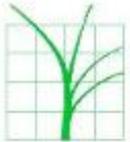


DOSE ADJUSTMENT IN FRUIT ORCHARDS IN FRANCE...





...HOW TO COMBINE NATIONAL REGULATORY REQUIREMENTS AND CHANGES AT THE EUROPEAN SCALE?

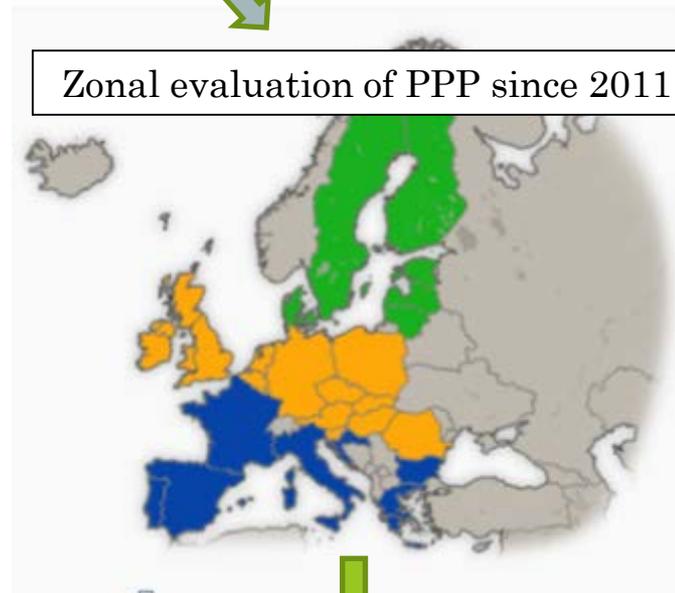
European Directive 2009/128

French
National Plan
ECOPHYTO

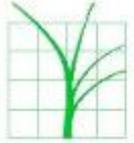
Objective : reduce the use of plant production products (PPP) -25% in 2020 et -50% in 2025.

Dose rate adjustment clearly identify by the french government in 2015 as one of the methods to be implemented to achieve this goal

Zonal evaluation of PPP since 2011



Towards a single way of expressing the dose...



...ACTUAL SITUATION IN FRUIT CROPS IN FRANCE

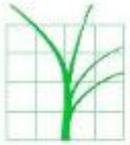
Dose registration on the label : /hL and /ha with a max rate/ha

General fruit grower practice : in the case of a product registered /hL → dose rate \times 10 on the basis of a spray volume of 1000 L/ha whatever the real spray volume applied (250 L/ha to 1000 L/ha depending on the crop) → fixed dose rate/ha.

Dose rate adjustment : can be done sometimes on young orchards or in early stages but adjustment not formalized and often unwritten (empirical practices).

