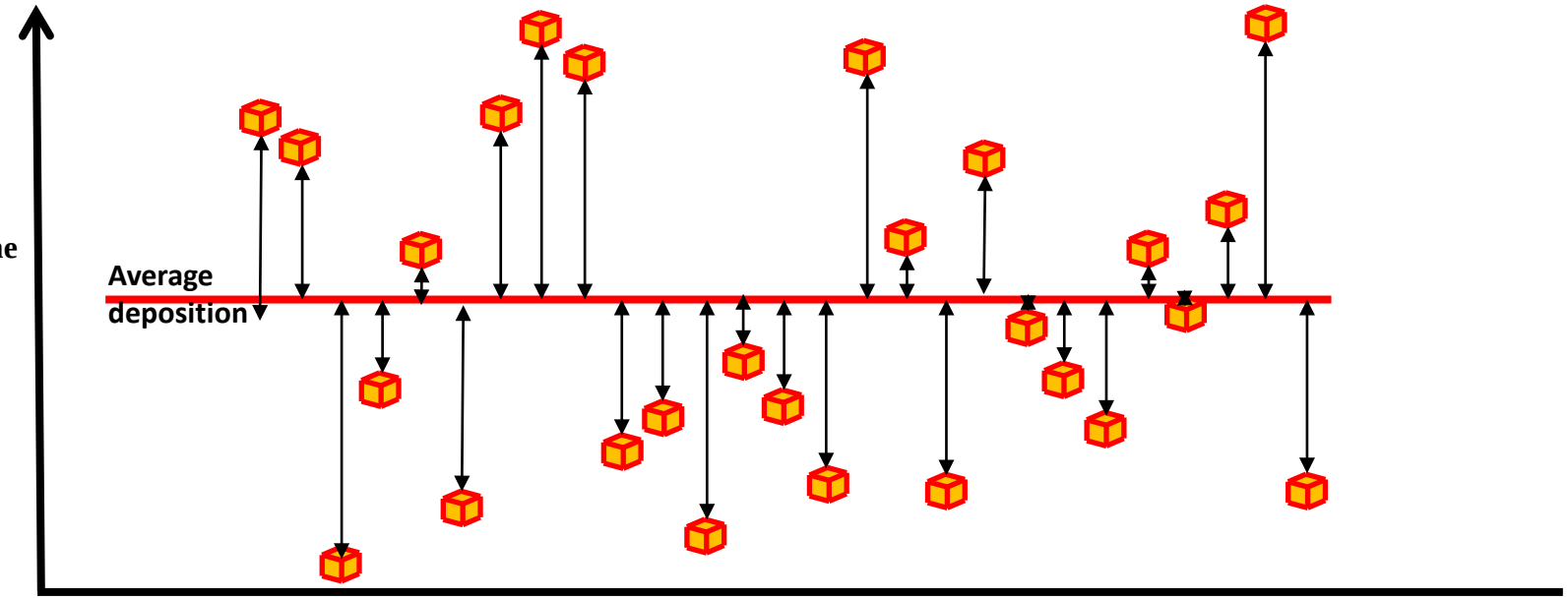
Calculation of spray quality indicators

Indicator n° 2 :

