



# PULVARBO :

## A FRENCH PROJECT

### TO IMPROVE SPRAY APPLICATION IN FRUIT GROWING



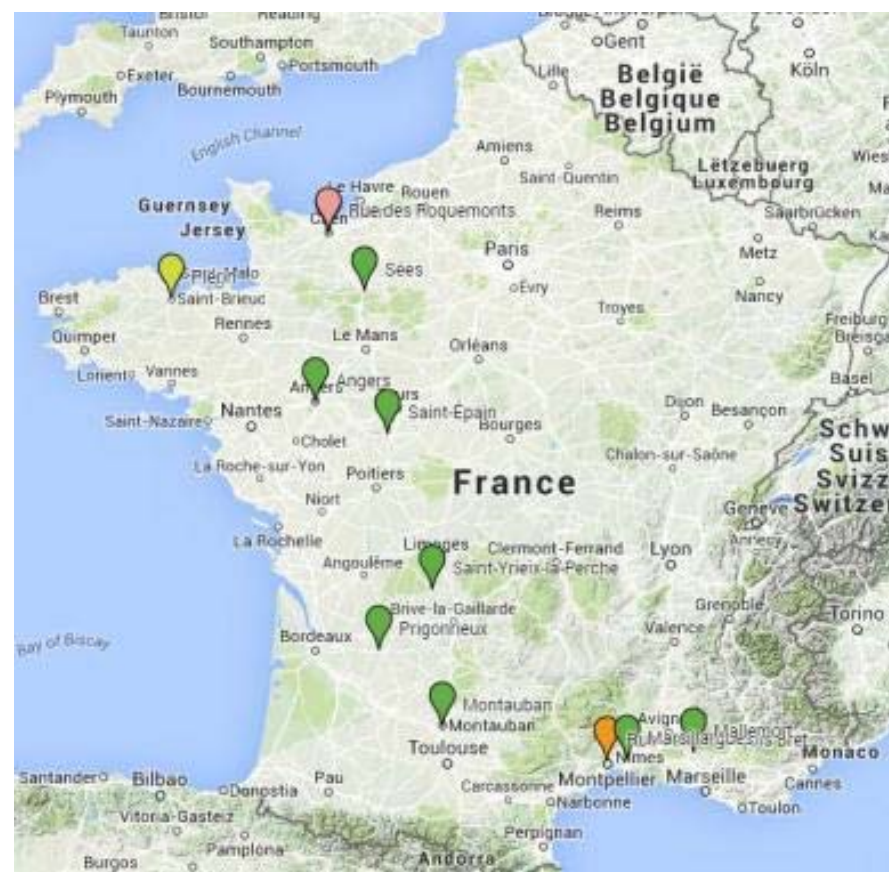
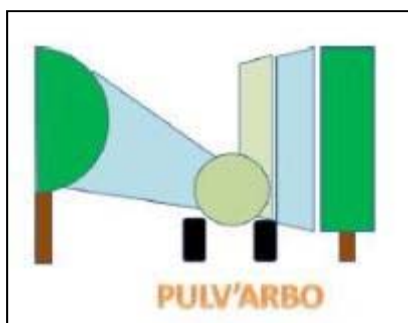
Florence VERPONT, Ctifl

14th Workshop on Spray Application in Fruit Growing, Hasselt, Belgium 10-12 May 2017



# WHAT IS THE PULVARBO PROJECT?

- A national multidisciplinary project, involving 12 different partners : Ctifl, IRSTEA, regional stations of experiments, the cider sector, in close cooperation with sprayers manufacturers, UIPP, INRA and Agricultural Ministry.





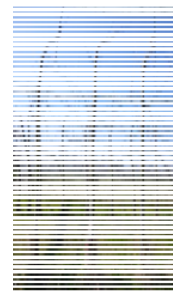
# WHAT IS THE PULVARBO PROJECT?

- 5 years to propose a set of ways to improve spray application in fruit growing, sustainable technically and economically, and fulfilling the objective of our National Ecophyto Plan (reduction of the use of plant production products PPP -25% in 2020 et -50% in 2025).

## Two main aims

**Optimize practices** by identifying the most performant sprayers, setting parameters and practices in terms of spray quality and drift reduction.