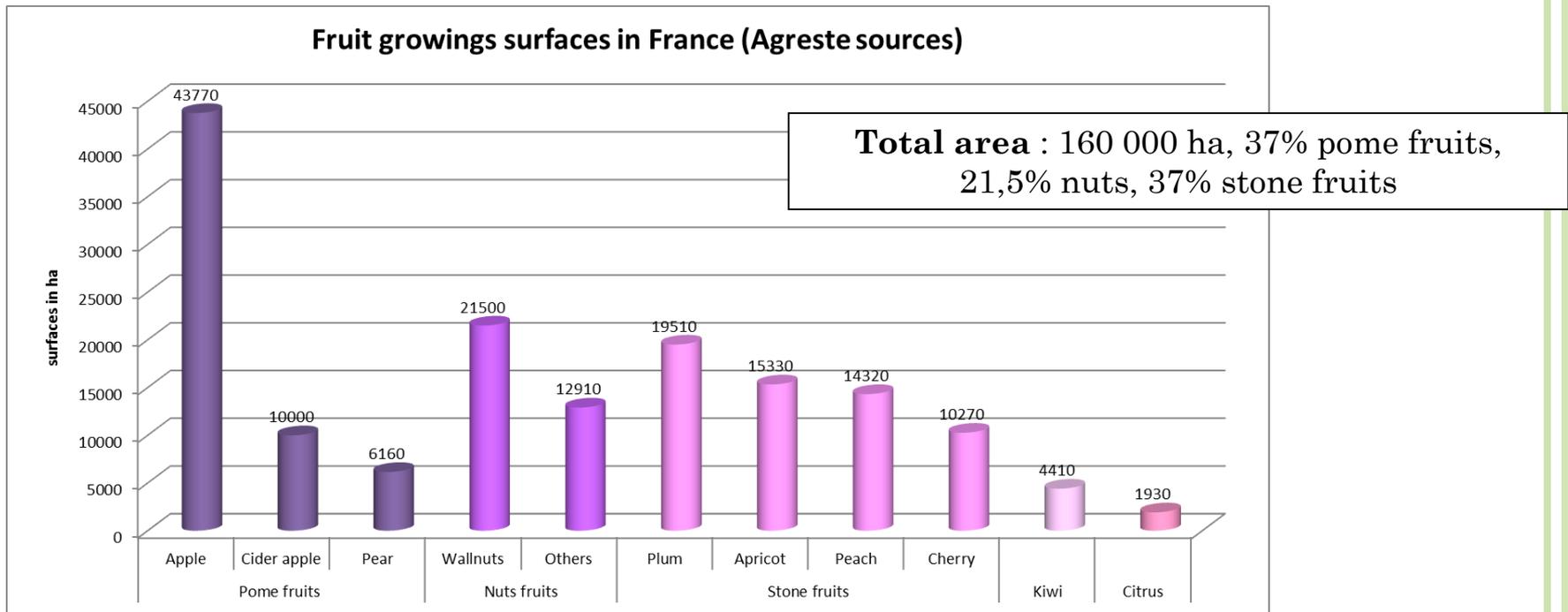
Differences in practices depending on fruit crops? Not at all excepted maybe for pome fruits taking into account the performances of the sprayers.





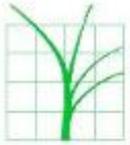
...ACTUAL SITUATION IN FRUIT CROPS IN FRANCE

Composition of the actual french orchard :



Treatments per year	Apple	Peach	Plum	Apricot	Wallnut	Cherry
fungicide, insecticide, herbicide, growth regulators	35	19	11	12	10	8





...TO WORK ON THE GOALS OF OUR NATIONAL ECOPHYTO PLAN

PULVARBO PROJECT (2015 – 2020)

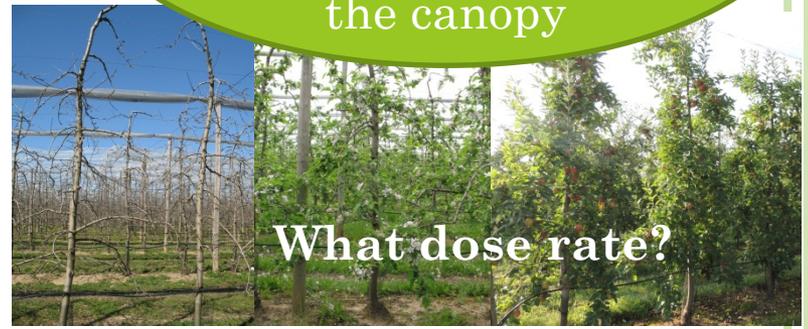


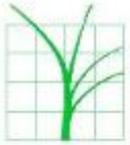
- A national multidisciplinary project, involving different partners : Ctifl, IRSTEA, regional stations of experiments, the cider sector, in close cooperation with sprayers manufacturers, UIPP, INRA and Agricultural Ministry.
- 5 years to propose a set of ways to improve spray in fruit growing, sustainable technically and economically, and fulfilling the objective of our National Ecophyto Plan (reduction of the use of phytosanitary products).

Optimize practices : drift reduction, best settings of the sprayers...

Reduce the use of PPP : method to adapt the doses to the characteristics of the canopy

What dose rate?



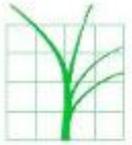


...THIS METHOD SHOULD :



- 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.



