



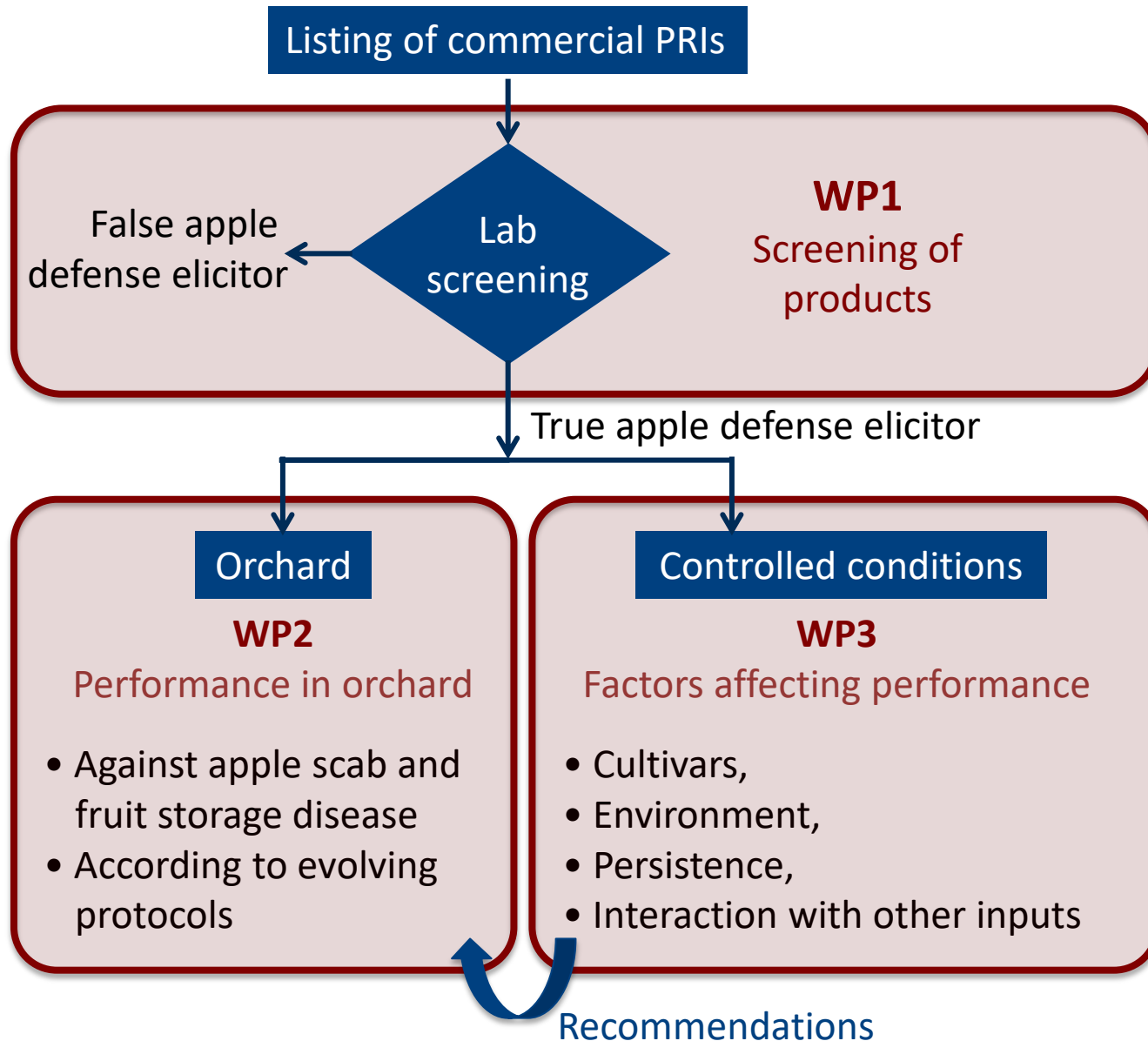
PEPS project (2014-2017)

Evaluation and optimisation of the use of plant resistance inducers (PRI) in apple orchards : application to apple scab and storage diseases

Action pilotée par le ministère chargé de l'agriculture et le ministère chargé de l'environnement, avec l'appui financier de l'Office national de l'eau et des milieux aquatiques, par les crédits issus de la redevance pour pollutions diffuses attribués au financement du plan Ecophyto

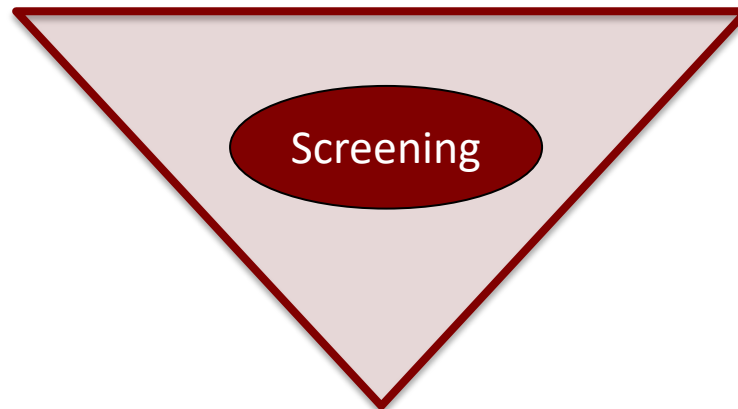
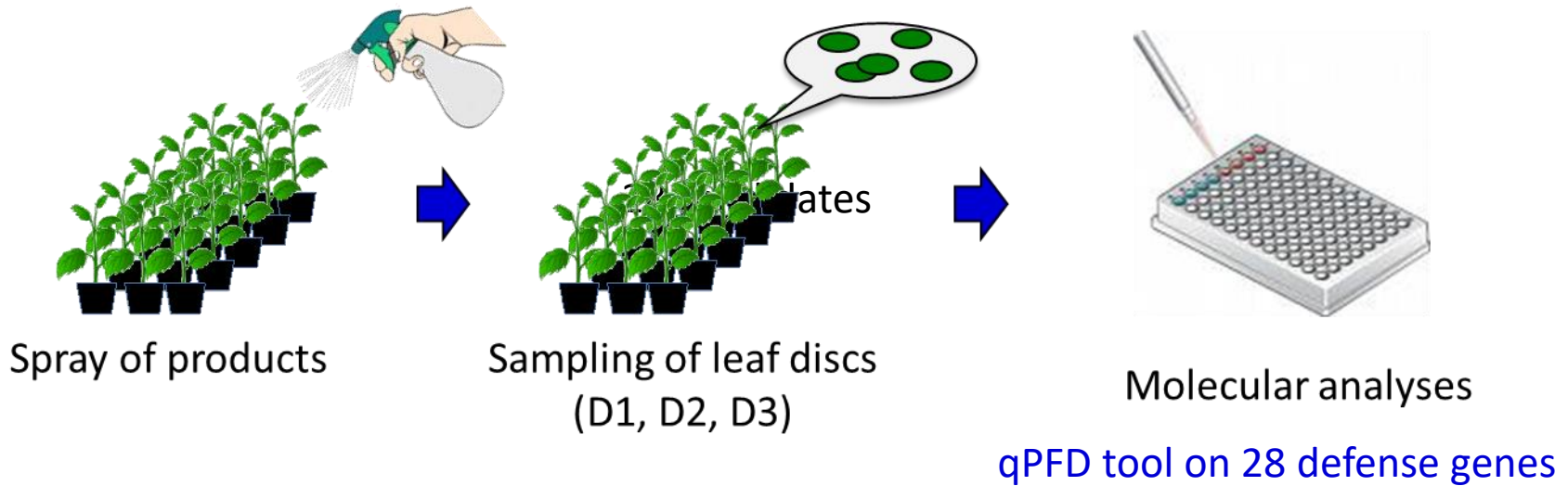