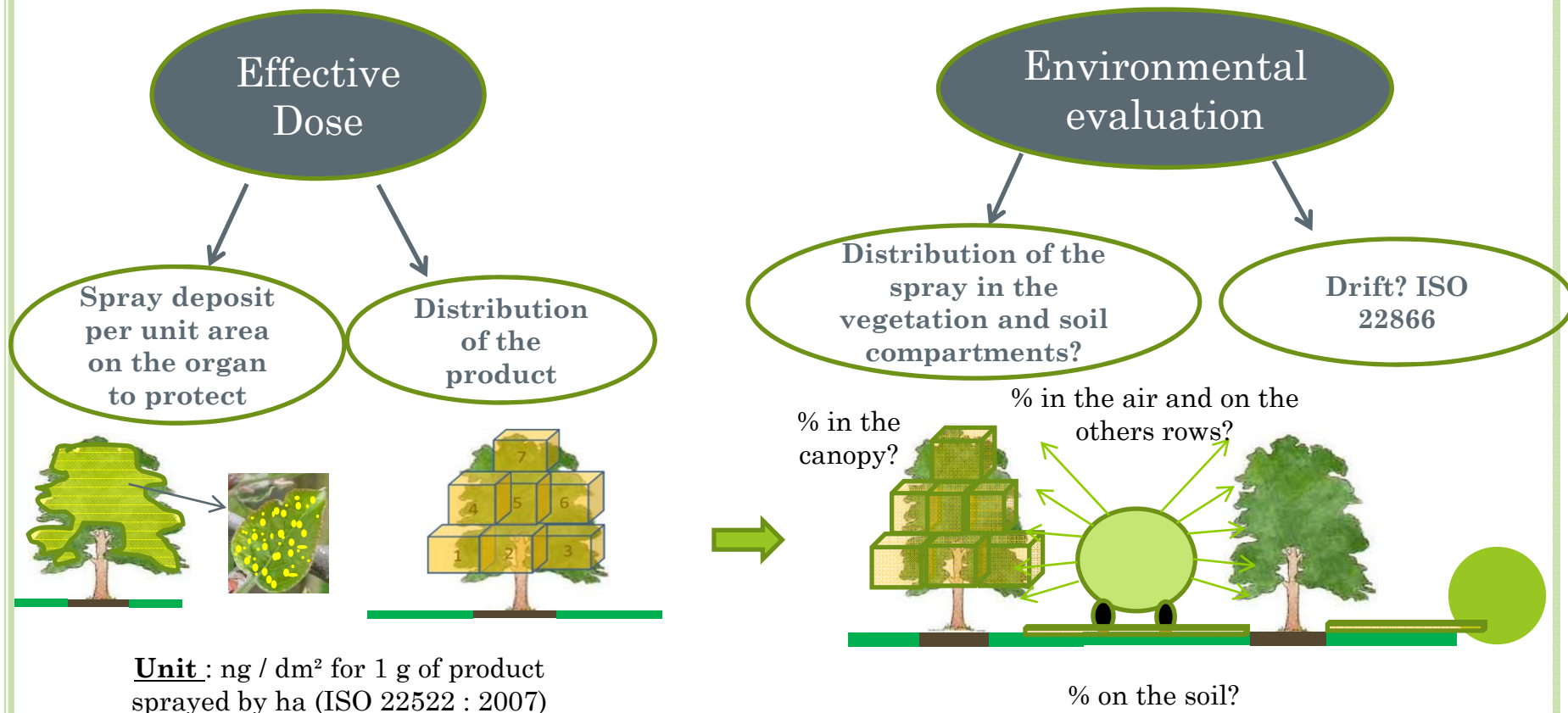
**Reduce the use of PPP** by developing a method of dose adjustment taking into accounts the characteristics of the vegetation.



What dose rate?

# IDENTIFY THE MOST EFFICIENT SPRAYERS, SETTINGS AND PRACTICES

- Objectives : acquire references on the performance of sprayers/settings/practices → necessary prerequisite for the study of the implementation of a safe dose reduction approach.
- Approach based on different indicators :





# DRIFT MEASUREMENTS

- Context : up to 2015 only 1 Spray Drift Reduction Technique (SDRT) registered on the french list for orchards → very little opportunity for the fruit growers to reduce the size of the buffer zones.
- Situation due to the complexity of french tests conditions, long time and high costs to carry out tests.



## Simplification of the drift field methodology

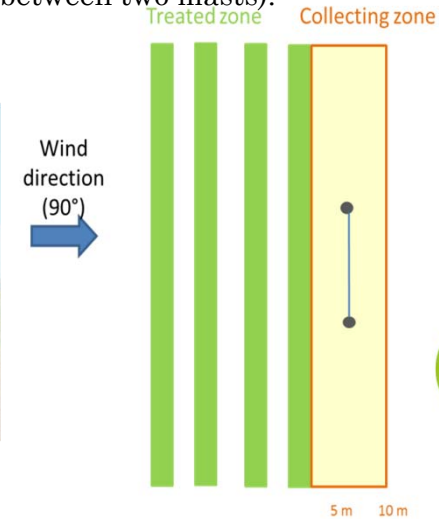


### Comparison of 2 drift field measurements

**Actual french methodology** : horizontal deposition at 5, 10, 20, 30 and 50m from the last row



**Simplified methodology** : vertical deposition at a distance of 5 to 10 m from the last row (PVC wires stretched between two masts).





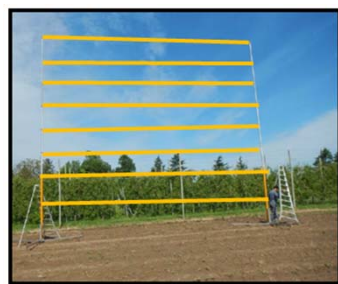
# DRIFT MEASUREMENTS

- Trials are going on actually...the challenge is to find a link between :