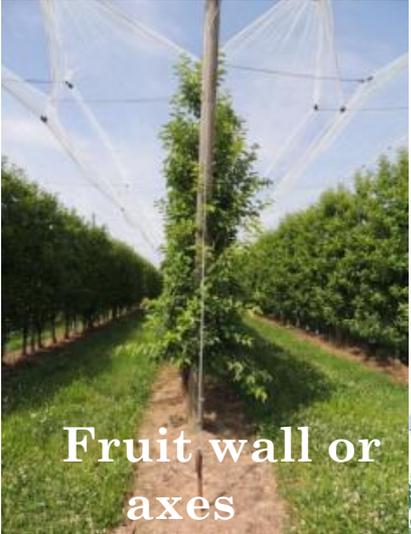


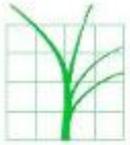
OUR APPROACH :



○ **Step 1 : characterization of canopy parameters by different indicators**

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





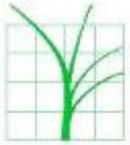
OUR APPROACH :



Step 1 : characterization of canopy parameters by different indicators

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



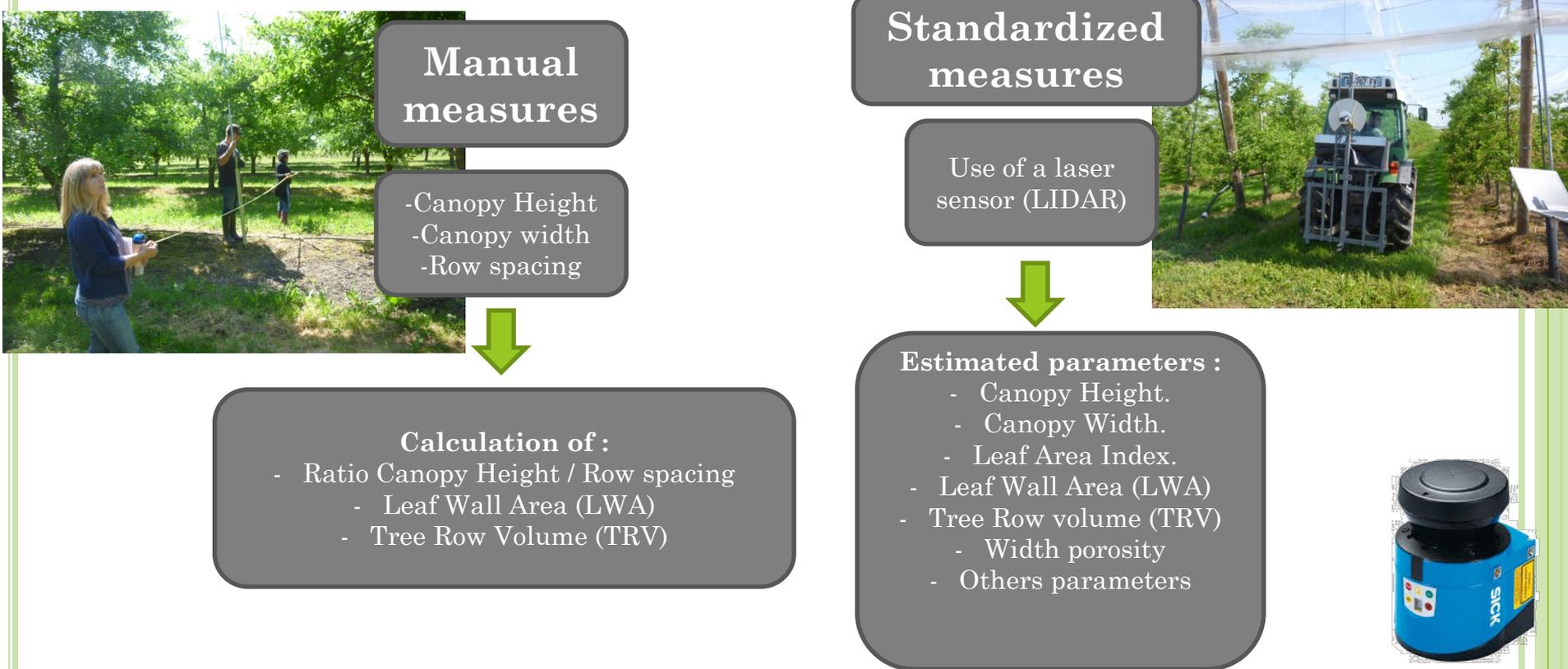


OUR APPROACH :