Project organization (11 partners)



WP1 – Screening of products

Methodology



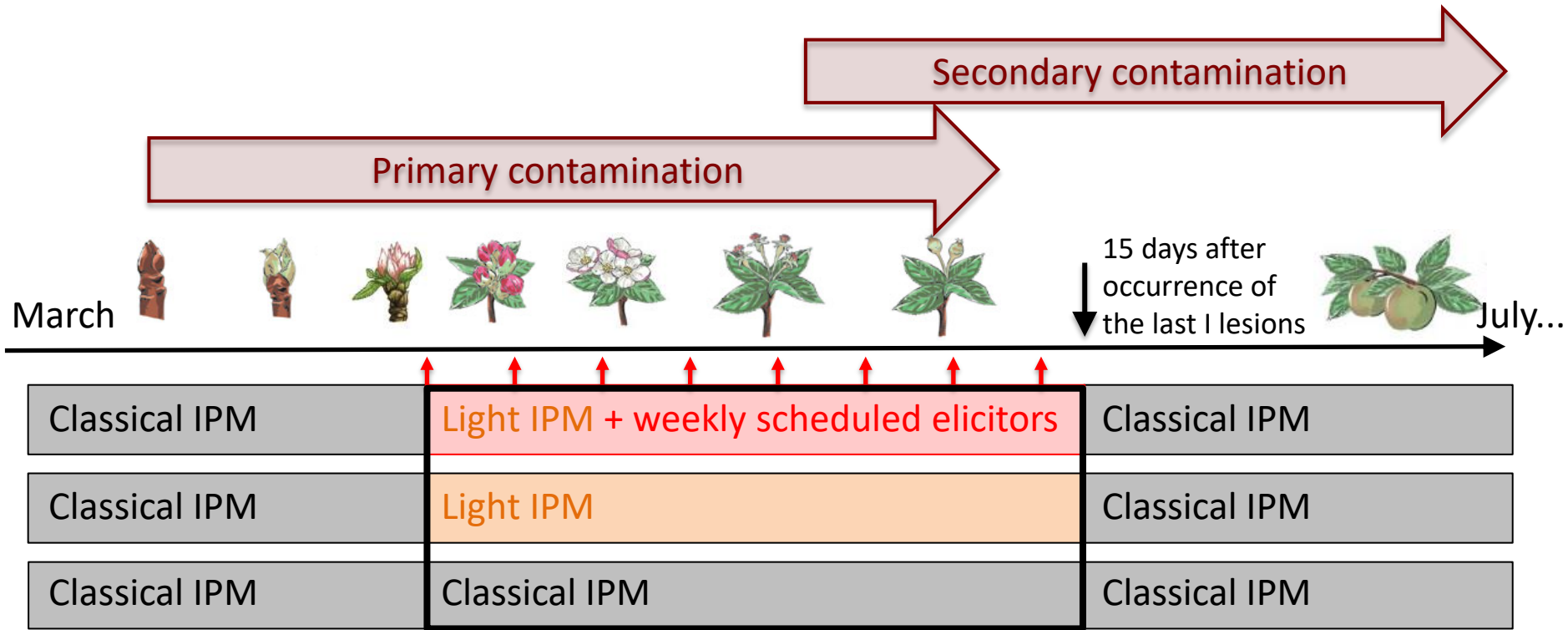
Results

5 best elicitors
for apple

Salicylic acid analog
 K-phosphonate
 K-bicarbonate
 2 foliar fertilizers

WP2 – Performance in orchard : apple scab

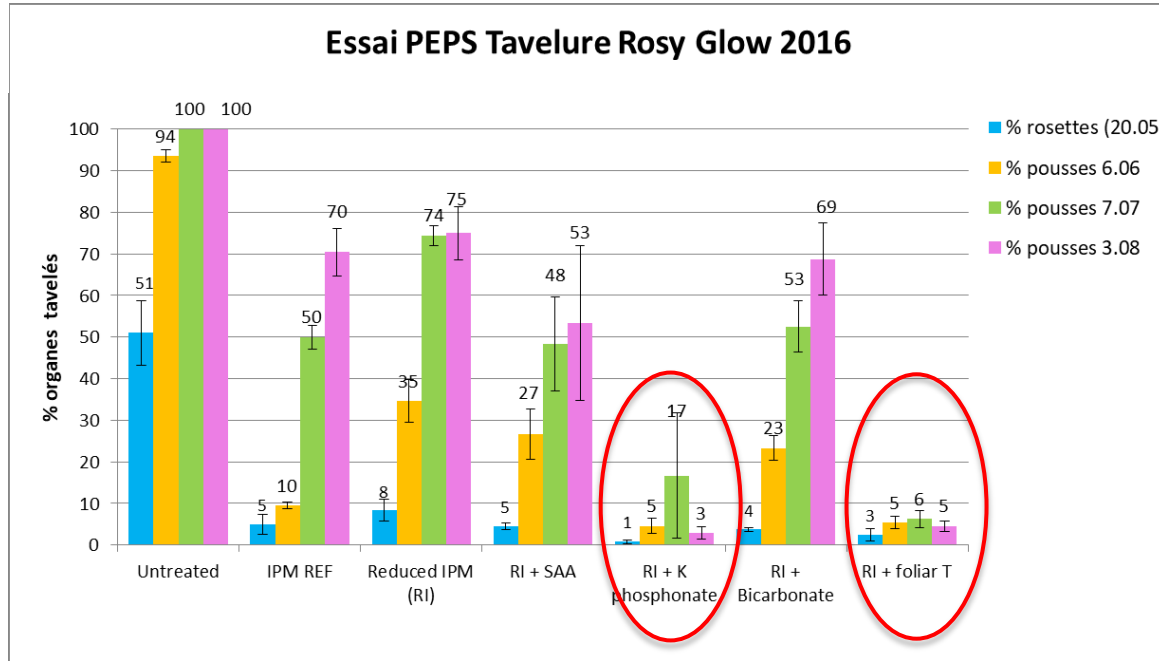
Strategy Common protocol agreed by the 8 experimental units



