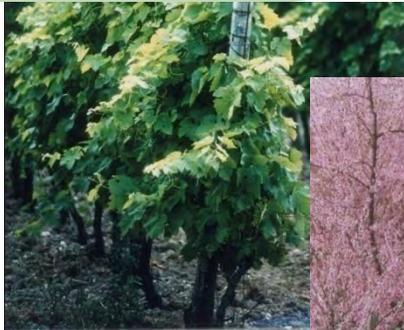


General Technical Dossier Laminarin



The choice to produce better ...



Vacciplant 

Fruits and vegetables

La nature qui stimule la nature.

Technical dossier Laminarin

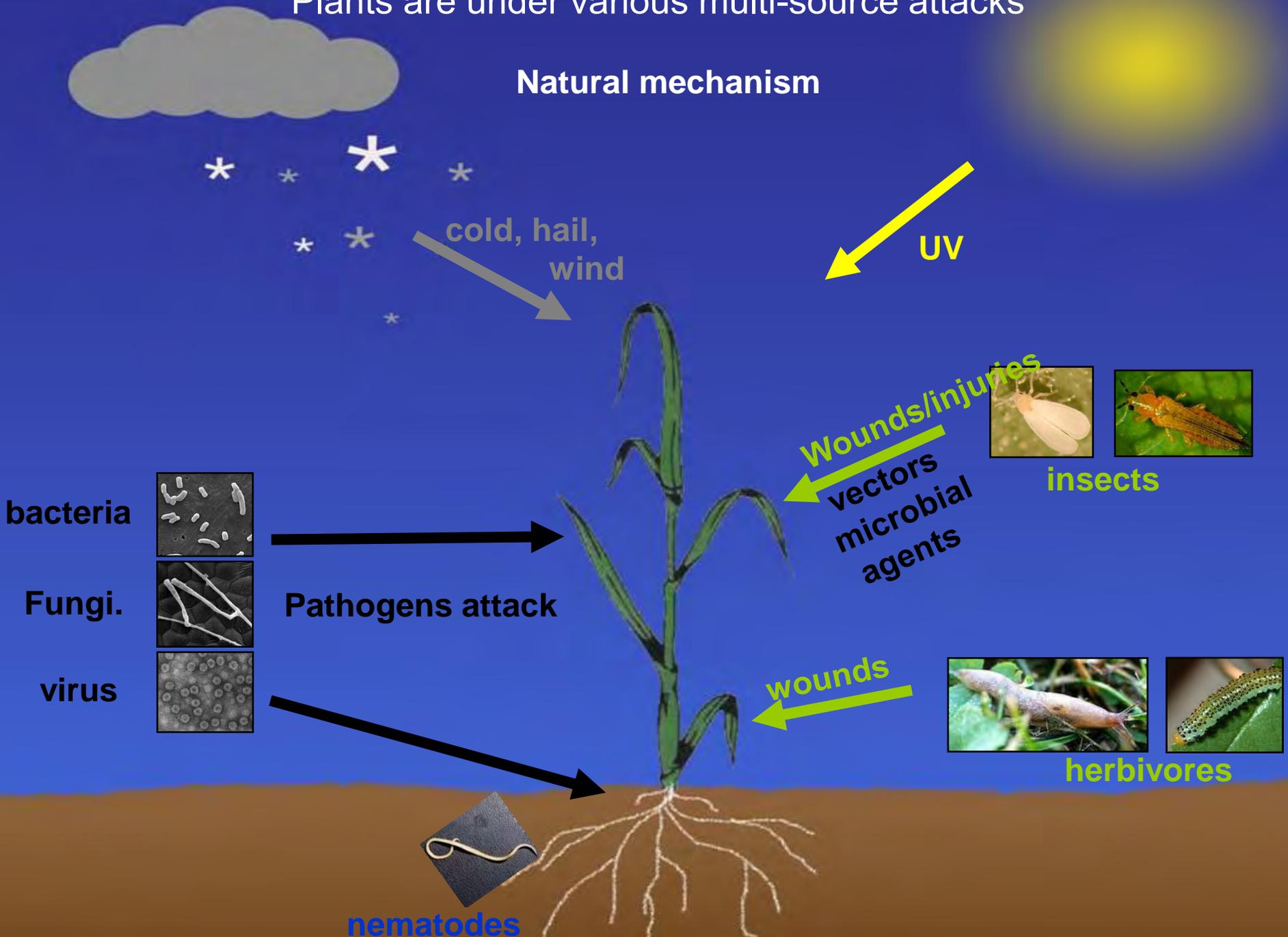
- 1) Plant natural defense mechanisms.
- 2) Laminarin: mode of action.
- 3) Laminarin: features.
- 4) Vacciplant: practical applications.
- 5) Vacciplant: trial results.
- 6) Vacciplant: use in organic farming.

Vacciplant 

Fruits and vegetables

Plants are under various multi-source attacks

Natural mechanism



The 2 plant defence strategies

Plant are naturally able to protect themselves :

Construction of a front line defence by reinforcing cell walls.



Plant strengthens its cell walls by producing lignin.

The counter attack : production of compound that directly target the agressor.



Phytoalexins inhibit the development of fungi.