Step 1 : characterization of canopy parameters by different indicators

How ? : 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)

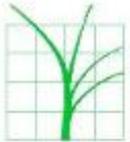
Standardized measures

Use of a laser sensor (LIDAR)

Estimated parameters :

- Canopy Height.
- Canopy Width.
- Leaf Area Index.
- Leaf Wall Area (LWA)
- Tree Row volume (TRV)
- Width porosity
- Others parameters





OUR APPROACH :



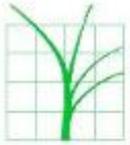
- **Step 2 : study the relation between the crop parameters or indicators and the deposits per unit area.**

Question ? : which indicator(s) is (are) the most correlated to deposits and what kind of relationship between the crop parameters and the deposits (linear, non linear,...)? Is it possible to find one indicator relevant for all the forms (axes, goblets, big volumes) ?

How ? : using the international method ISO 22522, 2007 which defines how to quantify deposits.



Deposits quantification at early stage, mid stage and full stage of vegetation \times dose rate (1 - 0,75 - 0,5).



OUR APPROACH :



- Step 3 : evaluate different methods of dose rate adjustment in multi-sites trials (different species and different pest and diseases pressures)

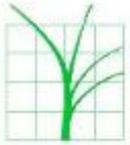
Question ? : what are the impacts of dose rate adjustment on PPP efficiency, on reduction of the PPP use, cost reduction, and potential development of resistance to medium term? what proposals can we make to the growers for a practical implementation of secure and dose adjustment based on the vegetative 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 :

- Crop : apple and cidar apple.
- 7 sites.
- Same methodology.
- Tested method : dose rate adjustment according to LWA with a standard apple orchard of 15000 m² LWA/ha.
- Comparison with : actual practice (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



Step 1 : characterization of canopy parameters by different indicators

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

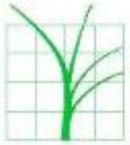
2015 : measures on 150 orchards (20 trees/orchard) at different stages between early and full stage of vegetation.

2016 : same orchards (10 trees / orchard) + plum and walnuts orchards (results in process)

Apple	Pear	Cider apple	Peach	Apricot	Plum
79 vergers 52%	26 vergers 17%	12 vergers 8%	29 vergers 19%	3 vergers 2%	2 vergers 1%