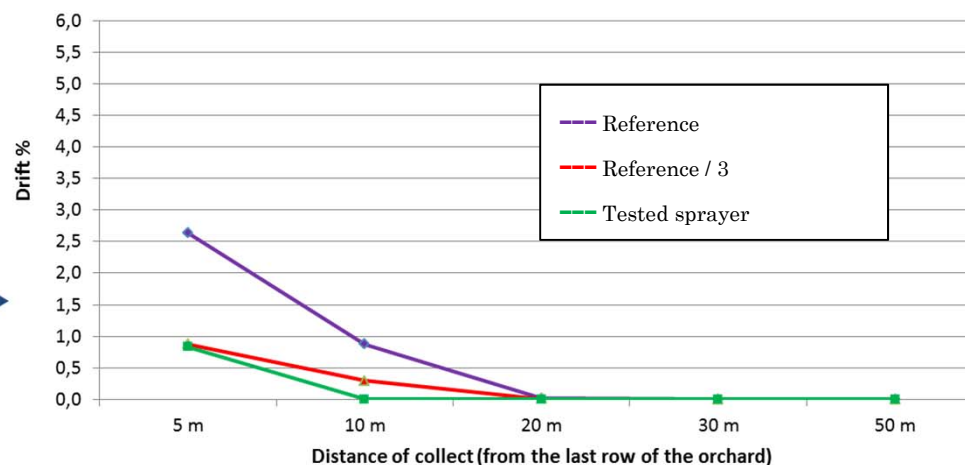
**Actual french methodology :** horizontal deposition  
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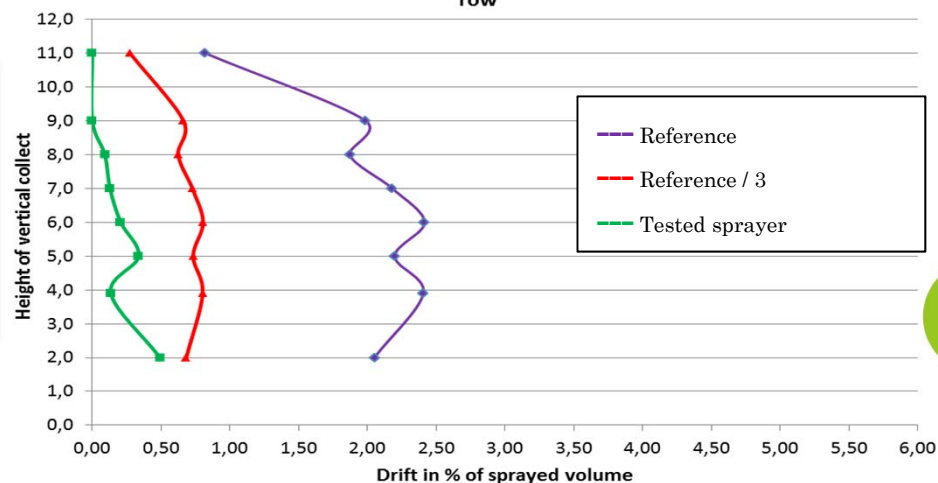
In France : drift reduction technique is registered if it reduces by a factor 3 the drift of the « spraying reference » at each distance of collect.



Median Drift curves (% of sprayed volume) – horizontal deposition



Median drift curves (% sprayed volume) – vertical deposition à 10 m of the last row



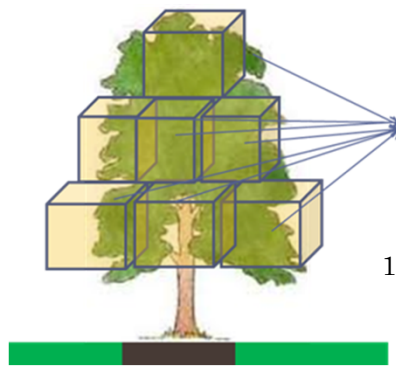




# PERFORMANCE ASSESSMENTS OF SPRAYERS

- Trials are carried out on 4 different experimental sites with the same methodology.
- Methodology used :

Based on ISO 22622:2007



7 zones defined / tree and 4 trees sampled



10 collectors / zone  
(5 on the upper  
sides + 5 on the  
lower faces)



Spraying of a  
solution water +  
tracer (tartrazine)



Removal of the  
collectors, extraction of  
the tracer




Analyzing of the  
samples by  
spectrophotometry

- In 2016 : 39 tests have been carried out.



# PERFORMANCE ASSESSMENTS OF SPRAYERS

- Definition of the reference application technique :

Sprayer type	Nozzle type	Adaptation of nozzle positioning to vegetation	Speed of air flow	Tractor speed (km/h)	Spraying volume (l/ha)	Number of treated rows
Axial airblast sprayer 	Hollow cone nozzles	No	Full fan speed (II)	5 to 6	400 l/ha apple 500 l/ha cedar apple	Every row

- In each trial, this reference is compared to a different setting :