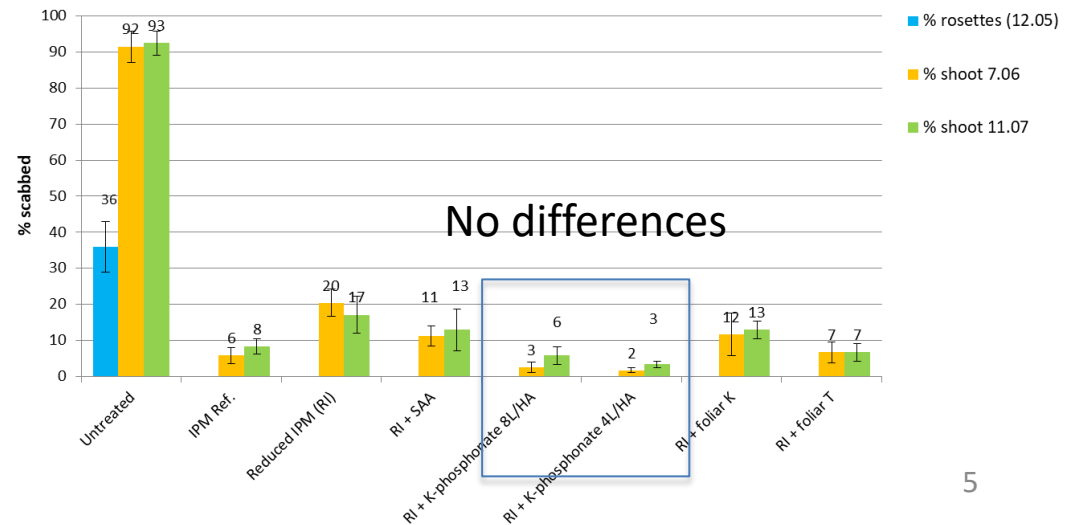
Light IPM Management with a risk taking:
 - 2016 & 2017 gap after at least 2 applications of elicitor

Reference and Light : spraying / tractor. Elicitors : spraying / portable sprayer (SOLO)
 Plots 10 trees / 4 Blocks

Apple scab : Results 2016 & 2017 on shoots

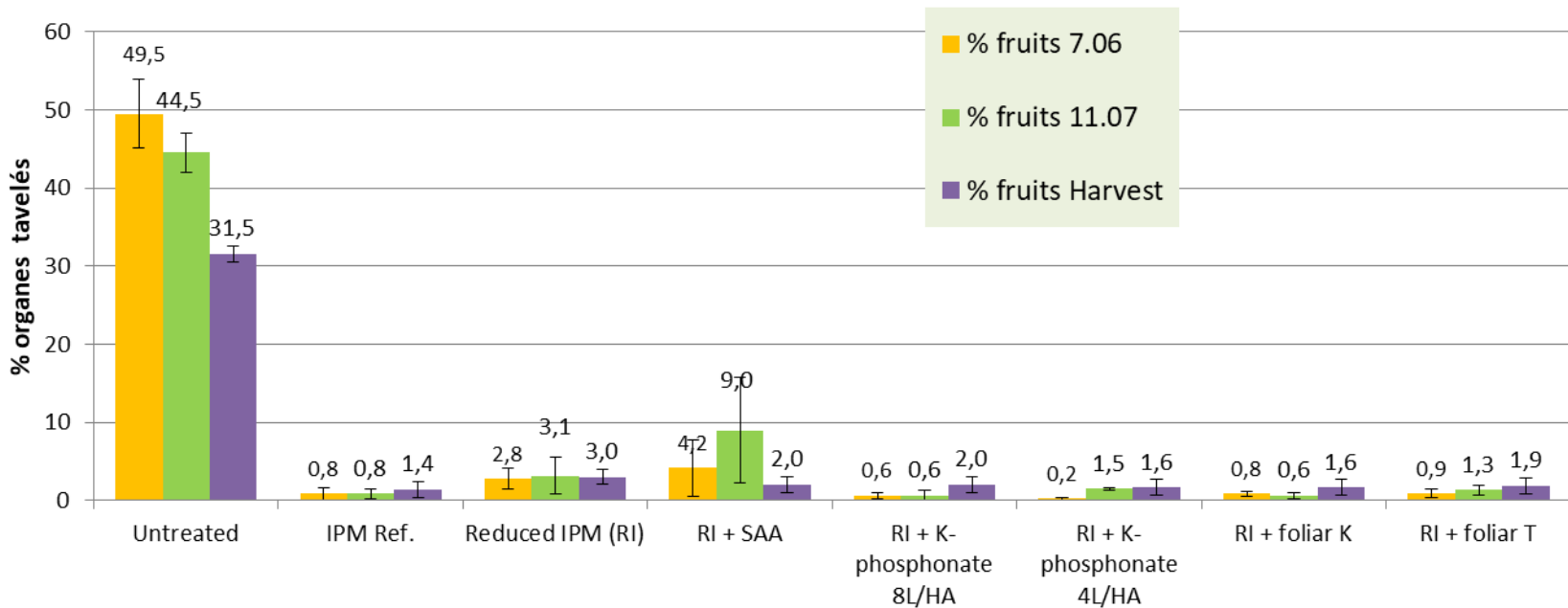


PEPS Tavelure Rosy Glow 2017



Apple scab : Results 2017 on fruits

PEPS Tavelure Rosy Glow 2017



**Strategy : 7 PRI spraying in cadence
from 22/03 to 3/05**

“Light” : 26 ppm (6 Delan Pro)
 “Light” + LBG 4L/ha : 41 ppm
 “Light” + LBG 8L/ha : 73 ppm