Axe	Goblet	« Free »
92 vergers 61%	47 vergers 31%	12 vergers 8%





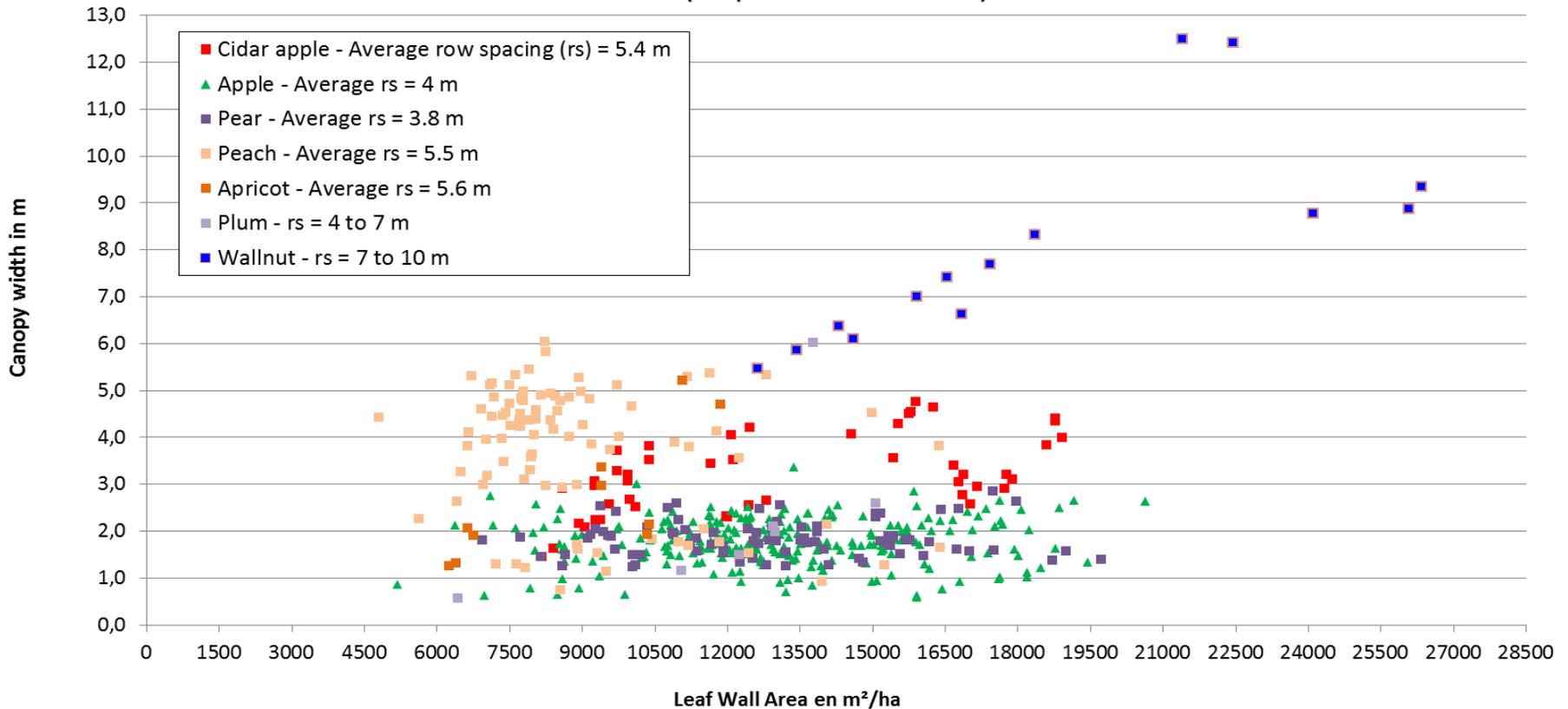
FIRST RESULTS



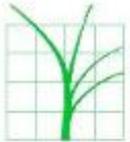
- Question: which area, which volume to treat for different types of french orchard?

Data 2015 (manual measures) PULVARBO, Serfel, Dephy Ferme PACA, GRCETA Basse Durance, BIP, Senura.

Characterization of different french orchards by canopy width and Leaf Wall Area - All vegetation stages and all orchard ages - Data 2015 (and plum and walnuts 2016)



