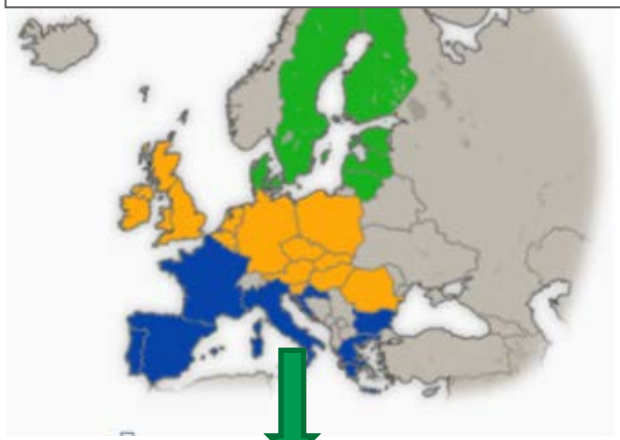
DOSE ADJUSTMENT FOR FRUIT ORCHARDS IN FRANCE : WHAT OPTIONS?

F. VERPONT, CTIFL
AAB Dose Expression Workshop, 6-7 november 2018

The context...

European Directive 2009/128

Zonal **Efficacy Evaluation** of PPP since 2011



Workshop EPPO 2016 (Vienna) :
« Leaf Wall Area (LWA) was agreed as an appropriate dose expression for plant protection products in pome fruit, grapevine and high growing vegetables »

French National Plan **ECOPHYTO II**

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

And the question is :

Is-it possible to answer to the french regulatory requirements (Ecophyto Plan) taking into account the evolution of the zonal efficacy evaluation?

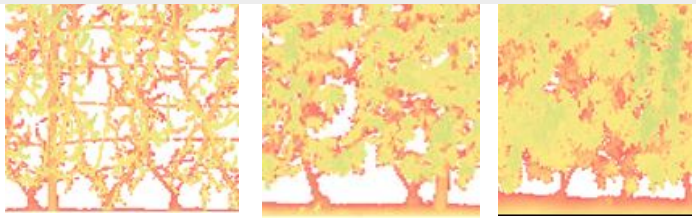
- **PulvArbo a national project** (2015-2020)

Zoom on PulvArbo

Two mains objectives

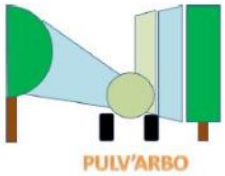
Optimization of spraying by the identification of the sprayers, practices and settings the most performants in terms of application quality and drift reduction

Reduction of the use of PPP by the set up of method allowing to adapt the dose to the developpement of the tree canopy



Necessary pre-requisite to go towards a reduction dose process

Reduction of the use of PPP



Objectives :

Design one or many methods (depending on fruit species) of dose adjustment to the characteristics of the canopy :

- Easy to use for the grower.
- Secured for the grower (in efficacy terms)
- Presenting interest according to the Ecophyto Plan (reduction of PPP)
- Compatible with the evolution at the european scale for the PPP registration.

3 steps :

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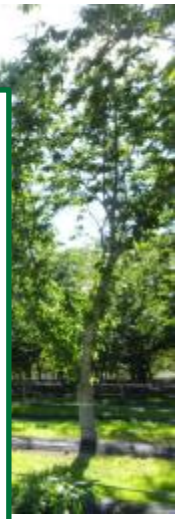
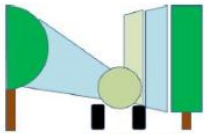
Step 1

- Characterize the orchards by different indicators such as treated high, width of canopy, row spaces, LWA, TRV, by manual measures et by standardized Lidar measures.

For the same species, which changes in the vegetation between budbreak and the harvest?



3 steps :



Step 1

- Characterize the orchards by different indicators such as treated high, depth of canopy, row spaces (LWA, TRV) by manual measures et by standardized Lidar measures.

Step 2

- Establish different scenarios for dose adjustment in line with national and European developments and taking into account the data obtained in step 1.

Step 3

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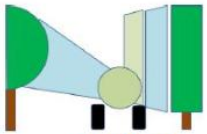