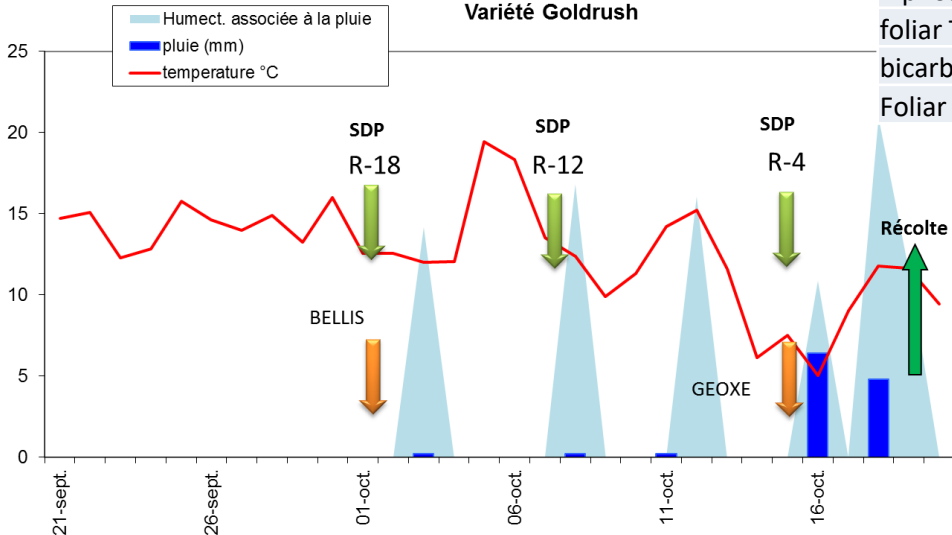
MLR = 75 ppm



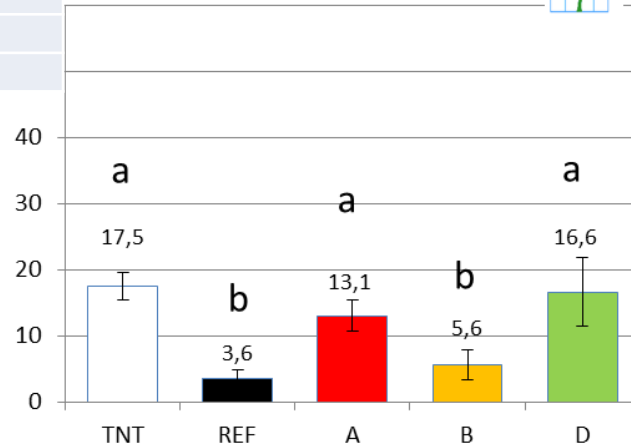
Storage diseases : Results 2015 & 2016

Untreated	TNT
Reference	REF
SAA	A
K phosph. foliar T	C
bicarb.	D
Foliar K	E

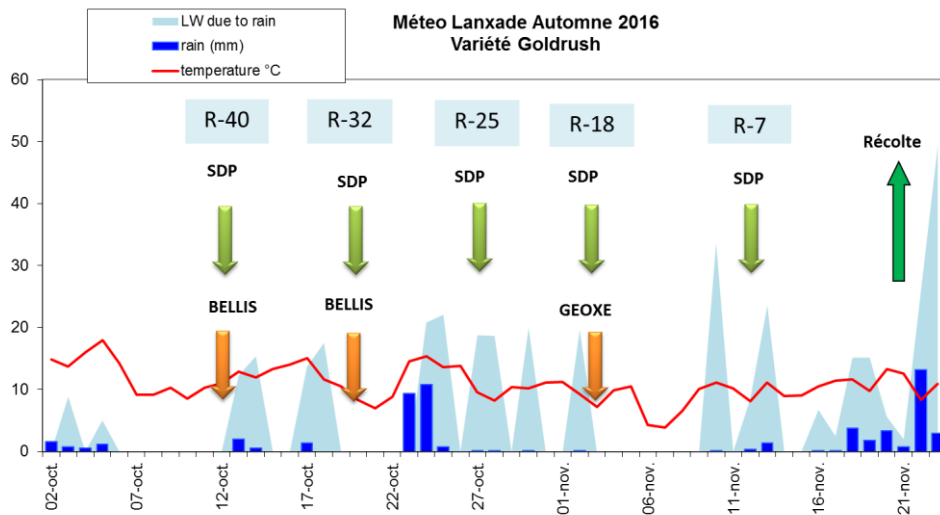
Méteo Lanxade Automne 2015
Variété Goldrush



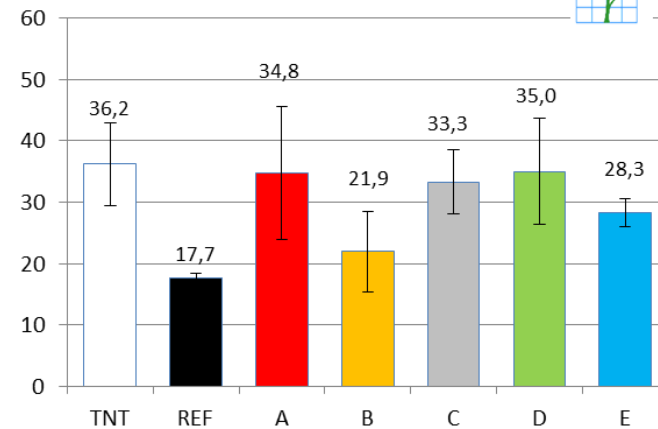
Goldrush 2015



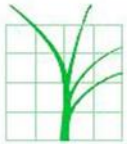
Méteo Lanxade Automne 2016
Variété Goldrush



Goldrush 2016

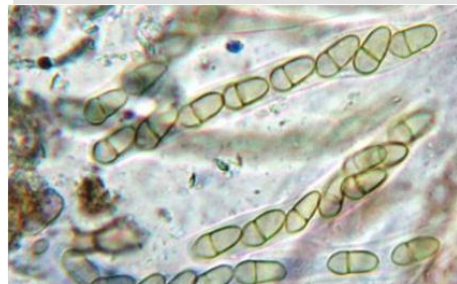


Ctifl



Rain cover against Apple Scab

Michel GIRAUD, Franziska ZAVAGLI
Ctifl, Centre Lanxade 24130 Prignonrieux - France





Rain covers in Pink Lady® Rosy Glow orchard



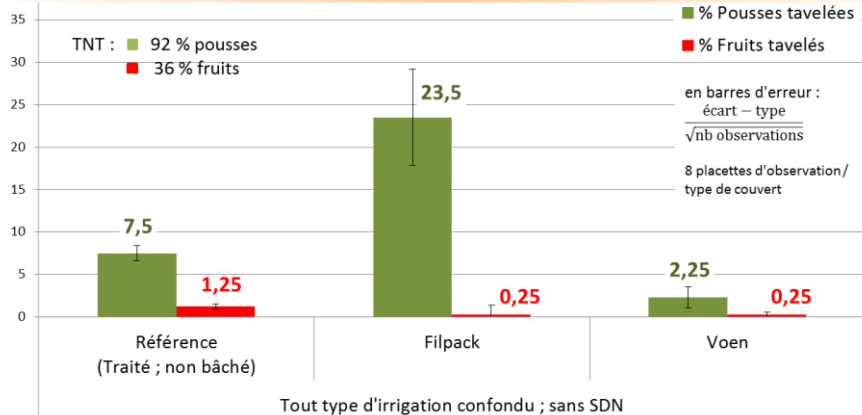
Voensystem

Filpack (under hailnet)

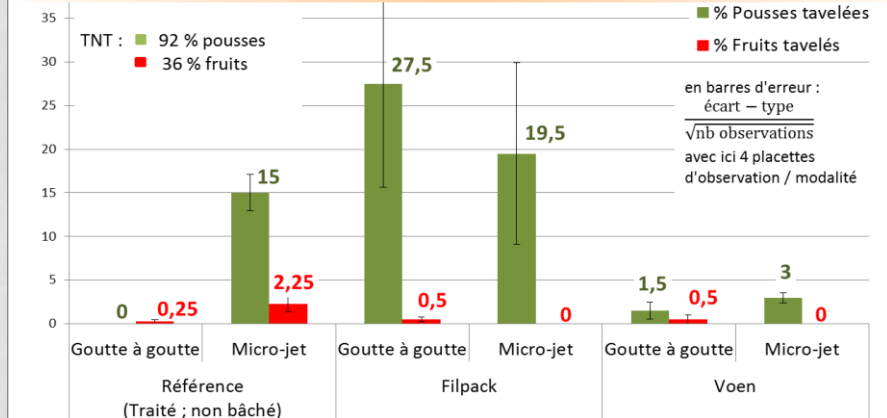
Influence of the type of rain cover and irrigation on apple scab

Rosy Glow, August 2017

Influence of the type of rain cover



Influence of the type of rain cover x irrigation



An important difference :

Filpack : higher apple scab pressure on shoots

Voën : efficacy similar to the reference, and even better.