1 point = average of 20 trees

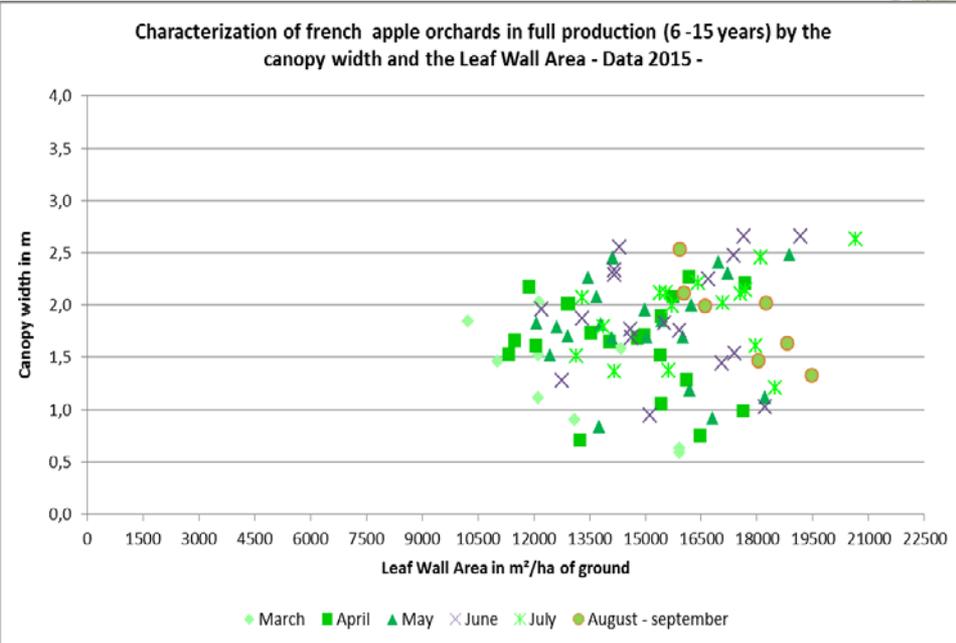
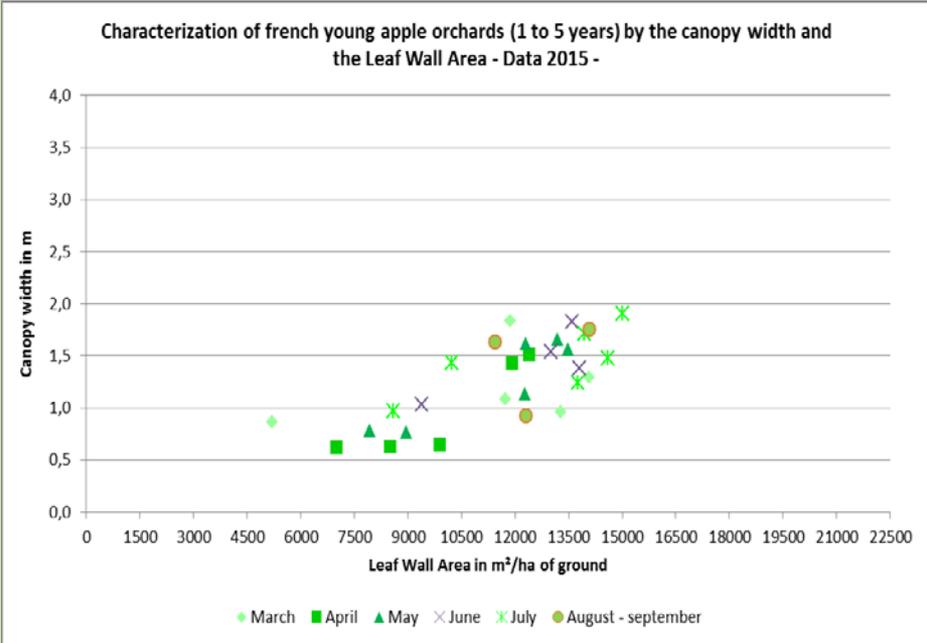


FIRST RESULTS

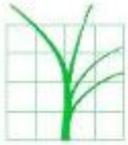


- For each species, possibility to cross the crop parameters and the description of the orchards (training, age, variety and localisation)