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Step 2

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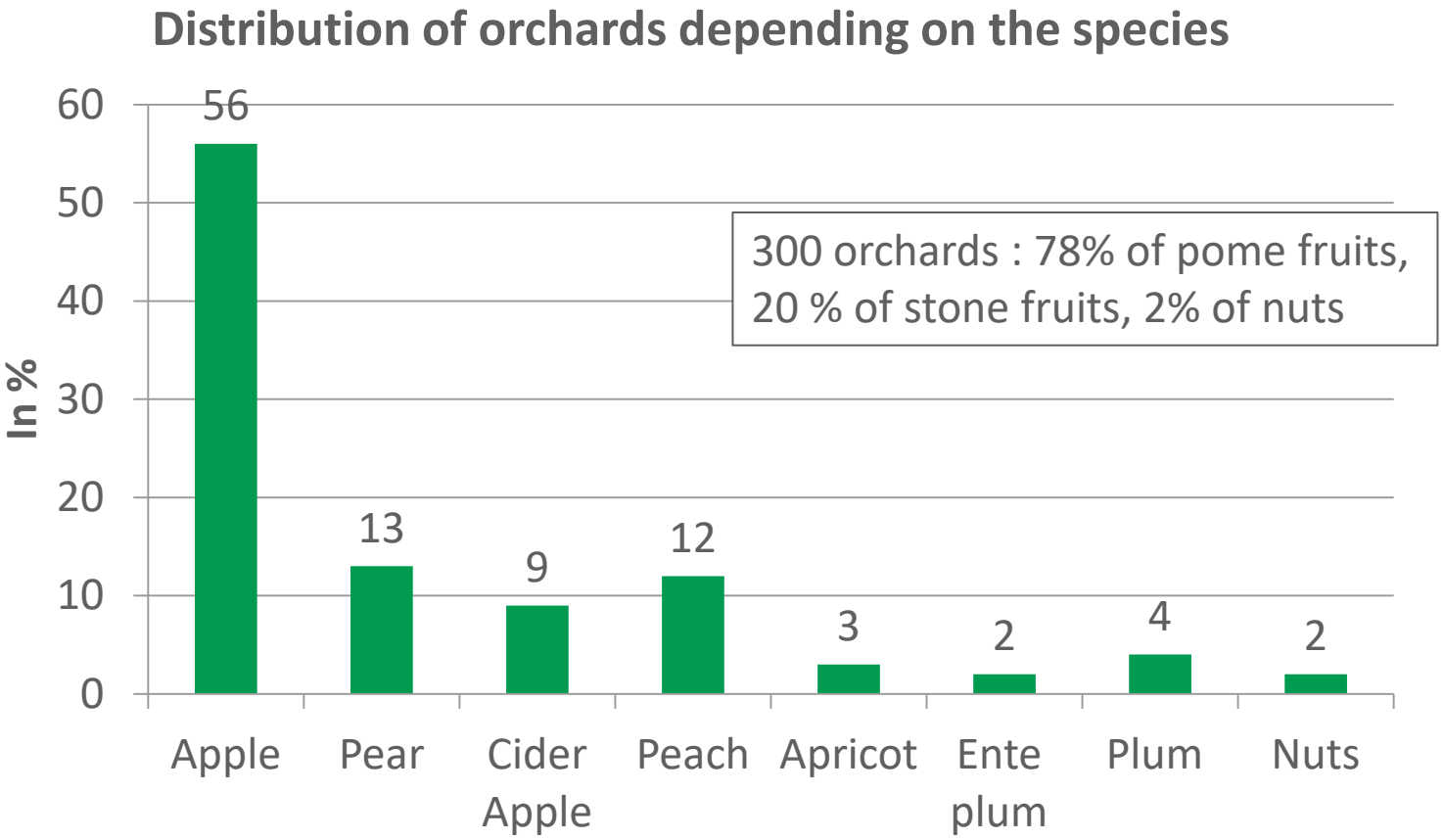
Step 3

- Assess the impacts of these scenarios in terms of biological efficacy, reduction of IFT (French Treatment Frequency Index), reduction of PPP input under different production conditions.

Step 1 « Characterization of orchards » : the results (without 2018)

300 orchards followed since 2015 by **manual measures**



Step 1 « Characterization of orchards » : the results (without 2018)

For each orchard monitored, 10 trees per orchard are measured on each measurement date: the BBCH stage, species, variety, treated height, canopy width, distance between rows, typology (wall, globular shape…). From these measurements are calculated the indicators LWA (Leaf Wall Area an m²/ha) and TRV (Tree Row Volume in m3/ha).