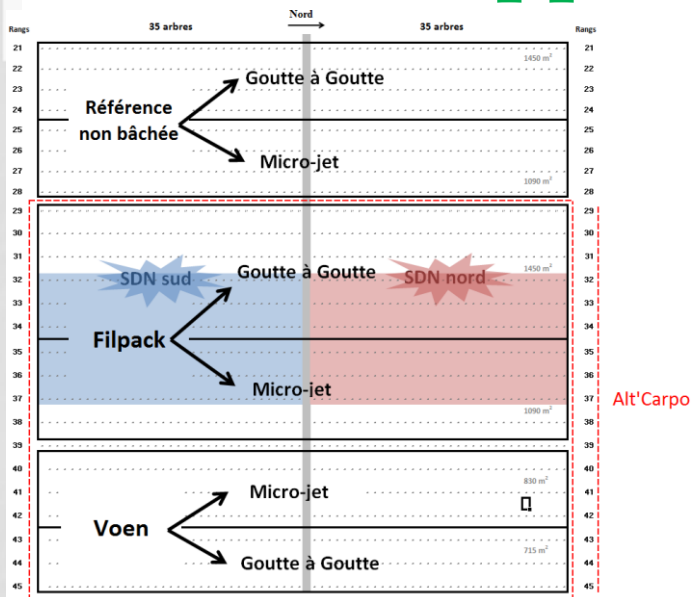
Not a clear effect :

For the reference, more apple scab with micro-jet.

Under rain cover, almost the same between micro-jet and drip system.



Effect of plant resistance inducers on apple scab under Filpack



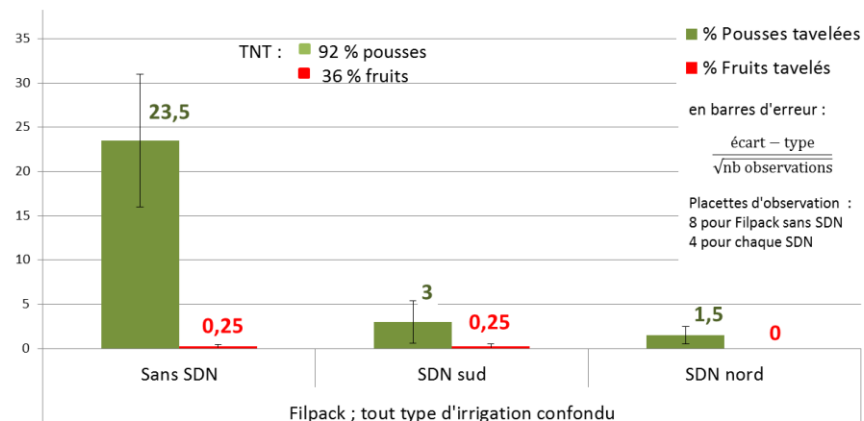
Treatments under Filpack :

- 8 sulphur from the beginning of March to the end of May
- 7 PRI from the end of March and Mid-May (one per week)
- *in Blue* : K-phosphonate
- *in Pink* : foliar fertilizer

Effect of PRI (August 2017)

- With PRI less apple scab symptoms , but no significant difference between the 2 PRI.
- Residues of phosphonic acid : ref. (uncovered) : 26 ppm (6 Delan Pro) ; Filpack LBG : 36 ppm (MLR = 75 ppm)

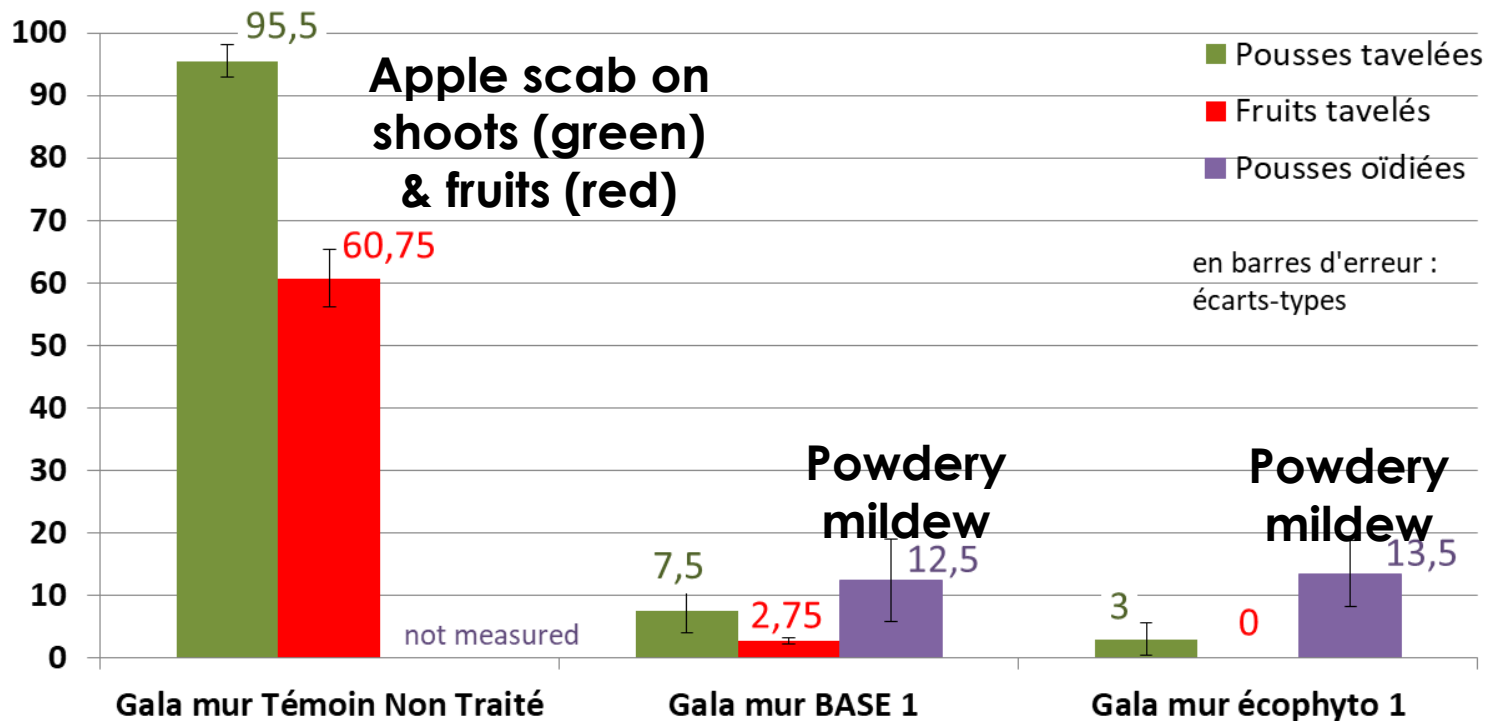
Influence du traitement SDN Pourcentages de pousses et fruits tavelés sur Rosy Glow en août (07/08/2017, Lanxade parcelle U)