Homogeneity of deposit distribution in the different compartments

Homogeneity indicator integrating all squares of deviations from the mean





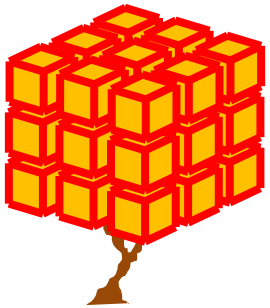
Coefficient of variation (CV) in %

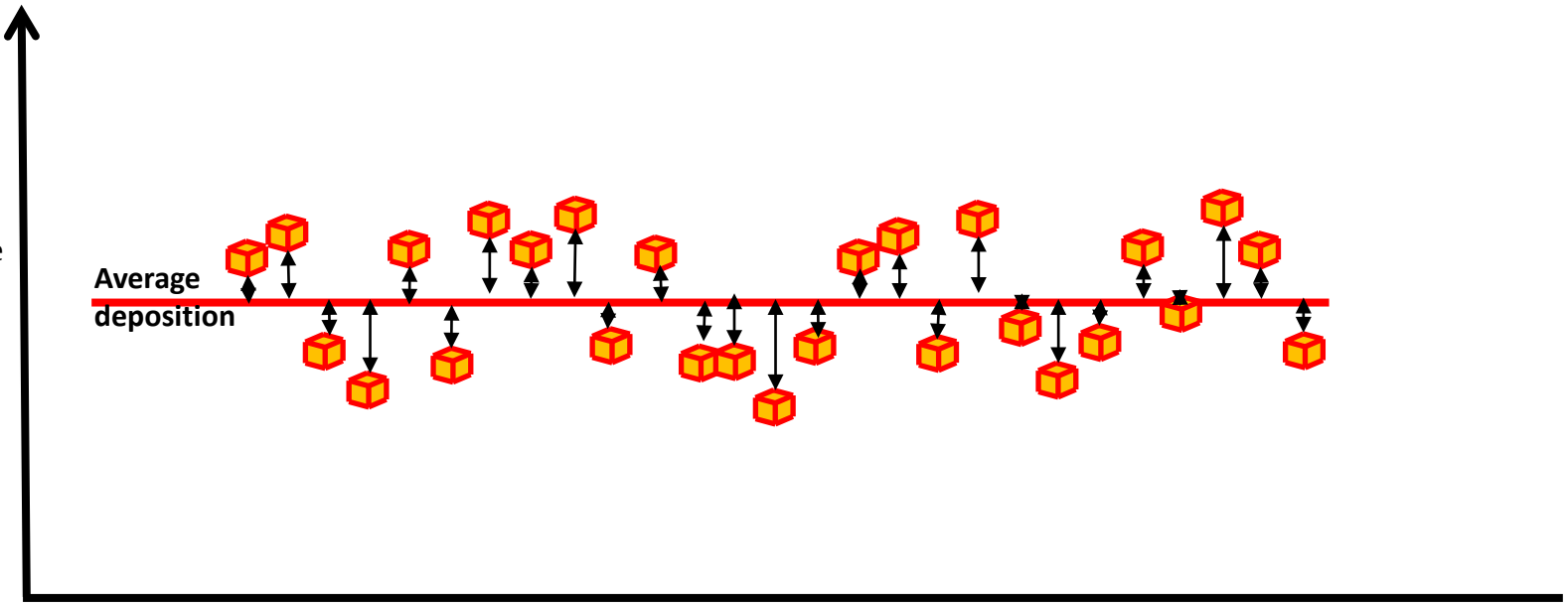
Calculation of spray quality indicators

Indicator n° 2 :

Homogeneity of deposit distribution in the different compartments

Homogeneity indicator integrating all squares of deviations from the mean



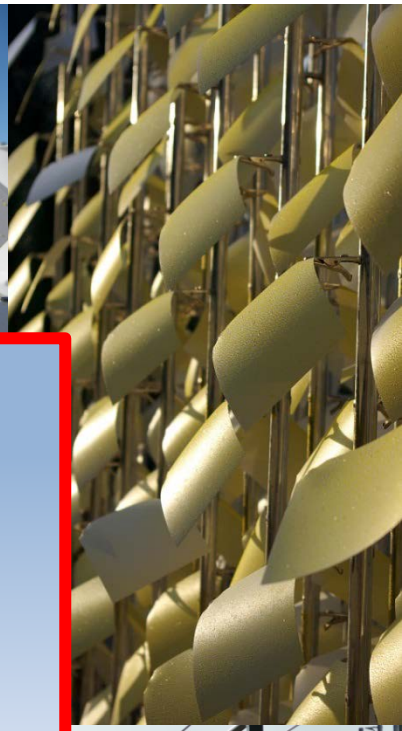


Coefficient of variation (CV) in %

Global analysis of the results

The test programs from 2013 to 2017 in a few numbers



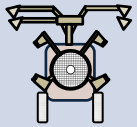
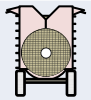
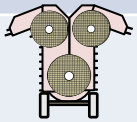
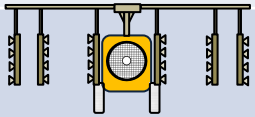
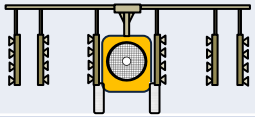
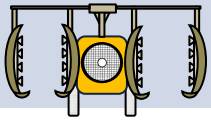



- 24 sprayers for large vineyards (ir= 2,5m)
- 15 sprayers for narrow vineyards (ir=1,1m)
- 217 trials
- More than 50 000 leaves collected
- 7149 measurements
- **1 data base**



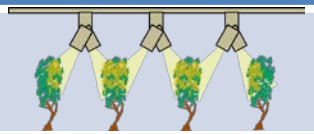
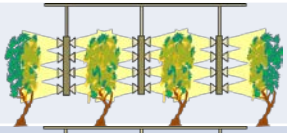
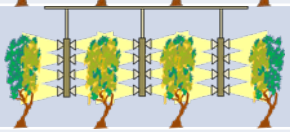
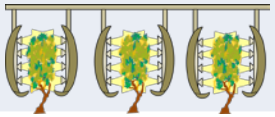
Sprayers assessed from 2014 to 2017 in large vineyard

(distance between the rows = 2,5m)