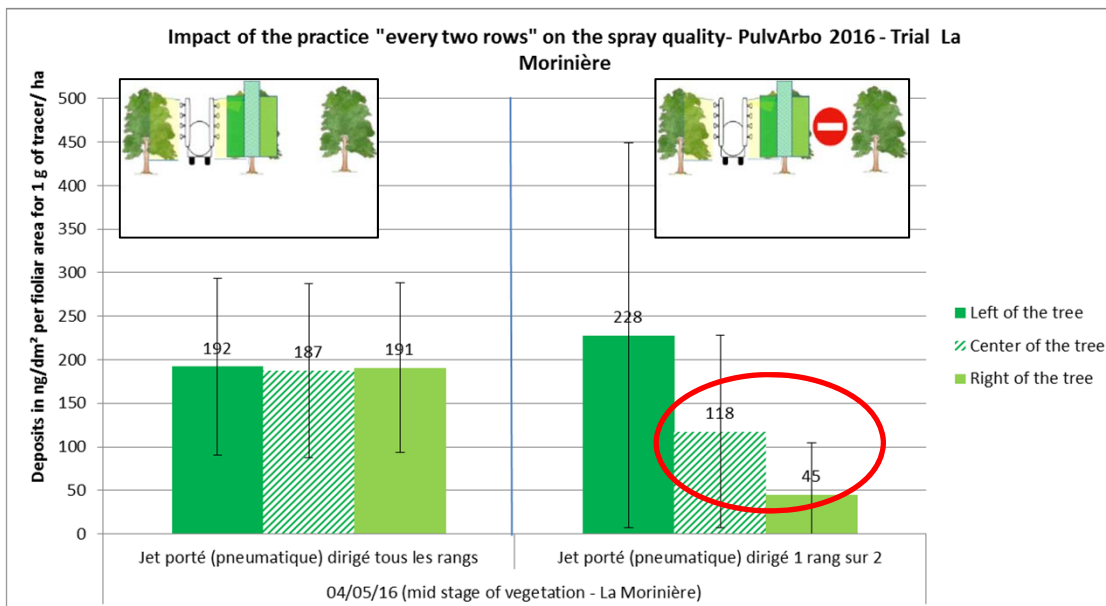




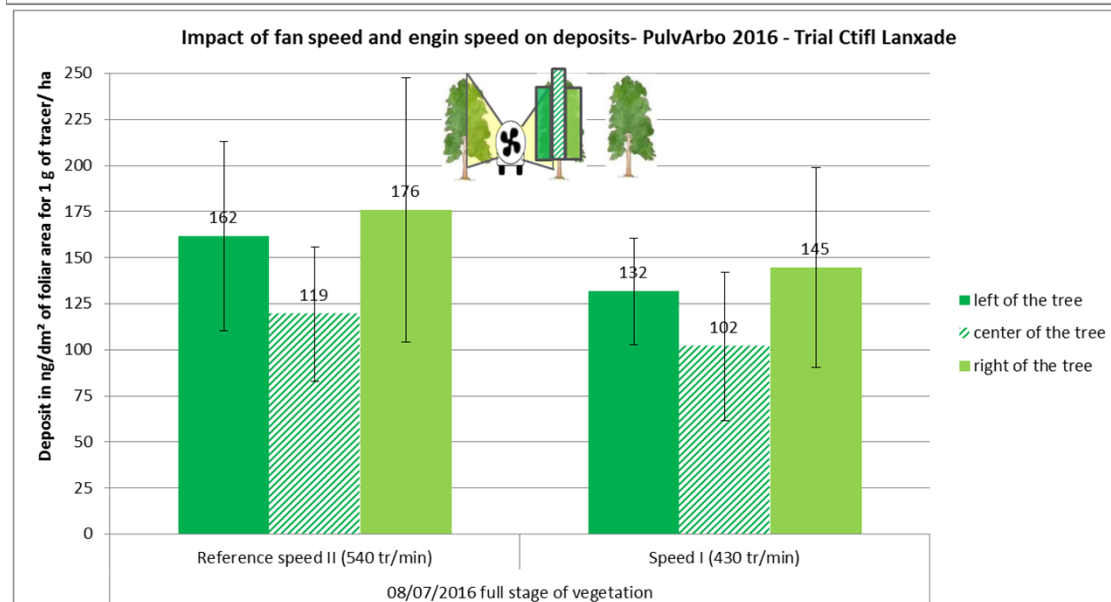
# PERFORMANCE ASSESSMENTS OF SPRAYERS

## Examples of results obtained in 2016 :

Comparison of spraying every row and every two rows.



Comparison of the 2 different fan speed.