Results (apple scab and powdery mildew) under Filpack for Gala in 2017

Pourcentages de pousses et fruits tavelés et de pousses oïdiées
sur Brookfield Gala le 12/07/2017
(Lanxade, parcelle Sa)

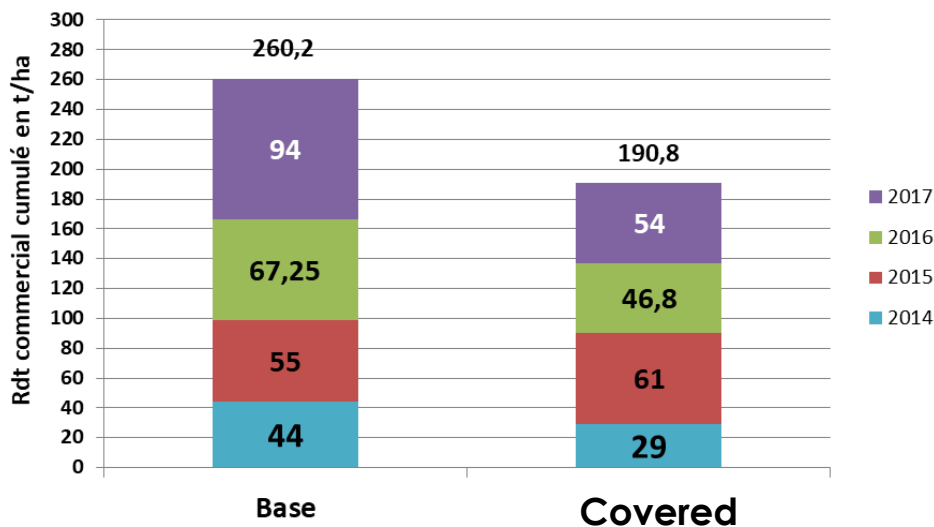


Under rain cover : 7 sulphur + 2 specific powdery mildew treatments



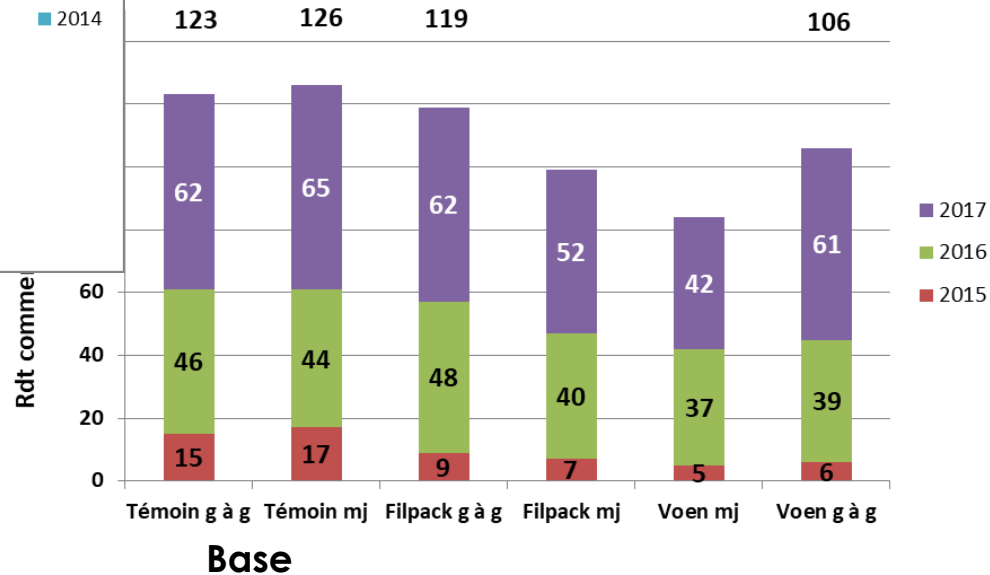
Cumulative yield obtained on Gala and Rosy Glow under rain cover / no covered

Comparaison "Rendements bruts cumulés" Brookfield base et Brookfield Ecophyto



g à g = drip irrigation
mj = microjet

Comparaison "Rendements bruts cumulés" Rosy glow parcelle U 2015 - 2017



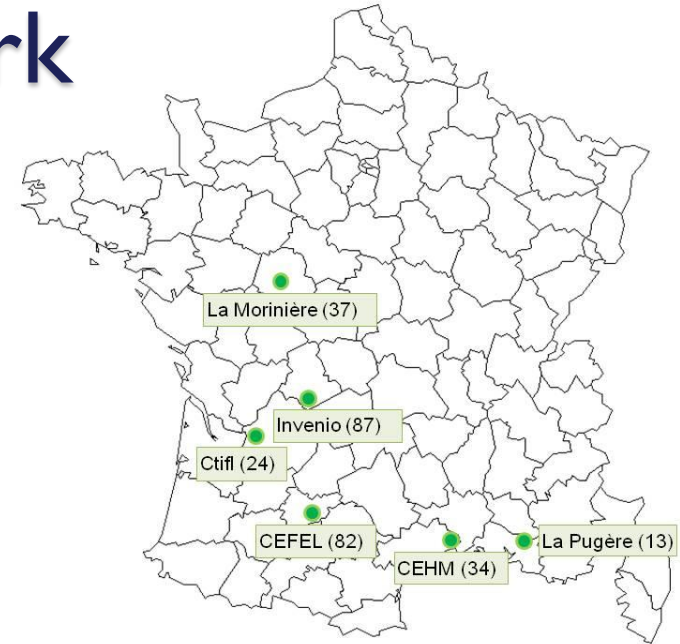


A multi-location, long term and multi-factors network

The French National Apple Network “Ecophyto Experimentation”