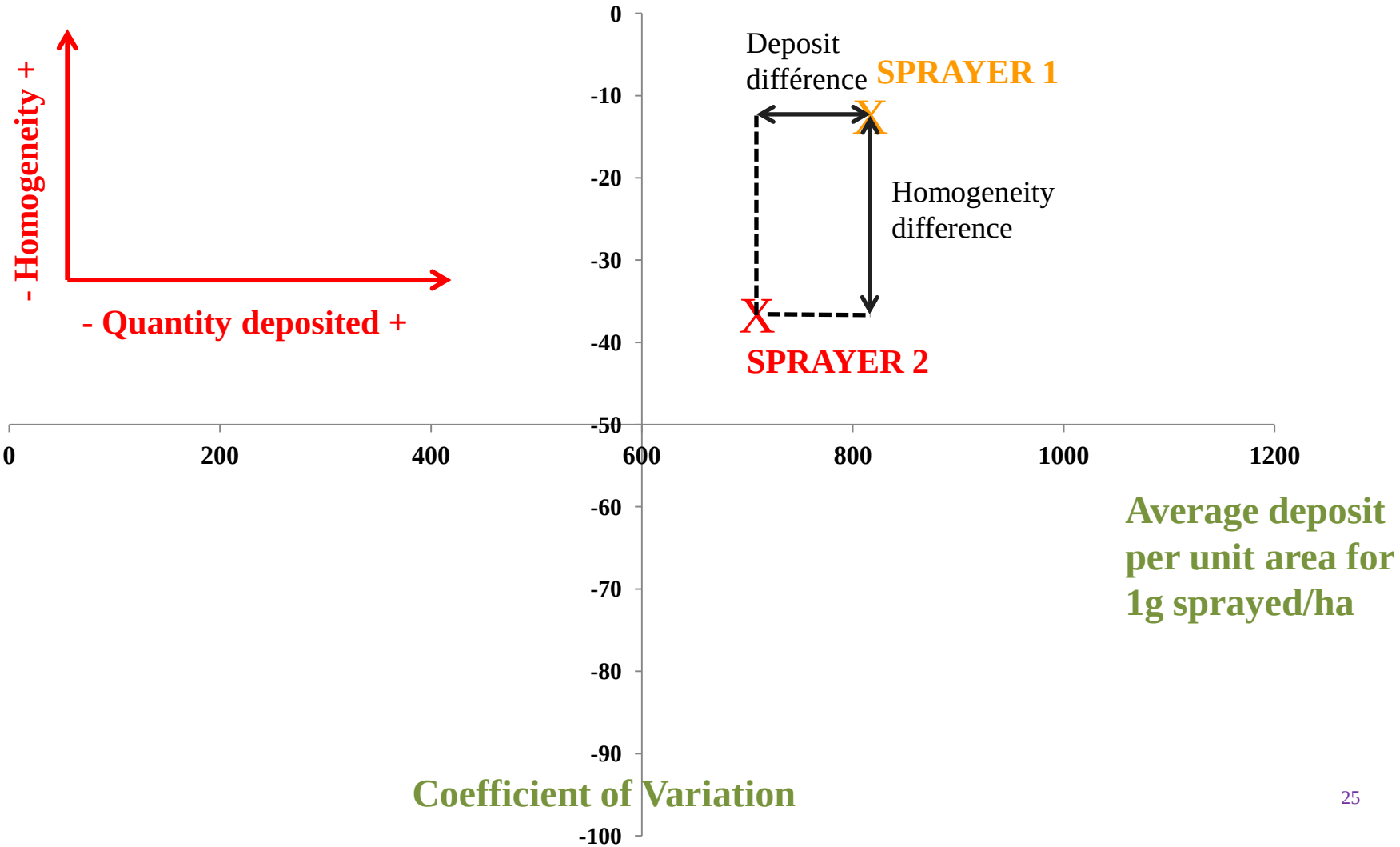
	2013	2014	2015	2016	2017	Total
REFERENCE SPRAYER 	1	2		2		**5**
	1	1	1			**3**
		1				**1**
			1			**1**
pneumatic 	1	1	1	1	1	**5**