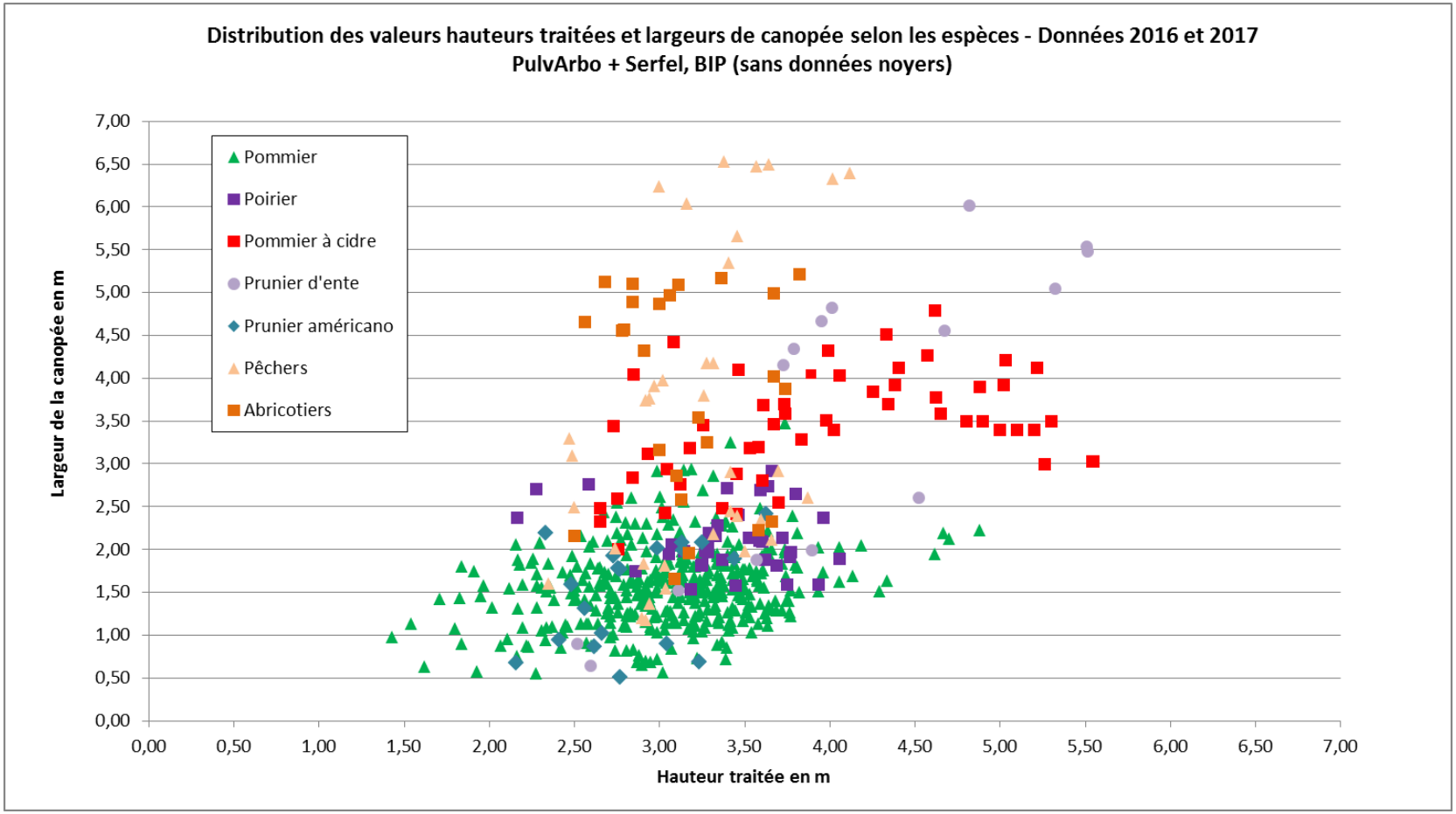
Creation of a data base :

Année	Espèce	Site	Variété	Conduite	Forme	Age	Date	Stade BB(	Moyenne de Haute	Écartype de Hauteu	Moyenne de Large	Écartype de Largeur	Moyenne de Distance entre ran	Moyenne de TLWA (Treated Leaf Wall Area)	Écartype de TLWA	Moyenne de TRV	Ecartype TRV	Ratio Hauteur canopée/Distance entre ranls
2016	Pommier	Ctifl	Ariane	Axe	sapin/haie/mur	12	22/03/2016	51-53	3,25	0,20	1,82	0,32	4	16255	1015	14751	2396	0,81
2016	Pommier	Ctifl	Ariane	Axe	sapin/haie/mur	12	14/04/2016	56-59	3,29	0,21	1,75	0,27	4	16435	1047	14413	2274	0,82
2016	Pommier	Ctifl	Ariane	Axe	sapin/haie/mur	12	25/05/2016	72-74	3,60	0,22	1,92	0,23	4	18020	1094	17317	2353	0,90
2016	Pommier	Ctifl	Ariane	Axe	sapin/haie/mur	12	15/06/2016	77	3,72	0,17	1,83	0,22	4	18605	874	17061	2131	0,93
2016	Pommier	Ctifl	Ariane	Axe	sapin/haie/mur	12	15/07/2016	77	3,80	0,17	1,83	0,22	4	18990	857	17328	2055	0,95
2016	Pommier	Ctifl	Ariane	Mur	sapin/haie/mur	12	22/03/2016	51-53	3,34	0,21	0,89	0,10	3,5	19074	1196	8479	1319	0,95

Total number of average data (2015+2016+2017) = 1096 (13420 individual data)