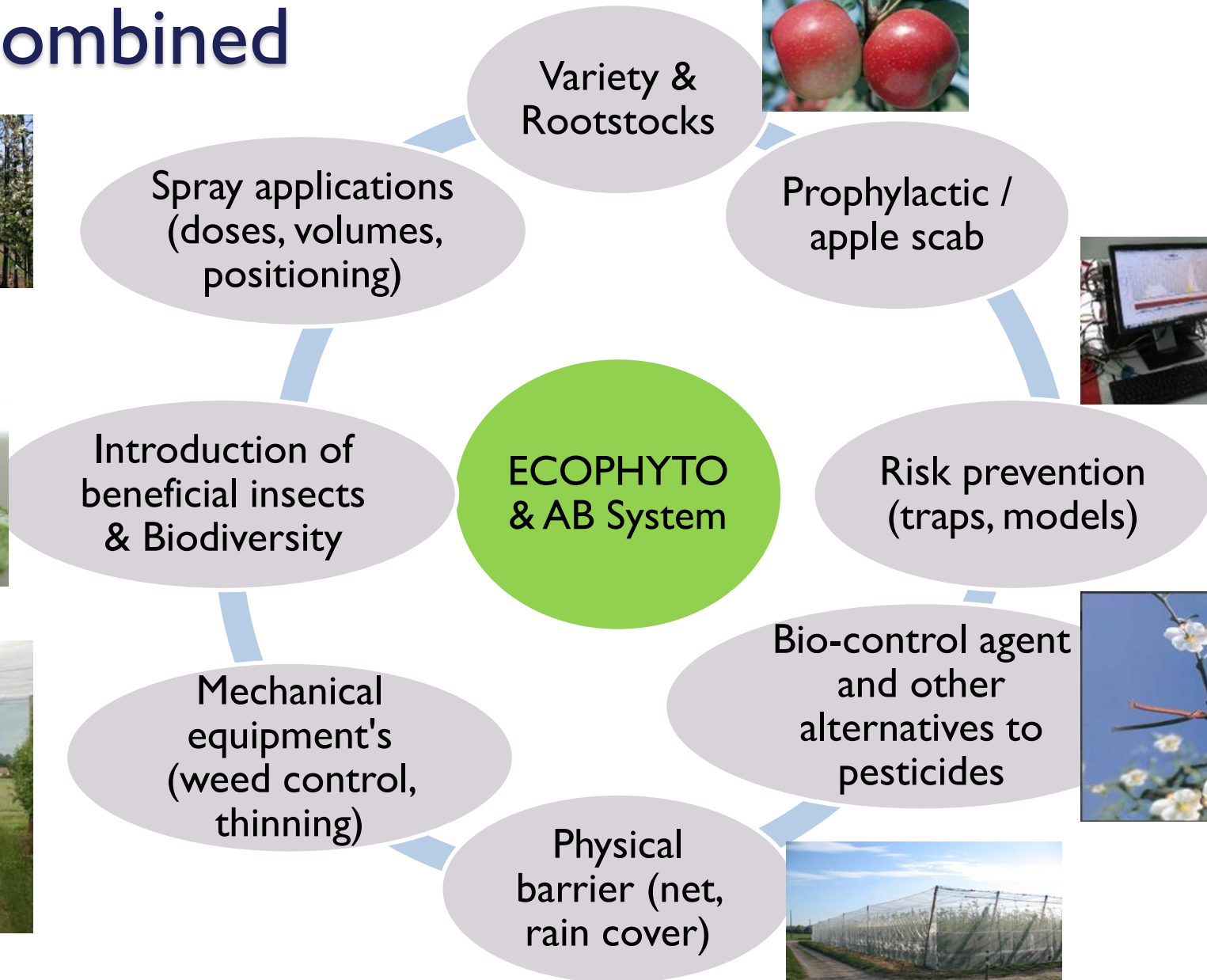
Evaluation of innovative multi-site apple production systems, with the aim to reduce the use of pesticides.

- 27 systems from 500 to 5200 m²
- 6 seasons (2012 – 2018)



Type of system	number	Varieties
Base system	11	Gala, Fuji, Golden, Granny, Rosy Glow, Ariane
ECOPHYTO 1 system	8	Gala, Fuji, Golden, Granny, Rosy Glow
ECOPHYTO 2 system	5	Ariane, Crimson Crisp
Organic system (AB)	3	Ariane, Crimson Crisp, Opal

Several techniques are combined



Spray applications
(doses, volumes,
positioning)

Variety &
Rootstocks

Prophylactic /
apple scab

Risk prevention
(traps, models)

Bio-control agent
and other
alternatives to
pesticides

Physical
barrier (net,
rain cover)

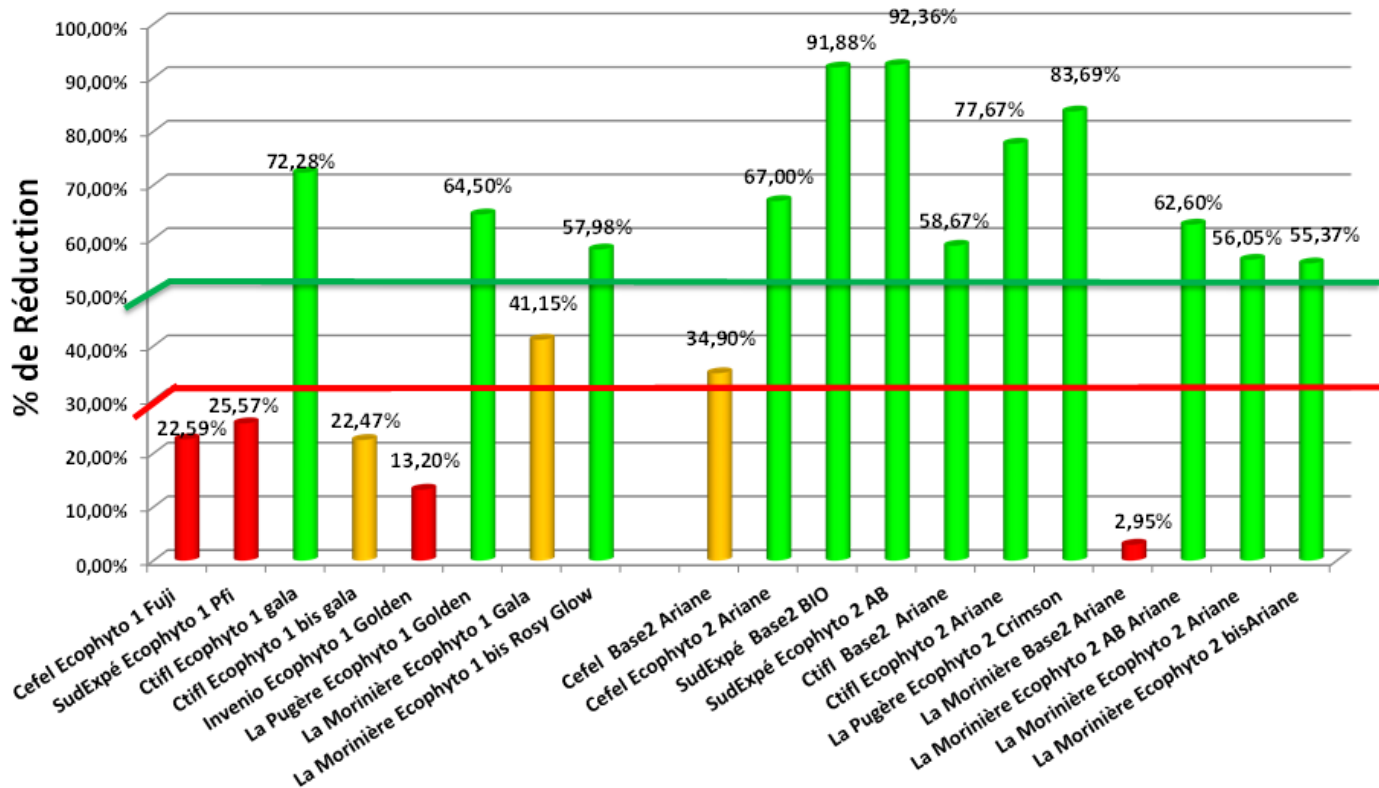
Mechanical
equipment's
(weed control,
thinning)

Introduction of
beneficial insects
& Biodiversity



Average percentage of reduction of the global chemical “TFI” (treatment frequency index : Ecophyto system / basic system (2013 to 2017)

Réduction de l'emploi des Produits phytosanitaires
 Campagnes 2013 - 2017



Scab sensible varieties

Scab resistant varieties



Reduction of the global chemical “TFI” for scab resistant varieties

Max. 35 %

Adapted scab management, but chemical fungicides

Important codling moth pressure : mating disruption & chemical insecticides

Between 55 and 65 %

Possibility to reduce the number of fungicides on primary infections. Use of "alternative" fungicides.