air assisted 	2		1		1	**4**
recycling sprayers 			3	2		**5**

Sprayers assessed from 2014 to 2017 in narrow vineyard

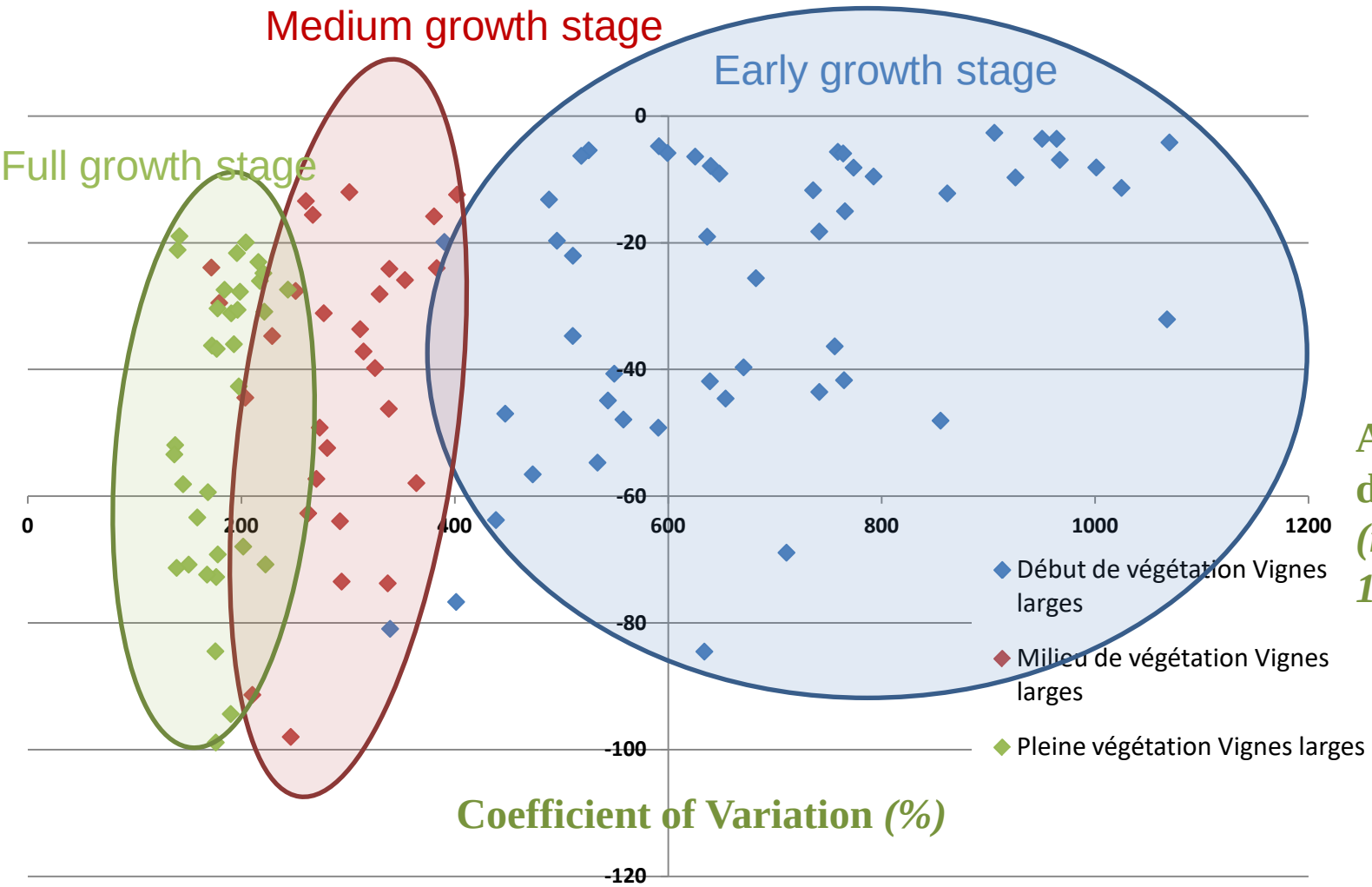
(distance between the rows = 1,1m)