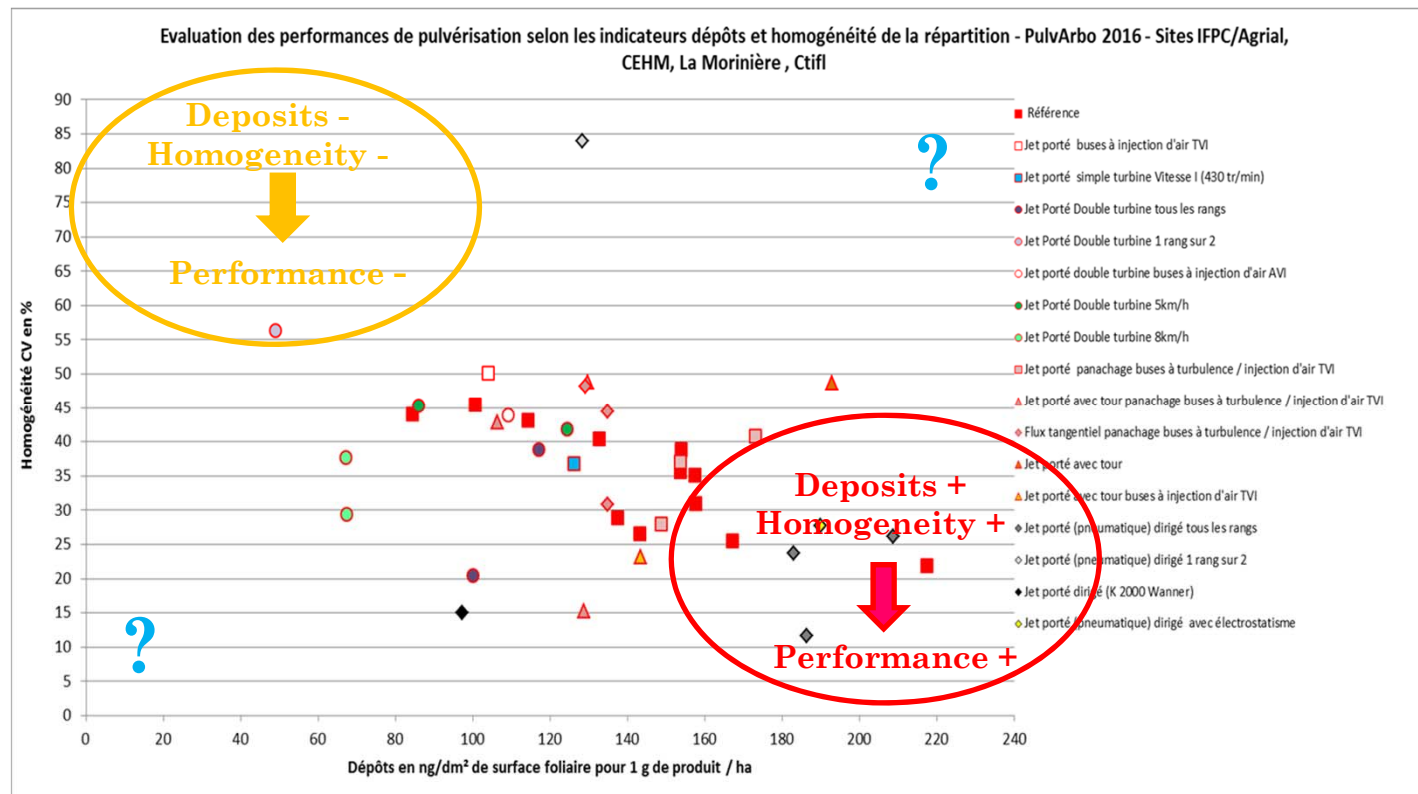
# PERFORMANCE ASSESSMENTS OF SPRAYERS

## ▪ **Objectives at short terms :**

- Carry on the trials in orchards and design an artificial fruit hedge to standardize tests conditions.
- Transfer these results to the fruits growers and accompany them towards optimal practices.

## ▪ **Objectives at longer terms (2020 end of the project) :**

- Develop a sprayer's classification methodology which could be the base of political measures to orientate the sprayer's fleet renewal.



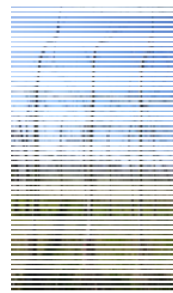
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**Reduce the use of PPP** by developing a method of dose adjustment taking into accounts the characteristics of the vegetation.



What dose rate?





# DEVELOPMENT OF A METHOD FOR DOSE ADJUSTMENT IN FRUIT ORCHARDS...

## ...THIS METHOD SHOULD :

- Be easy to use for the grower.
- Be secured for the grower (no risk concerning the efficiency of the PPP).
- Present an environmental interest (reducing use of PPP according to Ecophyto Plan).
- Present a financial sense (lower PPP expenses).
- Be compatible with the changes at european scale (homogenization of dose expression) and so be compatible with the label.



## THE DIFFERENT STEPS OF OUR APPROACH

### Etape 1

- characterization of canopy parameters by different indicators



### Etape 2

- study of the relation between the crop parameters and the deposits per unit area.

### Etape 3

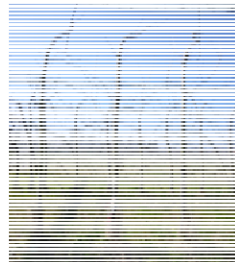
- Develop and test different scenarios of dose adjustment in multi-sites trials



- Question : which area, which volume to treat for different types of french orchard?



- Question : which changes in the vegetation between bud break and harvesting?



- How characterize our orchards? By measuring different parameters



### Manual measures

- Canopy Height
- Canopy width
- Row spacing

### Calculation of :

- Ratio Canopy Height / Row spacing
- Leaf Wall Area (LWA)
- Tree Row Volume (TRV)

### Standardized measures

Use of a laser sensor (LIDAR)

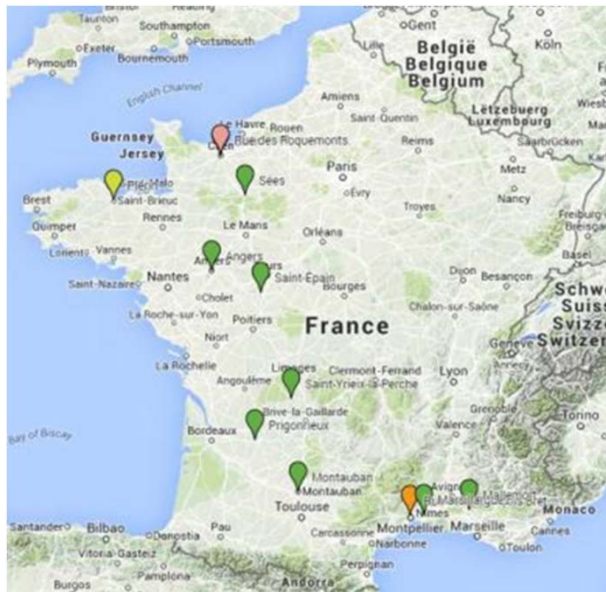
### Calculated parameters :

- Leaf Area Index.
- Leaf Wall Area (LWA)
- Tree Row volume (TRV)
- Width porosity...





- Question : what are the impacts of dose rate ajustement on PPP efficiency, on reduction of the PPP use, cost reduction, and potential development of resistance to medium term? what proposals can we make to the growers for a practical implementation of secure and dose adjustment based on the vegetative development in our orchards?
- How ? In setting up trials in different production regions and evaluating the effectiveness of the methods tested on a complete season.



**In 2016 :**

- Crops : apple and cidar apple.
- 9 sites.
- Same methodology.
- Tested method : dose rate ajustement according to LWA with a standard apple orchard of 15000 m<sup>2</sup> LWA/ha.
- Comparison with : actual pratice (fixed dose rate/ha),  $\frac{3}{4}$  dose rate,  $\frac{1}{2}$  dose rate and non treated block, for all the treatments along the season.
- Observation : apple scab (shoots and leaves), aphids, codling moth, oïdium, mites.