Important codling moth pressure : Alt'Carpo nets + mating disruption + chemical & biocontrol insecticides

Low codling moth pressure : Alt'Carpo nets or mating disruption + biocontrol insecticides

More than 75 %

Organic production + mating disruption or Alt'Carpo nets & biocontrol insecticides

Only « alternative fungicides ». Adjusted doses of all treatments + Alt'Carpo nets and few insecticides

Only « alternative fungicides » + Alt'Carpo (low codling pressure)



Reduction of the global chemical “TFI” for scab sensible varieties

Max. 25 %

No or very low possibility to reduce the number of fungicides.

Alt'Carpo nets with chemical treatments on the first generation, and sometimes third generation

No possibility to reduce insecticides against aphids

around 40 %

Possibility to reduce the number of fungicides on primary and secondary infections. Use of "alternative" fungicides.

Low codling moth pressure : mating disruption + biocontrol insecticides

Possibility to reduce insecticides against aphids

More than 58 %

Rain cover and mating disruption with chemical and biocontrol insecticides

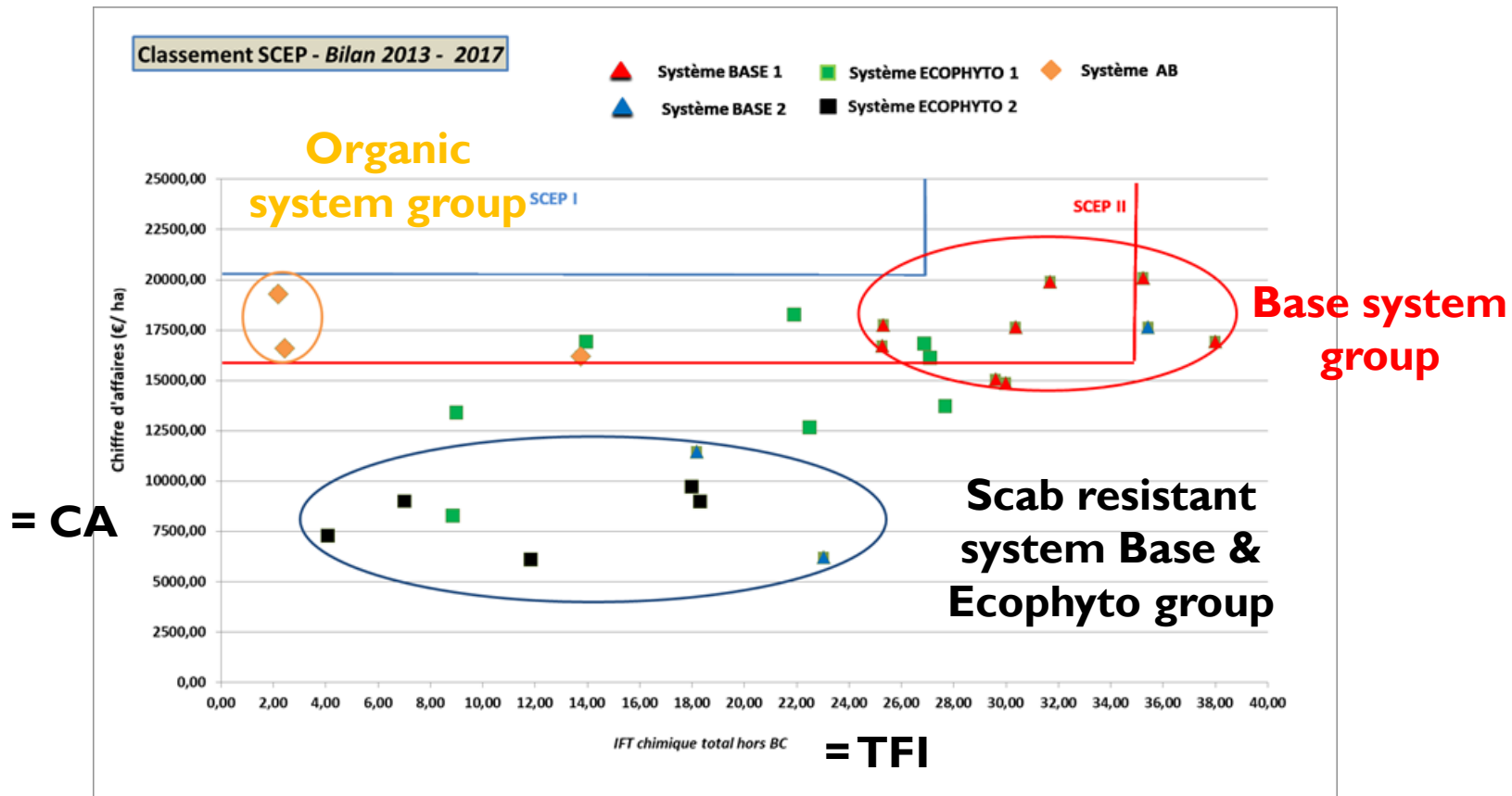
Rain cover and Alt'Carpo nets with limited insecticides (low codling moth pressure).

Adjusted doses of all treatments + Alt'Carpo nets without insecticides

Possibility to reduce insecticides against aphids



SCEP (economical & performing production system) classification



SCEP 1 = treatment frequency index (= IFT) < 26,7 and turn over (= CA) > 20212 €/ha

SCEP II = TFI < 34,8 and CA > 16 020 €/ha

Expenses, turnover & residues

On 27 production systems :

- 8 have a **turnover > expenses**
(protection costs, mechanization costs, labour costs)
- 4 have a **turnover ≈ expenses**

Which systems ?

- 6 are the **Base system** of each experimental station
- 6 are **ECOPHYTO or organic systems.**

Which protection ?

- Organic production + scab resistant variety + Alt'Carpo nets (low codling moth pressure)
- A reduced number of fungicides on Granny Smith (lower scab pressure in the South East of France) + Alt'Carpo nets
- Scab resistant variety + doses and water volume adjusted to the leave volume
- Fixed spraying system + Alt'Carpo nets (low codling moth pressure).

Zero residues :

- Organic production (copper analysis not done every time).
- Scab resistant variety, low codling moth pressure (Alt'Carpo or mating disruption), no storage diseases treatments.
- Rain cover (on Gala) + Alt'Carpo nets (low codling moth pressure).
- Doses adjustment, no storage disease treatments.



Thanks for your attention

Merci de votre attention

Action pilotée par le ministère chargé de l'agriculture, avec l'appui financier de l'Office national de l'eau et des milieux aquatiques, par les crédits issus de la redevance pour pollutions diffuses attribués au financement du plan Ecophyto 2018