Example for one sampling of apple orchards



1 point = average of 20 trees



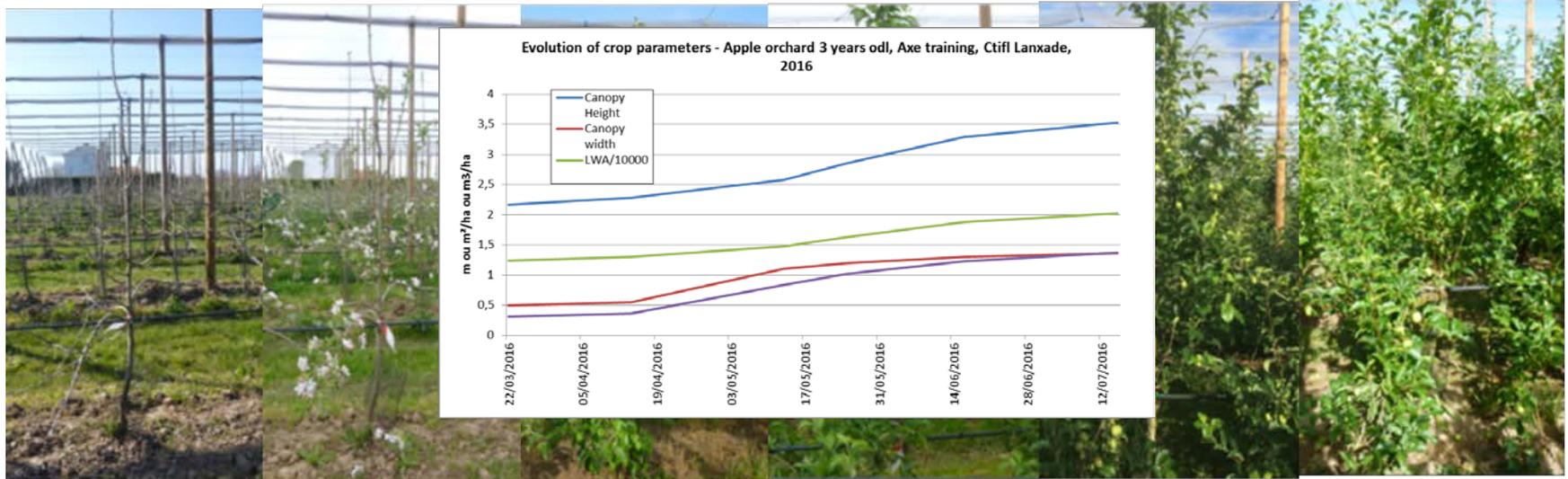
FIRST RESULTS



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

For each of the 150 followed orchards, growth curves during the season for each crop parameter.

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



22/03/16

H = 2,17 m

L = 0,5 m

D = 3,5 m

LWA = 12400 m²

TRV = 3100 m³

C-C3

14/04/16

H = 2,28 m

L = 0,55 m

D = 3,5 m

LWA = 13028 m²

TRV = 3638 m³

F-F2

13/05/16

H = 2,58 m

L = 1,1 m

D = 3,5 m

LWA = 14742 m²

TRV = 8344 m³

I-J

25/05/16

H = 2,86 m

L = 1,2 m

D = 3,5 m

LWA = 16342 m²

TRV = 10177 m³

Grossissement

16/06/16

H = 3,29 m

L = 1,3 m

D = 3,5 m

LWA = 18800 m²

TRV = 12251 m³

15/07/16

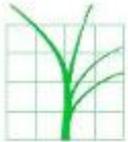
H = 3,53 m

L = 1,36 m

D = 3,5 m

LWA = 20171 m²

TRV = 13738 m³



FIRST RESULTS :



- **Step 2 : study the relation between the crop parameters or indicators and the deposits per unit area.**

Results obtained in 2016 are in process...

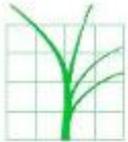
- **Step 3 : evaluate different methods of dose rate adjustment in multi-sites trials (different species and different pest and diseases pressures).**

A synthesis of the data obtained in the different regions will be done at the end of the season (after harvest).

Parts of the results obtained in the trial of Ctifl Lanxade :

- Support of the trial : young apple orchard (3 years).
- Variety : Rosy Glow (Pink Lady)
- Ground Area / modality : 500 m²
- Sprayer : airblast sprayer
- Observation : apple scab, rosy apple aphids, oidium, codling moth.
- Number of treatments (from march to end of august) : 28 PPP in 21 treatments.