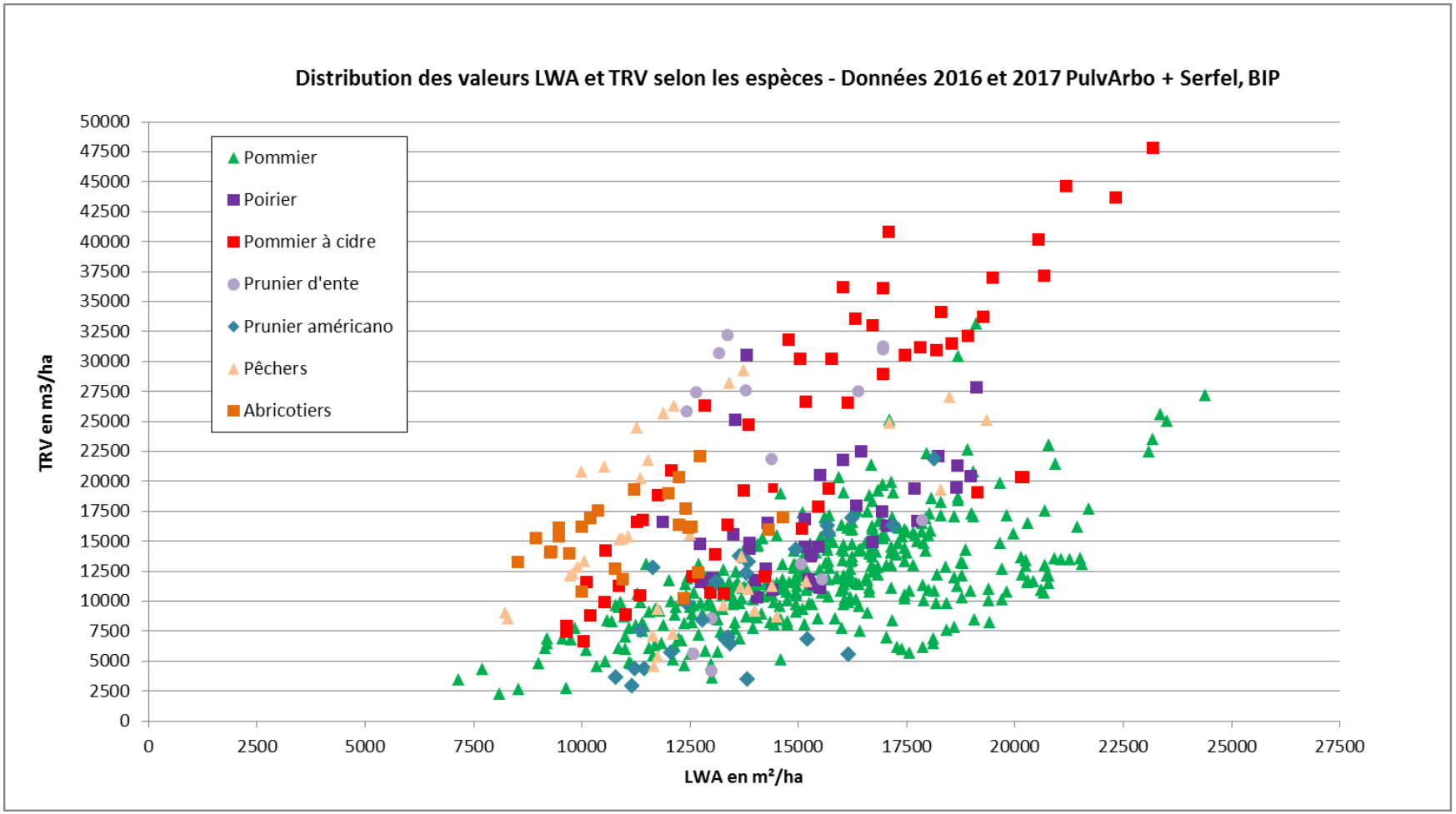
Step 1 « Characterization of orchards » : the results (without 2018)

Which treated hight for each species ? Which canopy width for each species?



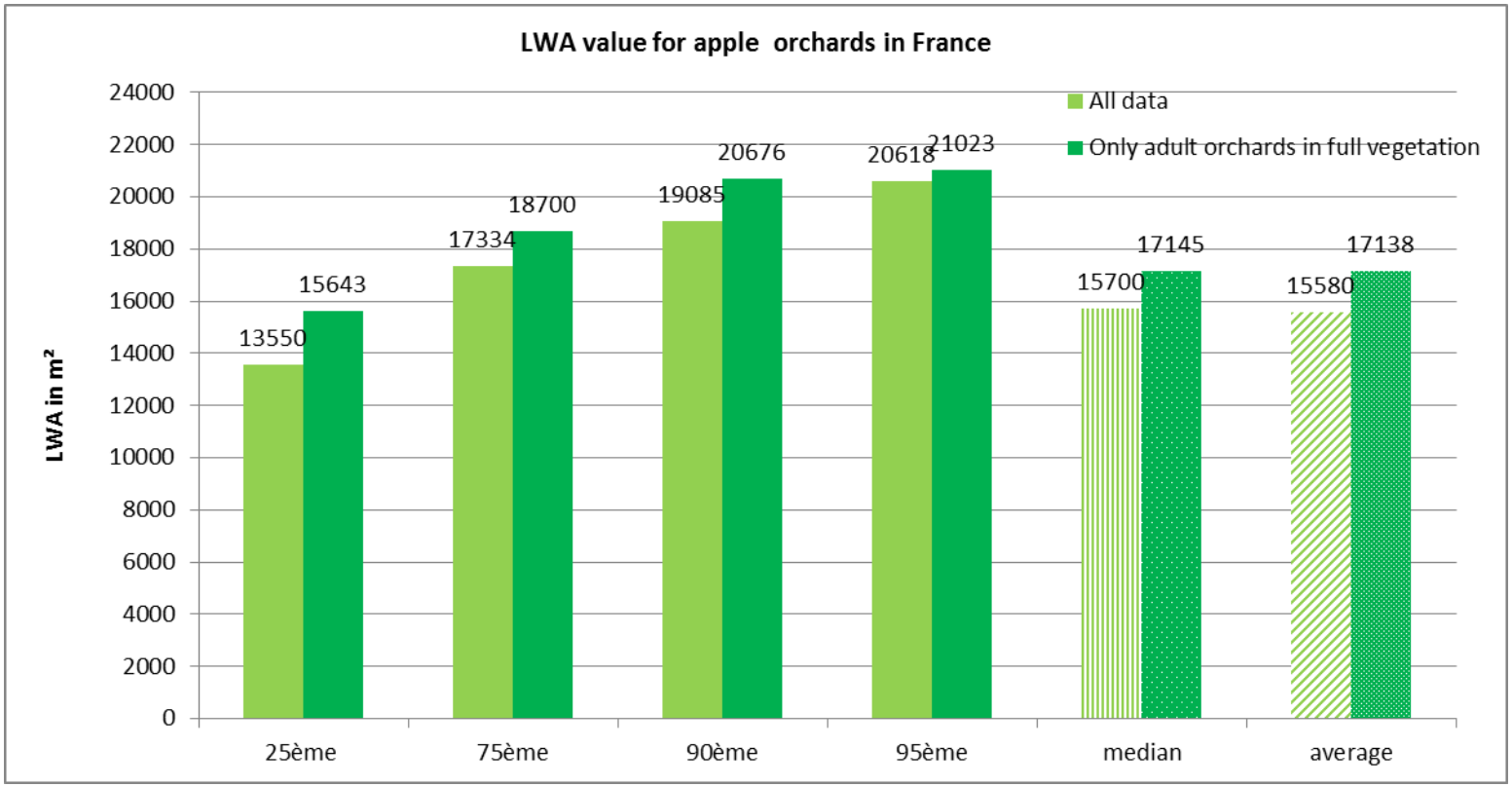
Step 1 « Characterization of orchards » : the results (without 2018)