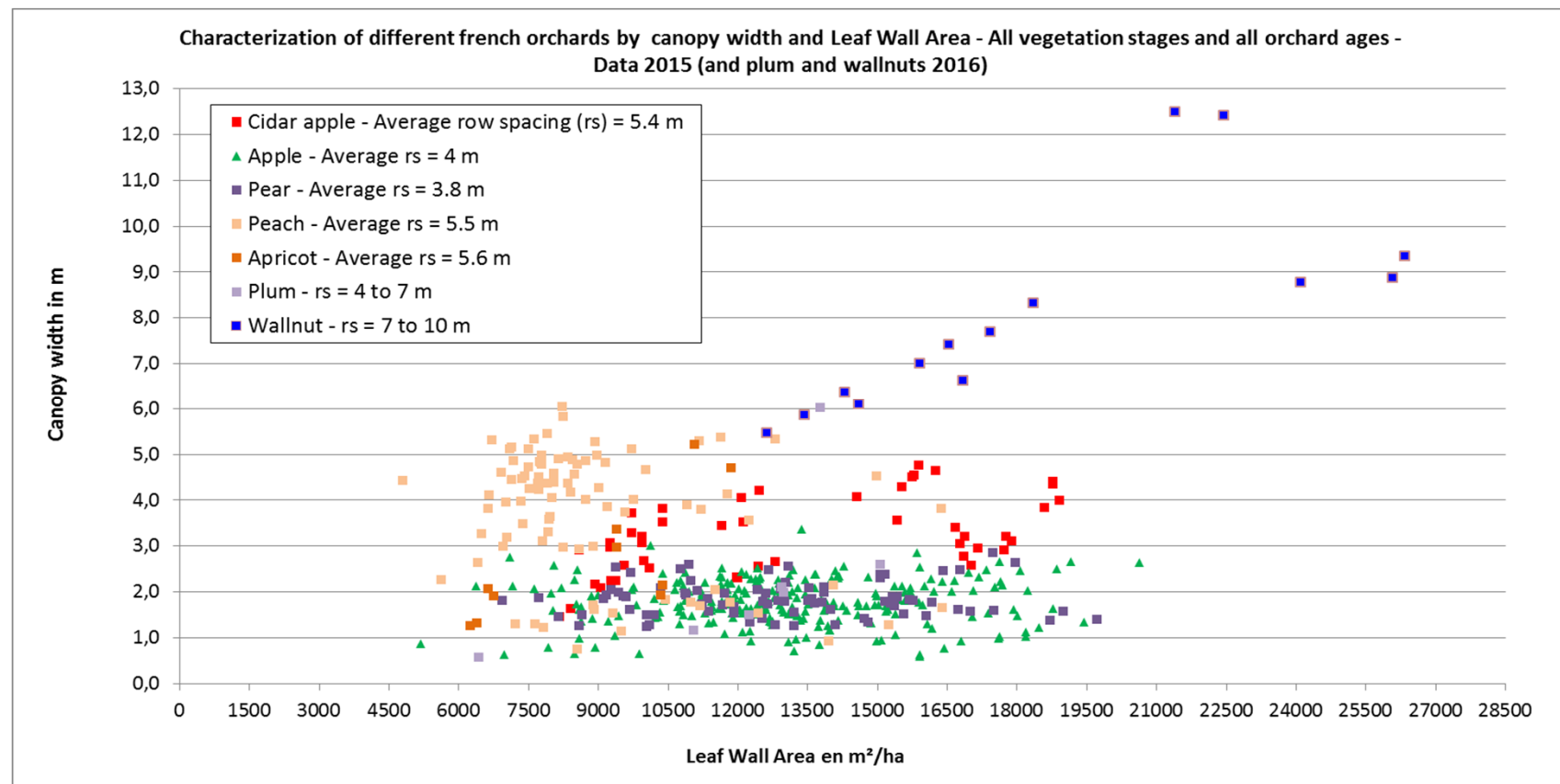




# FIRST RESULTS (2015-2016) : CHARACTERIZATION OF CROP PARAMETERS BY MANUAL MEASURES

- Creation of a data base on crop parameters : fruit species, age of orchard, location, form, BBCH stage, treated height, canopy width, distance between rows, Treated LWA, Treated TRV. 485 mean values (7390 individual data) in 2015 and 290 mean values (2900 individual values) in 2016 : 230 orchards.