	2015	2016	Total
	2		**2**
	1		**2**
	3	3	**6**
		1	**1**

Synthetic representation of the performance of a sprayer over the season according to 2 axes:

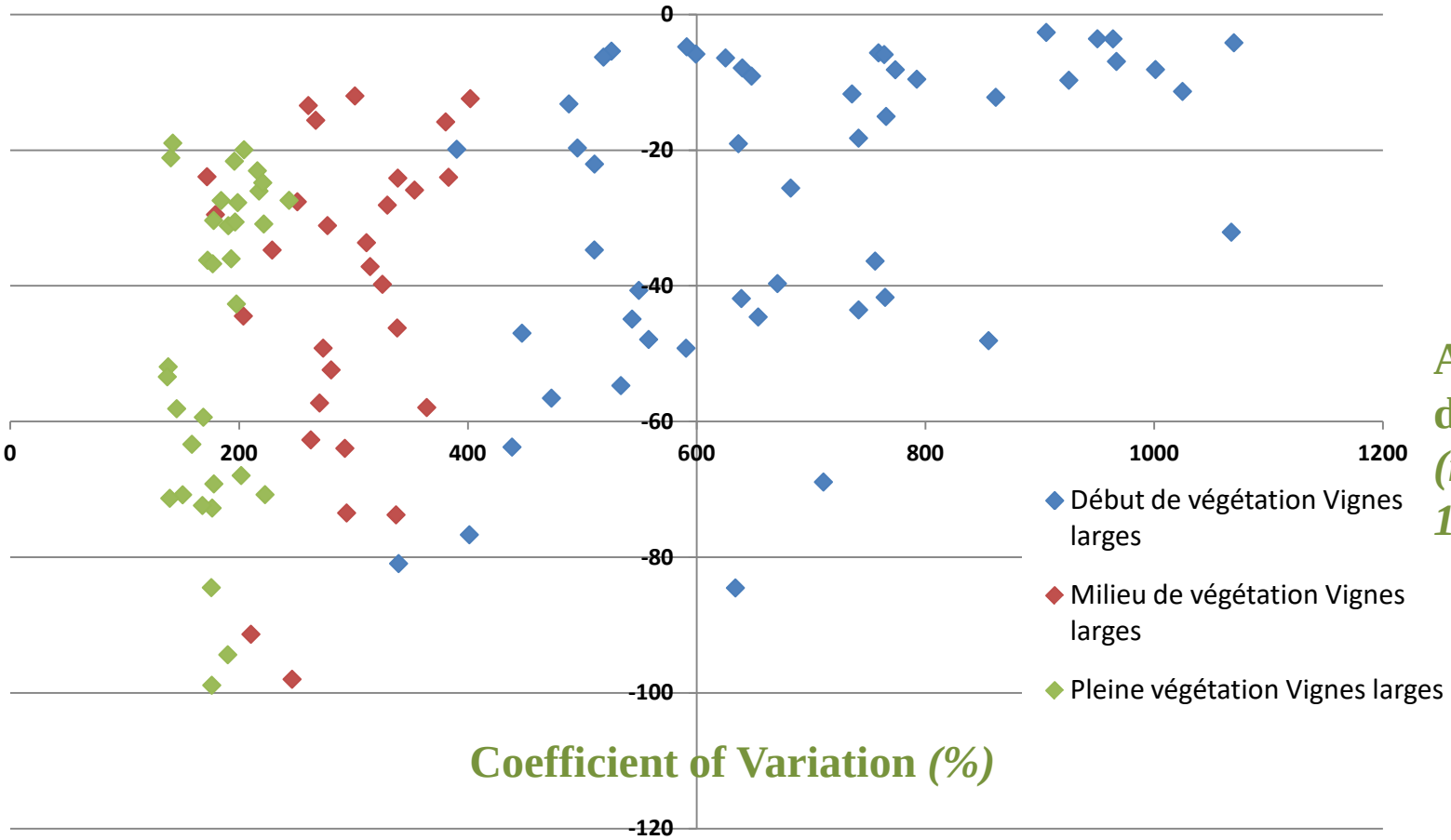


Overall view of the results in large vineyard
Distance between rows = 2,5m



Average spray deposition *(ng/dm2 for 1g/ha)*