Which LWA or TRV for each species?



Step 1 « Characterization of orchards » : the results (without 2018)

The different values of LWA apple orchards in France depending on the percentile



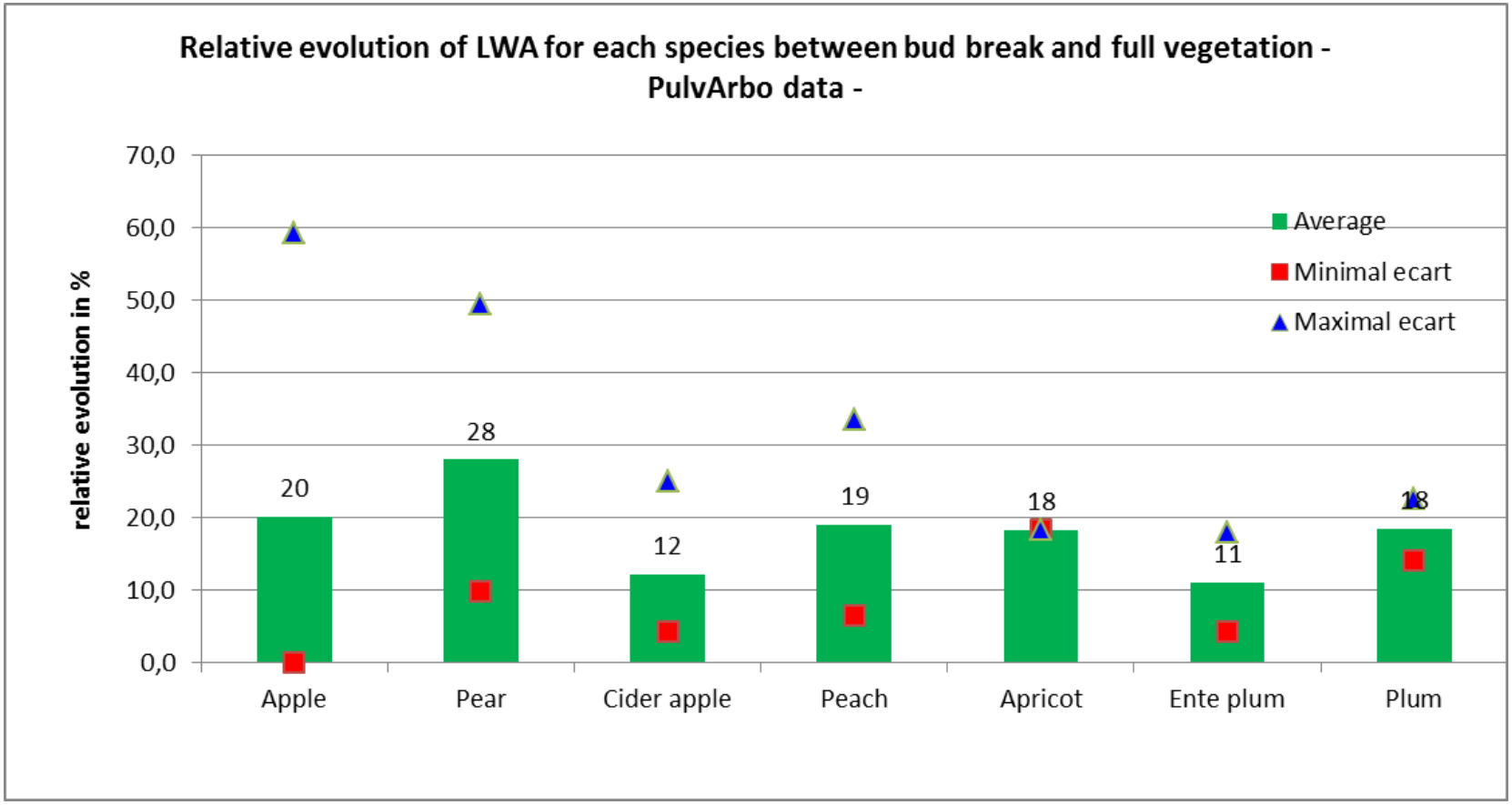
Step 1 « Characterization of orchards » : the results (without 2018)

What the evolution during the season for a same species?