## Examples of 2015 results by species

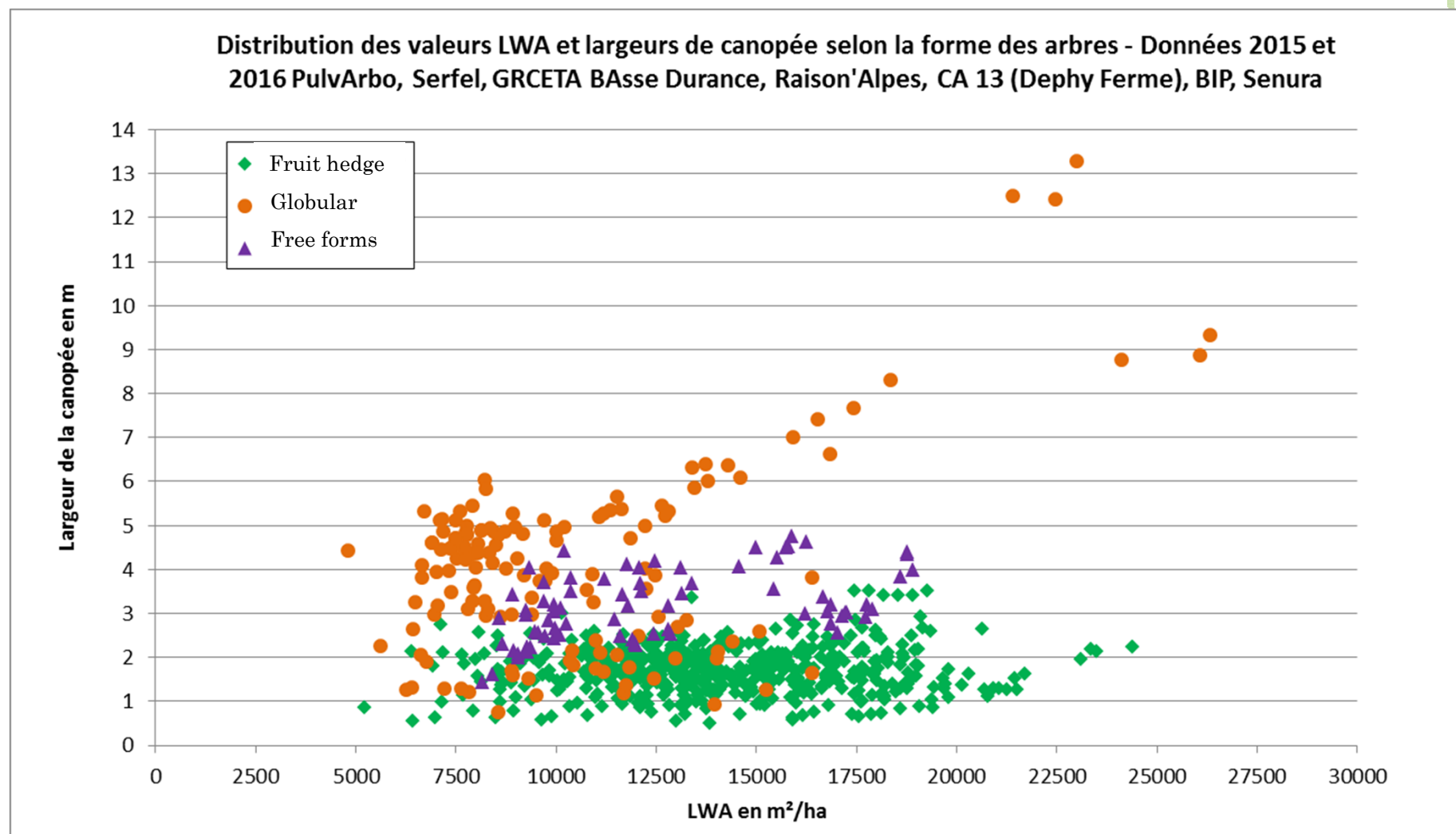


1 point = average of 20 trees



# FIRST RESULTS (2015-2016): CHARACTERIZATION OF CROP PARAMETERS BY MANUAL MEASURES

Examples of 2015-2016 results by forms



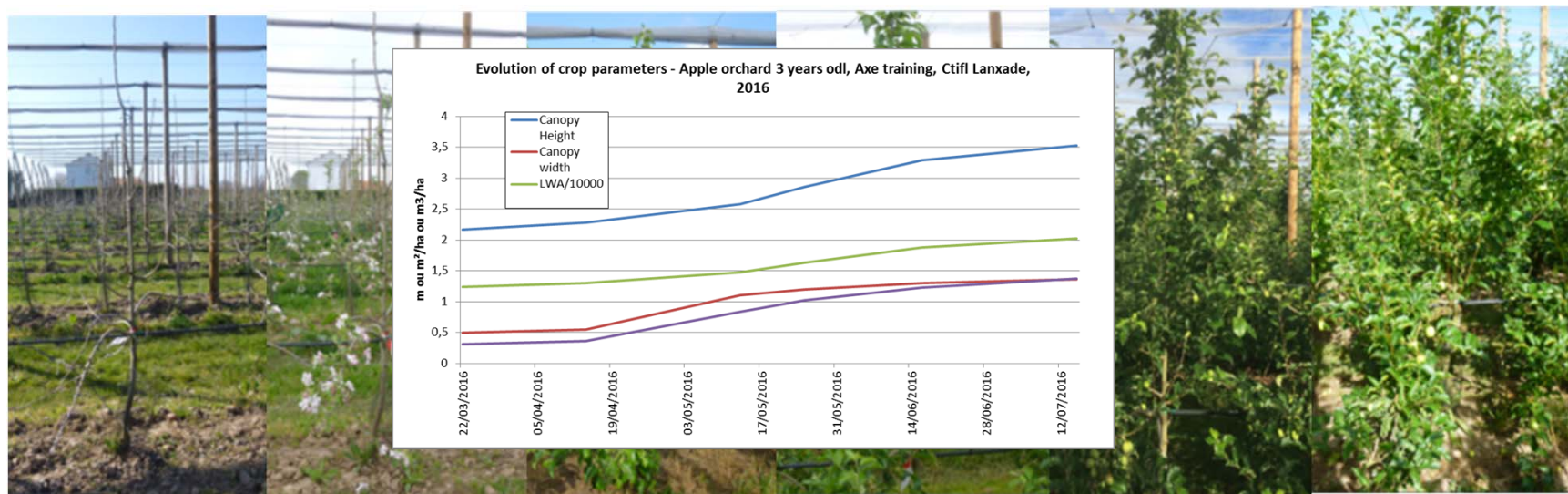




# FIRST RESULTS (2015-2016): CHARACTERIZATION OF CROP PARAMETERS BY MANUAL MEASURES

For each following orchard, growth curves during the season can be done for each crop parameter.