Overall view of the results in large vineyard
Distance between rows = 2,5m

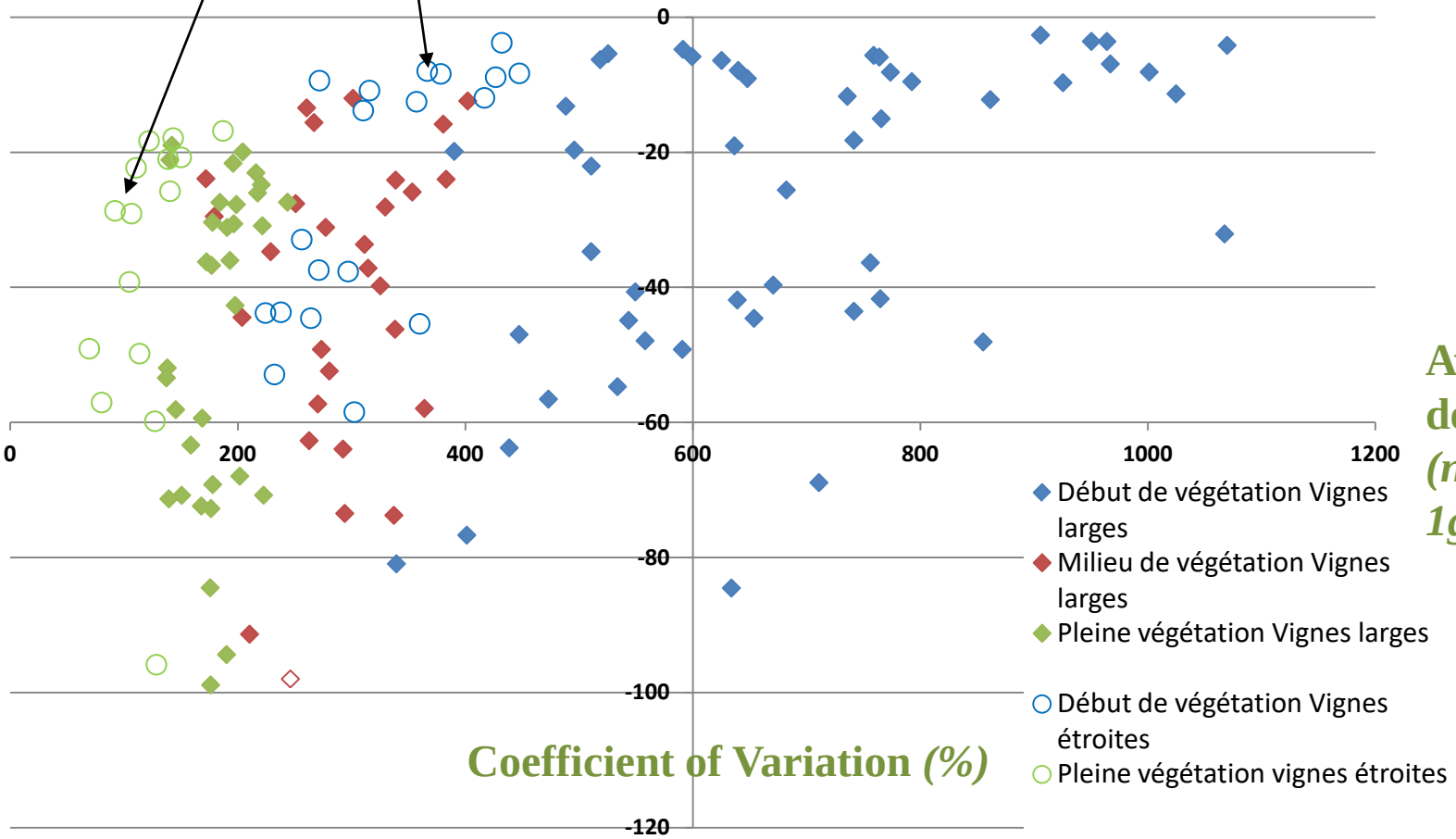


Average spray deposition *(ng/dm2 for 1g/ha)*

Coefficient of Variation *(%)*

Overall view of the results including narrow vineyards

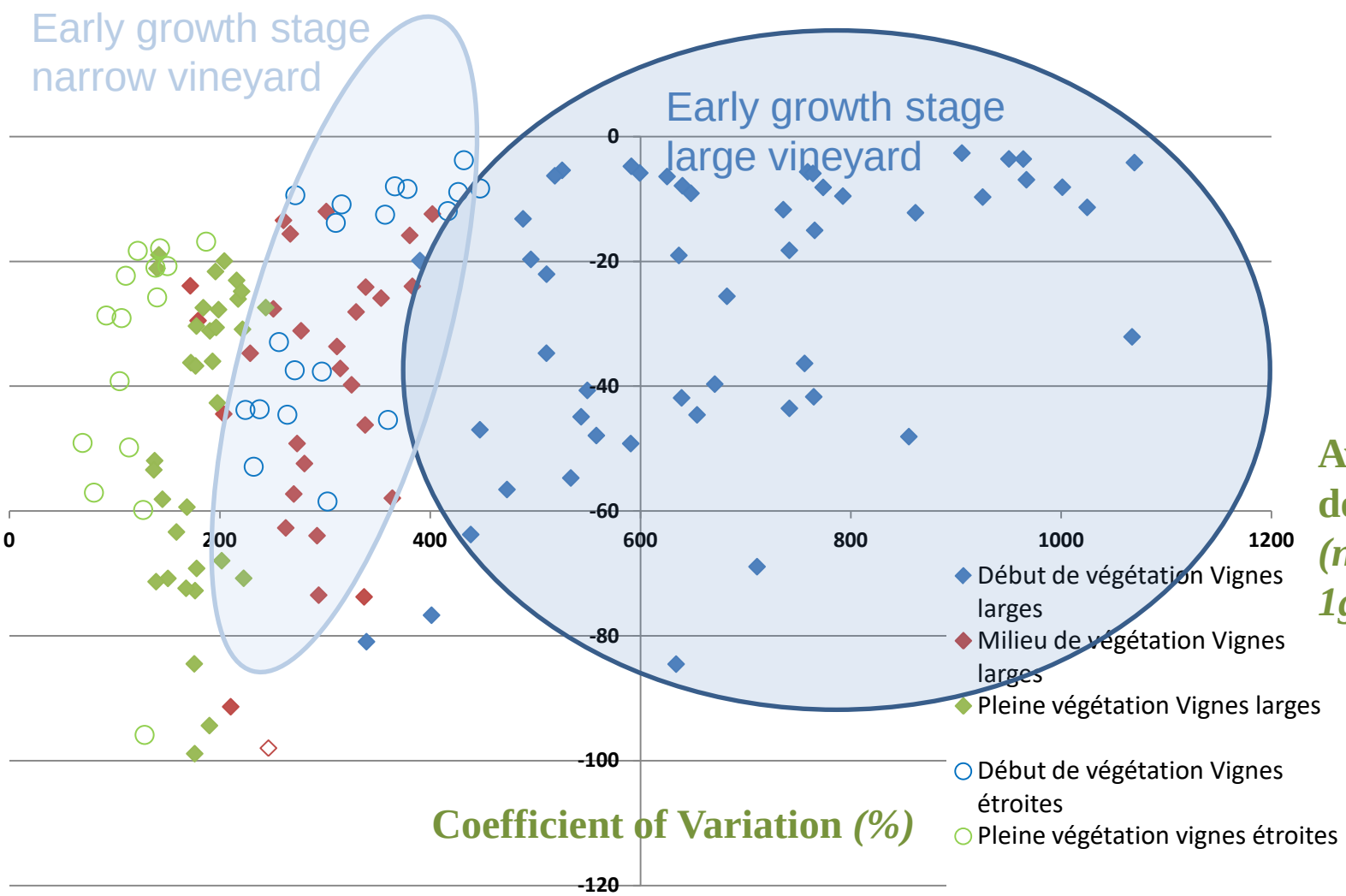
O and O : Narrow vineyard (distance between rows = 1,1 m)