22/03/16	14/04/16	13/05/16	25/05/16	16/06/16	15/07/16
H = 2,17 m	H = 2,28 m	H = 2,58 m	H = 2,86 m	H = 3,29 m	H = 3,53 m
L = 0,5 m	L = 0,55 m	L = 1,1 m	L = 1,2 m	L = 1,3 m	L = 1,36 m
D = 3,5 m	D = 3,5 m	D = 3,5 m	D = 3,5 m	D = 3,5 m	D = 3,5 m
LWA = 12400 m²	**LWA = 13028 m²**	**LWA = 14742 m²**	**LWA = 16342 m²**	**LWA = 18800 m²**	**LWA = 20171 m²**
TRV = 3100 m3	**TRV = 3638 m3**	**TRV = 8344 m3**	**TRV = 10177 m3**	**TRV = 12251 m3**	**TRV = 13738 m3**
C-C3	F-F2	I-J	Grossissement		

Step 1 « Characterization of orchards » : the results (without 2018)

What the evolution during the season for a same species?



Step 1 « Characterization of orchards » : the results (without 2018)

65 orchards followed since 2017 by Lidar measures

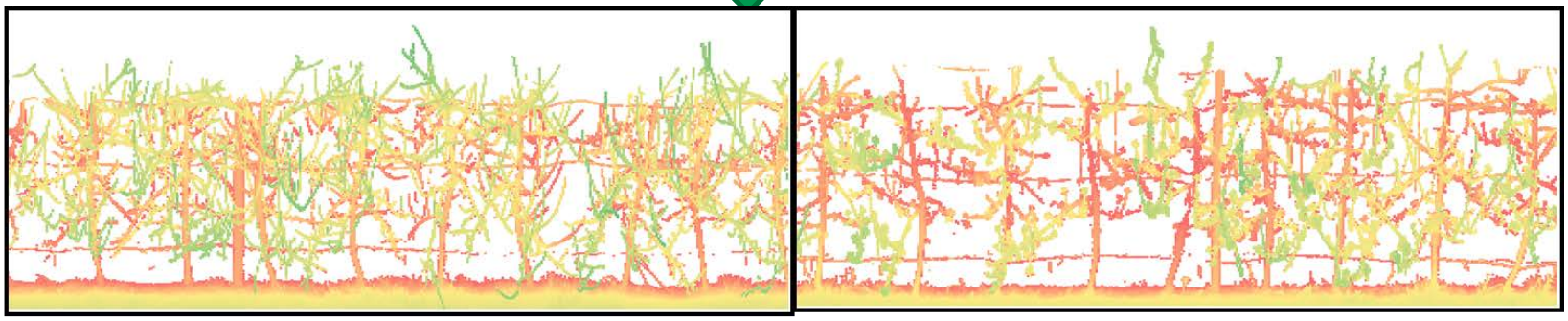
→ ***Pome fruits :*** *hedge, axe, drilling (38 orchards)*
→ ***Stone fruits :*** *gobelet (10 orchards)*
→ ***Nuts, cider apple:*** *axe, gobelet (17 orchards)*

Step 1 « Characterization of orchards » : the results (without 2018)

65 orchards followed since 2017 by Lidar measures

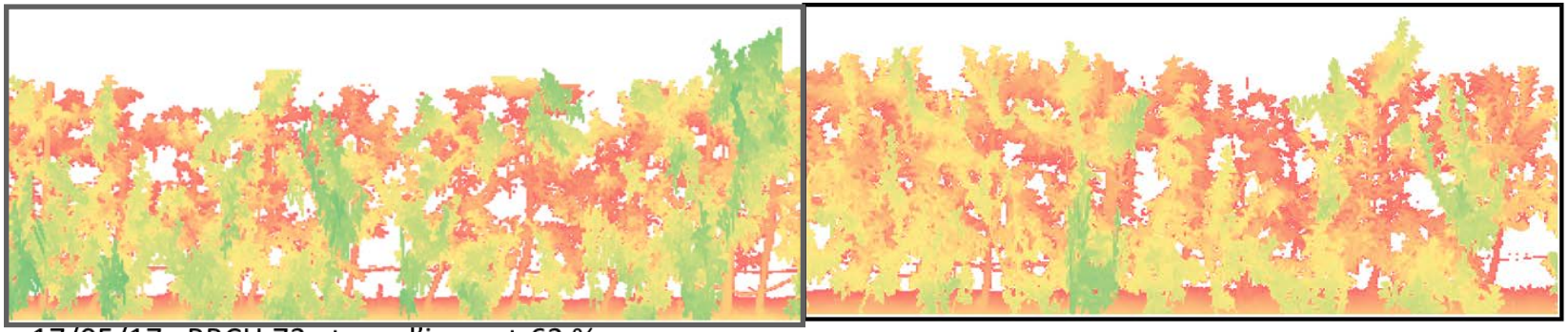
The same approach is adopted : 4 dates of measurements on each orchard by year

Apple, Golden, Axe, 7 years.