## Example of a young apple orchard (3 years old), Ctifl Lanxade



**22/03/16**  
H = 2,17 m  
L = 0,5 m  
D = 3,5 m  
LWA = 12400 m<sup>2</sup>  
TRV = 3100 m<sup>3</sup>  
C-C3

**14/04/16**  
H = 2,28 m  
L = 0,55 m  
D = 3,5 m  
LWA = 13028 m<sup>2</sup>  
TRV = 3638 m<sup>3</sup>  
F-F2

**13/05/16**  
H = 2,58 m  
L = 1,1 m  
D = 3,5 m  
LWA = 14742 m<sup>2</sup>  
TRV = 8344 m<sup>3</sup>  
I-J

**25/05/16**  
H = 2,86 m  
L = 1,2 m  
D = 3,5 m  
LWA = 16342 m<sup>2</sup>  
TRV = 10177 m<sup>3</sup>  
Grossissement

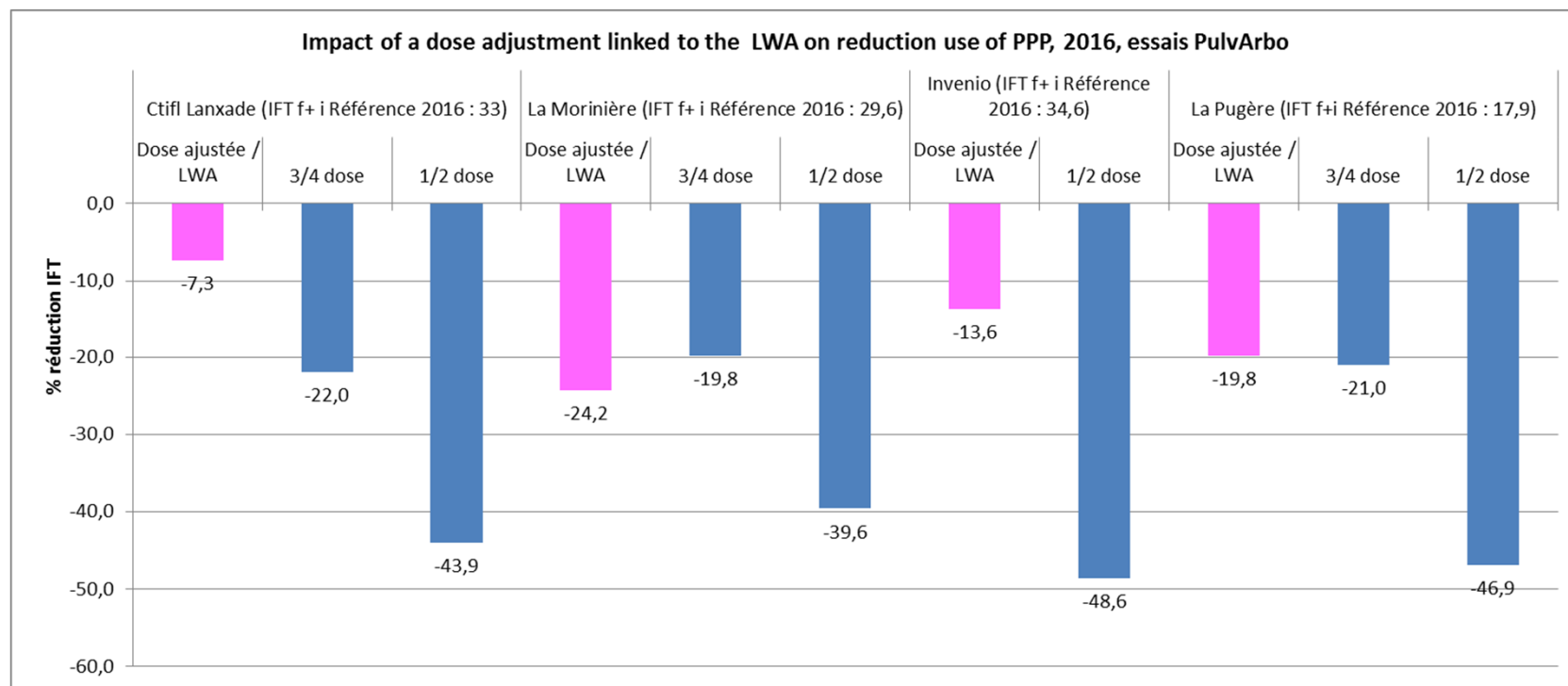
**16/06/16**  
H = 3,29 m  
L = 1,3 m  
D = 3,5 m  
LWA = 18800 m<sup>2</sup>  
TRV = 12251 m<sup>3</sup>

**15/07/16**  
H = 3,53 m  
L = 1,36 m  
D = 3,5 m  
LWA = 20171 m<sup>2</sup>  
TRV = 13738 m<sup>3</sup>



# FIRST RESULTS (2016): ASSESSMENT OF THE BIOLOGICAL EFFICACY WITH AN ADJUSTMENT OF THE DOSE

- Depending on the site, the reduction of the use of Plant Protection Product varied between 7 to 24% for a same quality at the harvest than the reference treated at full dose







# PULVARBO PROJECT WILL CONTINUE UNTIL 2020...

...with the aim of improving spray in fruit growing taking into account the needs of the different actors.

THANKS FOR YOUR ATTENTION !