Average spray deposition *(ng/dm2 for 1g/ha)*

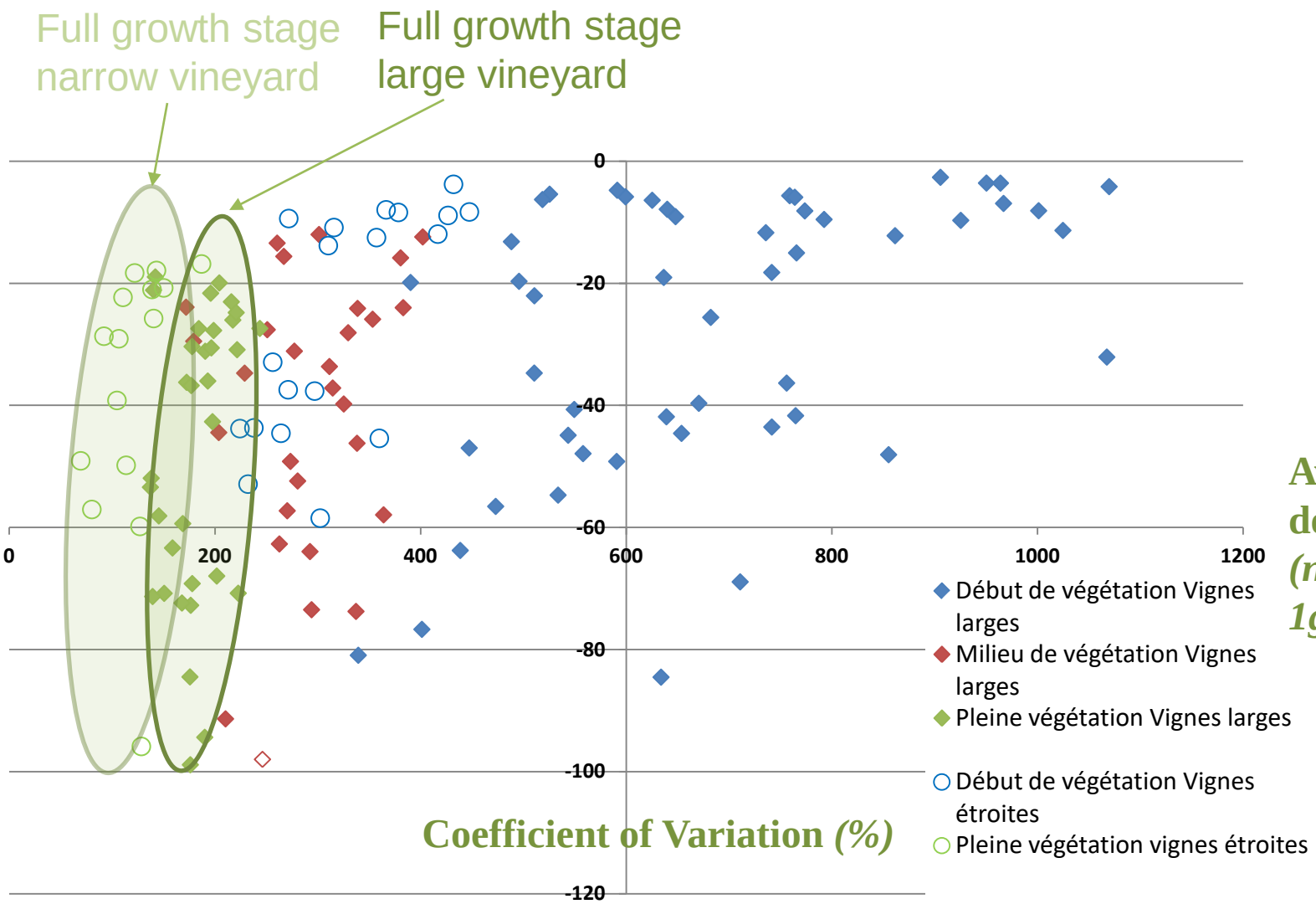
Coefficient of Variation *(%)*

Overall view of the results including narrow vineyards

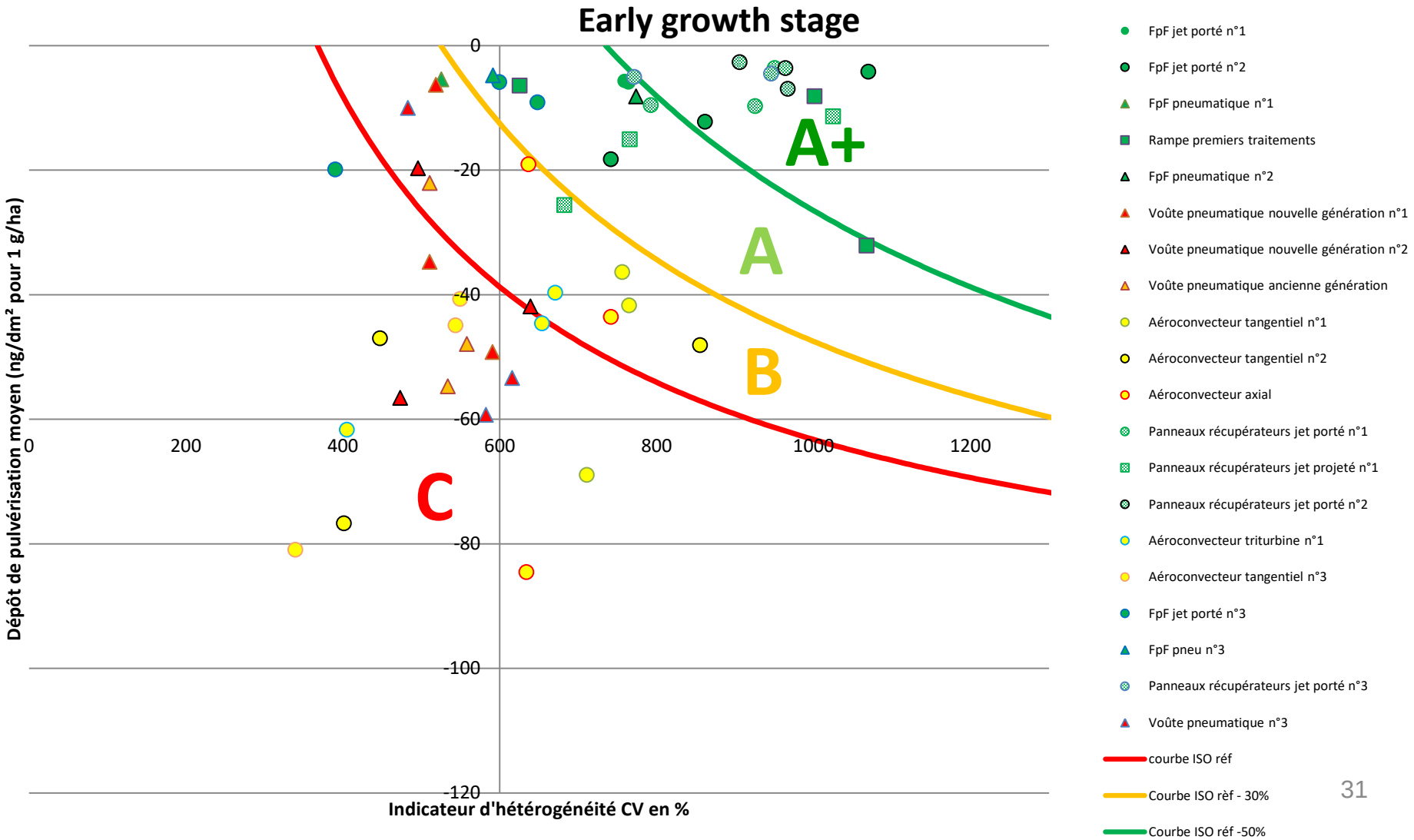


Average spray deposition *(ng/dm2 for 1g/ha)*

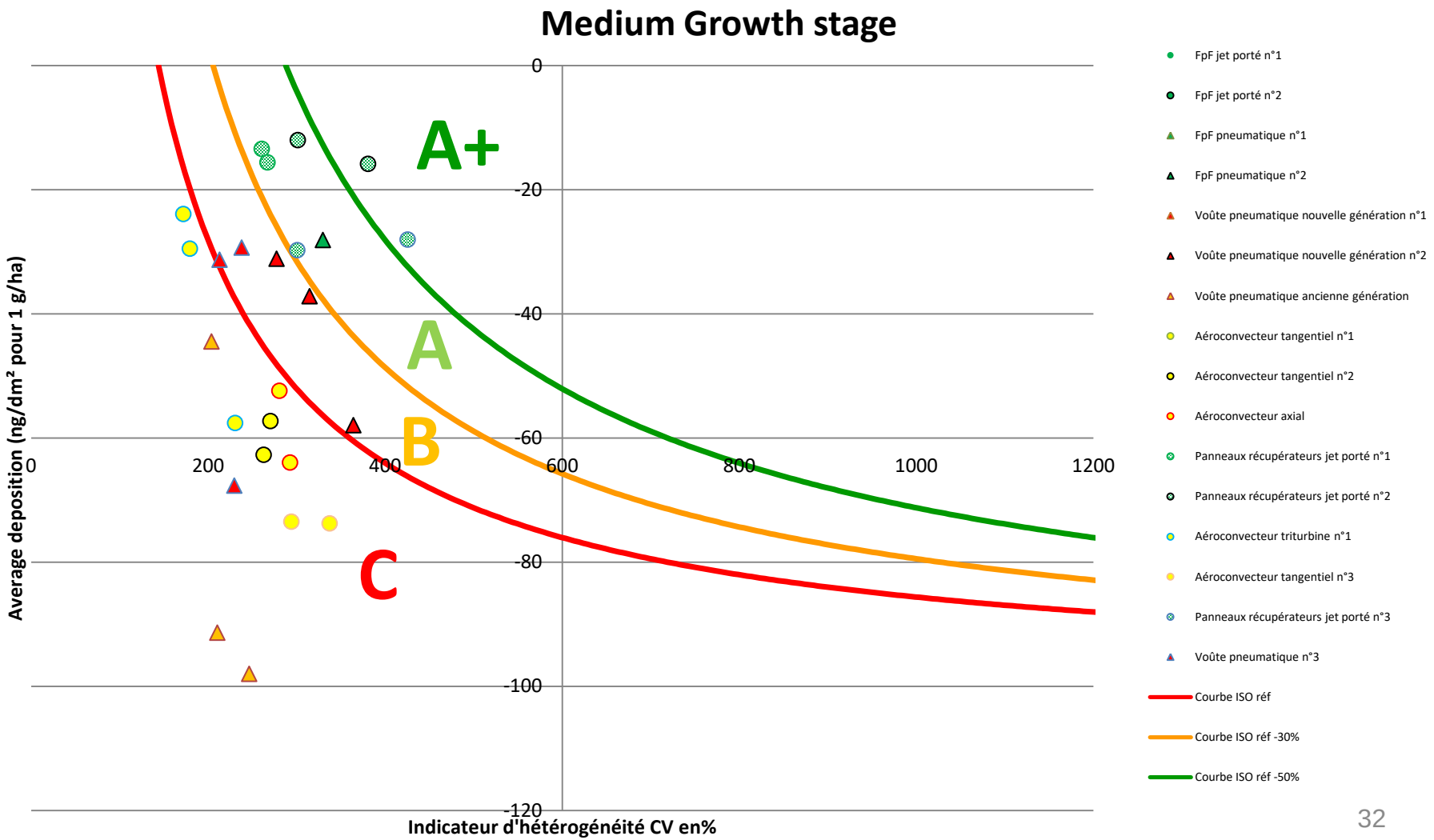
Overall view of the results including narrow vineyards



Display of classification thresholds on the representation according to the two axes



Display of classification thresholds on the representation according to the two axes



Labelling system under construction with manufacturers

will be effective and implemented from June 2019

BRAND : **TOP PULVE**
MODEL : **DEPOS+**

	DOSE REDUCTION POTENTIAL: maintenance of the deposit with a dose reduction of :	GROWTH STAGES
A+	50 %	A+
A	30 %	A A
B	No systematic dose reduction possible.	
C	No dose reduction possible	

Thanks for you attention

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