23/02/17 ; Dormance ; taux d'impact 36,5%

30/03/17 ; BBCH 66 ; taux d'impact 37%



17/05/17 ; BBCH 73 ; taux d'impact 63 %

11/07/17 ; BBCH 77 ; taux d'impact 70%

Step 1 « Characterization of orchards » : the results (without 2018)

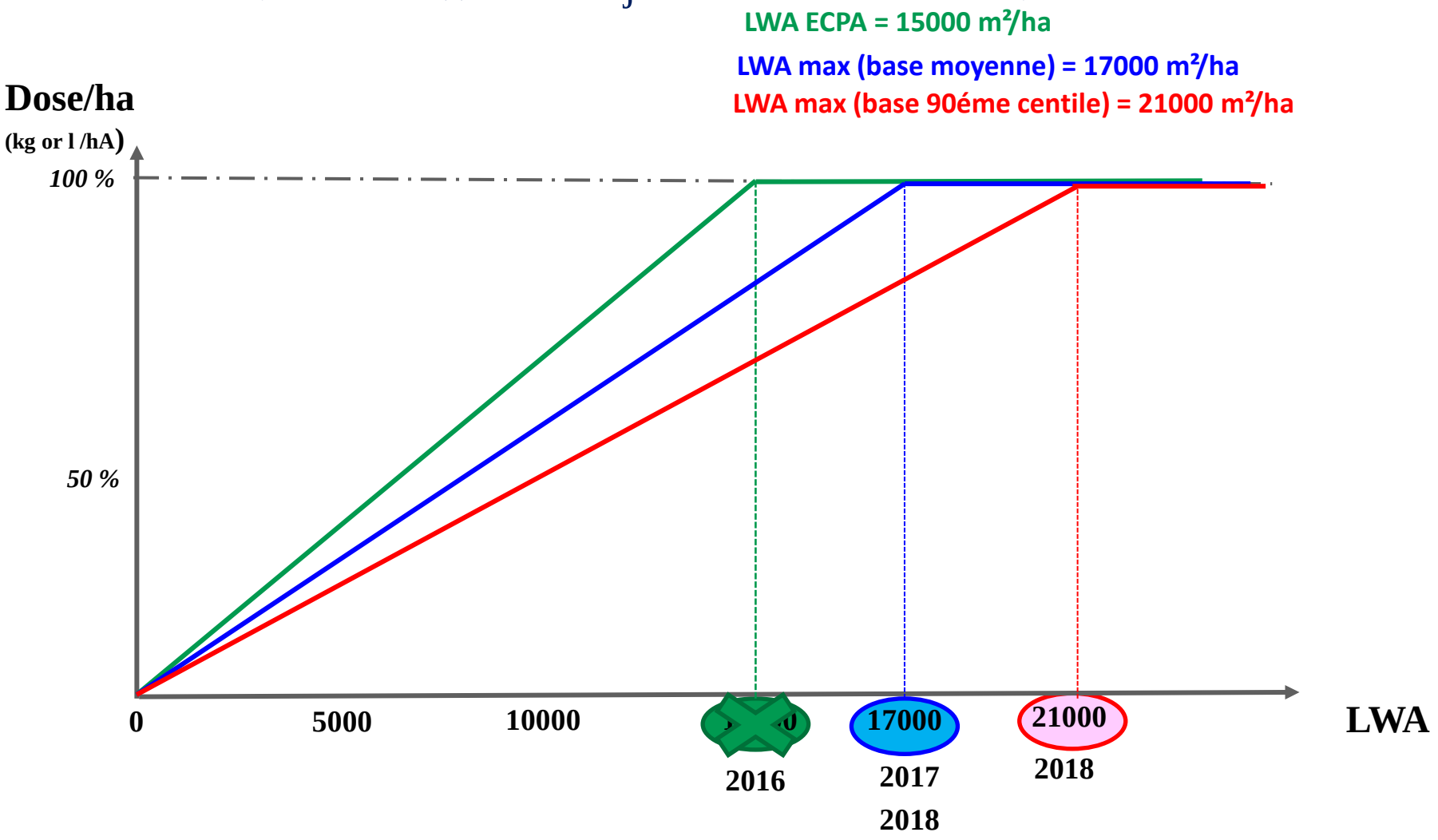
65 orchards followed since 2017 by Lidar measures