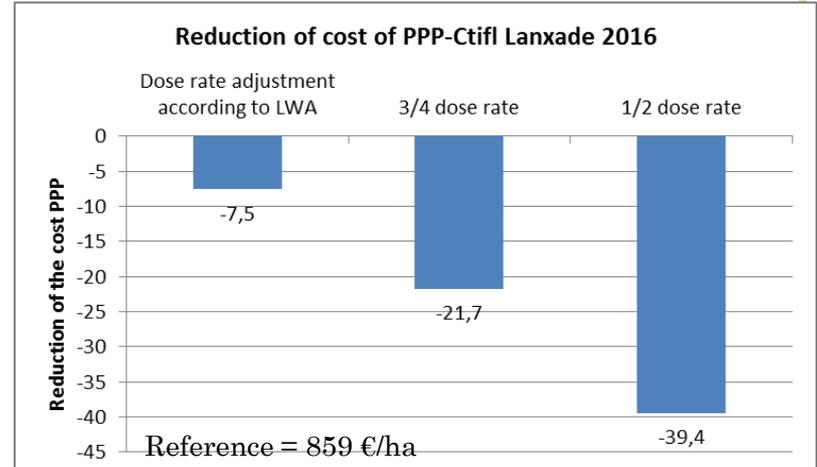
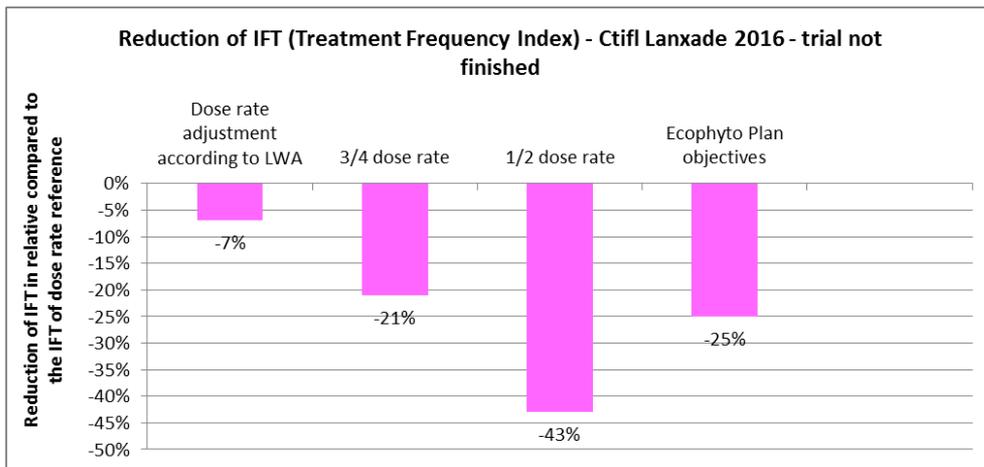
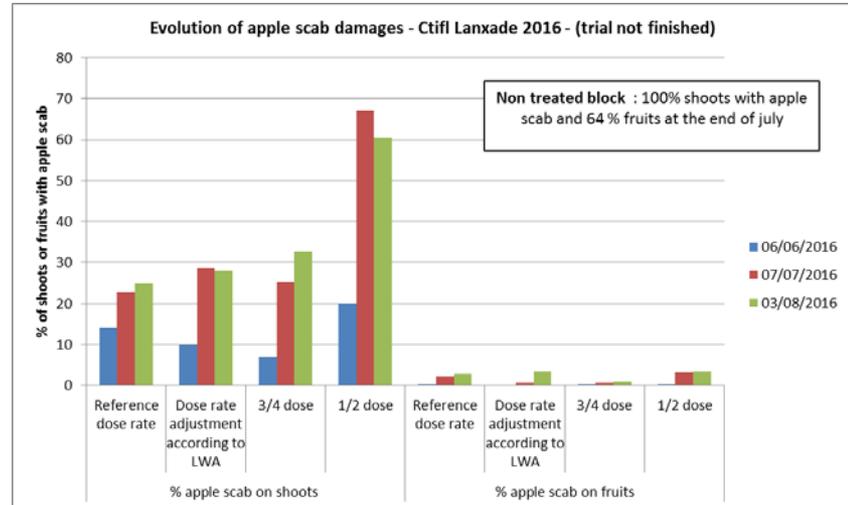
	Dose rate adjustment according to LWA with a max dose rate for 15000m ² LWA
17/03 to 12/04	83% of full registered dose
12/04 au 10/05	86%
10/05 to 27/05	98 %
27/05 to today	100%

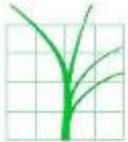


FIRST RESULTS :



Parts of the results obtained in the trial of Ctifl Lanxade :





QUESTIONS...



Assuming the LWA would be adopted as the method for efficacy assessment at the european scale :

- How will be define the « standard orchard » to fixe a maximal dose?

	Nbe de moyennes	Nbe d'individus	Distribution des valeurs LWA en m ² /ha				
			25ème percentile	50ème percentile	75ème percentile	90ème percentile	95ème percentile
Pommier	257	3714	11323	12775	14775	16641	17670
Poirier	81	1065	10875	12873	15165	16733	17500
Pommier à cidre	48	959	9676	12106	16702	17802	18709
Pêcher	93	1138	7500	8233	9500	11829	13990
Abricotier	10	200	6667	9404	10378	11153	11501
Prunier	7	110	11644	12948	13380	14293	14680
Noyers (valeurs SENURA 2016)	15	150	15259	17423	22721	25292	26158

- In the case of species where training can be very different, what type of orchard will be choose to make the efficacy trials (problems of over dosage or under dosage)?
- How to transfer this method in large volumes orchards on which the evaluation of LWA is pretty difficult?

Thanks for your attention !