Creation of a data Base by IRSTEA

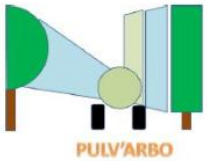
Station	Code rang	Date	Espèce	Variété	Age	Conduite	Distance I	Moyenne des hauteur	centile des	centile des	95eme centile des hauteurs	mum des h	des Epaisse	80emes cer	90emes cer
CEHM	E49	21/02/2017	Pomme	Dalinette	10	Axe	4	2,21	2,52	2,78	3,01	3,65	0,75	1,18	1,40
CEHM	E49	21/02/2017	Pomme	Dalinette	10	Axe	4	2,21	2,51	2,80	3,06	3,61	0,76	1,20	1,43
CEHM	E49	21/02/2017	Pomme	Dalinette	10	Axe	4	2,31	2,62	2,92	3,09	3,76	0,67	1,07	1,26
CEHM	E49	21/02/2017	Pomme	Dalinette	10	Axe	4	2,28	2,59	2,86	3,02	3,73	0,65	1,04	1,23
CEHM	J9	21/02/2017	Pomme	Joya	13	Axe	4	2,27	2,52	2,79	3,05	4,12	0,47	0,77	0,94
CEHM	J9	21/02/2017	Pomme	Joya	13	Axe	4	2,28	2,55	2,82	3,09	4,13	0,47	0,77	0,94
CEHM	J9	21/02/2017	Pomme	Joya	13	Axe	4	2,25	2,47	2,79	3,05	4,07	0,48	0,79	0,96
CEHM	J9	21/02/2017	Pomme	Joya	13	Axe	4	2,20	2,45	2,51	2,69	3,29	0,36	0,58	0,73
CEHM	J20	21/02/2017	Pomme	Ariane	13	Axe	4	2,93	3,26	3,39	3,52	3,94	0,70	1,15	1,40
CEHM	J20	21/02/2017	Pomme	Ariane	13	Axe	4	2,93	3,25	3,39	3,52	3,95	0,70	1,14	1,39
CEHM	J20	21/02/2017	Pomme	Ariane	13	Axe	4	2,97	3,32	3,49	3,63	4,24	0,66	1,08	1,32

Step 2 : define different scenario

➢ **Scénario n°1**: test the LWA as a adjustment dose indicator.



Step 2 : define different scenario



- **Scénario n°2**: test abacus or grid taking into account BBCH stage, high canopy classes and width canopy classes …Why?

- Perhaps more relevant than a simple linear adjustment?
- No calculation to arrive at indicators: facilitation of implementation for the growers.

Example of the apple grid

	Stade BBCH < 69			Stade BBCH > 69		
	Largeur canopée en m			Largeur canopée en m		
Hauteur traitée en m	0.5 à 1.5 m	[1.5 à 2.5 m[	≥ 2.5 m	0.5 à 1.5 m	[1.5 à 2.5 m[	≥ 2.5 m
< 2.5 m	40 *	50		60	70	
2.5 à 3.2 m[	70	80	100	80	90	100
[3.2 à 4.2 m[	80	90	100	90	100	100
≥ 4.2 m		90	100	90	100	100

* In % of full dose

Step 3 : assess the different scenario

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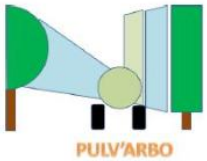
- 9 trials sites : 7 experimental sites & 2 growers sites.
- Species : apple and cider apple.
- Same methodologie on each site : observation of apple scab, aphis, codling moth, oidium…
- Calcul of indicators: IFT, PPP reduction, PPP charge…

Comparison of the dose adjustment scenario to the full dose and measure of the impact of the different scenario on the managment of pest and diseases.

Step 3 : assess the different scenario



- Definition of a sanitary quality index to compare the scenario , based on different thresholds:

	Threshold (%) for apple	Threshold (%) for cider apple
Apple scab damages on fruits	2	10
Apple scab damages on shoots	20	40
Codling moth damages	2	5
Rosy apple Aphis damages on shoots	15	20
Wolly aphids damages	30	30
Oidium damages on shoots	20	20

- **Insufficient control** (●): one threshold is exceedeed on fruits for at least one pest or disease, wether there is damage or not on shoots.
- **Average control** (●) : no threshold is exceedeed on fruits but at least one is exceedeed on shoots.
- **Good control** (●) : no pest and disease is present in the orchard or no threshold is exceedeed on fruits or shoots.

Step 3 : assess the different scenario

- The first conclusions on the different scenario tested :

Scenario	% of reduction of PPT use (IFT)	sanitary quality index compared to the reference full dose
Linear adjustment to LWA with a LWA max = 15000m²/ha	-7 à -24%	
Easy to implement but 15000m²LWA too low for our french orchards (value achieved at the first treatment of the season in 55% of the case)		
Linear adjustment to LWA with a LWA max = 17000m²/ha	-1 à – 22%	80% of cases 
Easy to implement, can allow a PPP reduction use of 22% in 80% of situation		
Linear adjustment to LWA with a LWA max = 21000m²/ha	? Results 2018 in process	? Results 2018 in process
Abacus of adjustment	-8 à -26%	
Easy to implement, take account of many parameters (BBCH, high and width), allow a interesting reduction of PPP use for an equal pest and disease control than the full dose.		

The perspectives

- Continue this work !
- Measure the deposits linked to the different scenarios at early, mid and full stage of vegetation.
- make proposals to the ministery in accordance with the decisions taken in the new CEB working group

Ctifl

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