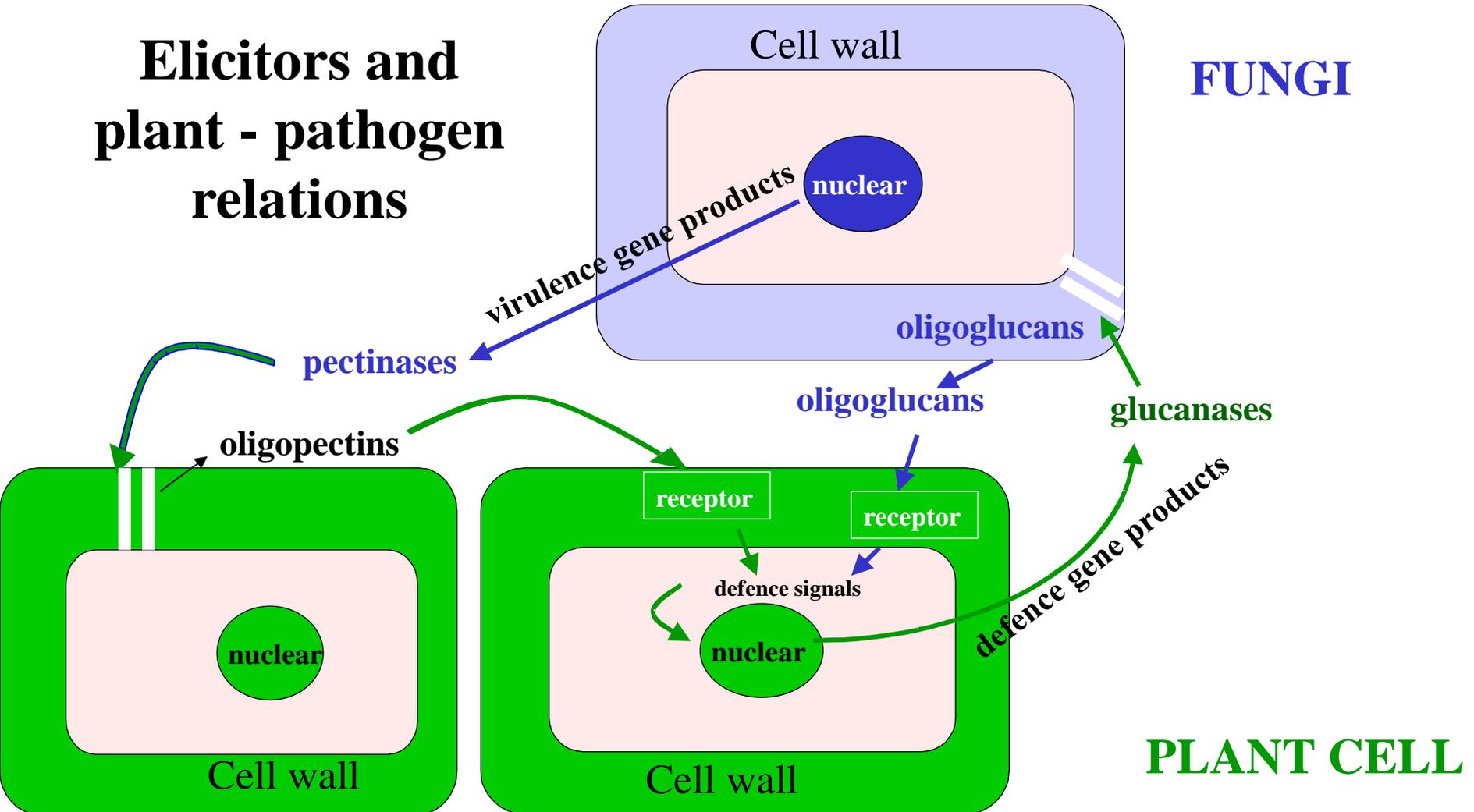
La nature qui



Plants produce defence proteins (PR proteins) that attack fungus cell walls.

Plant cell **reactions**

Elicitors and plant - pathogen relations



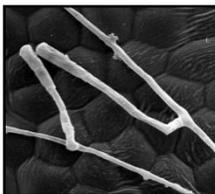
Plant defence mechanisms are universal

All species have the ability to set up non specific plant defence mechanisms.



These plant defence mechanisms are efficient against a wide range of various pathogens.

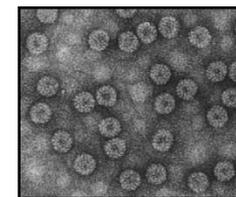
Fungi



Bacteria

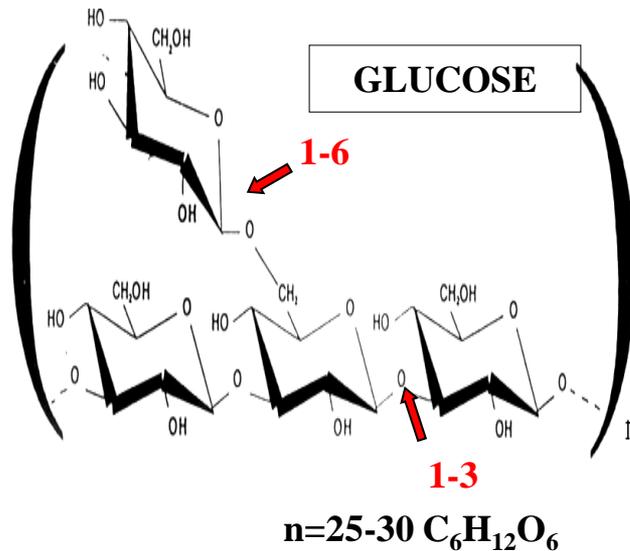


Virus



A GOËMAR / CNRS innovation project

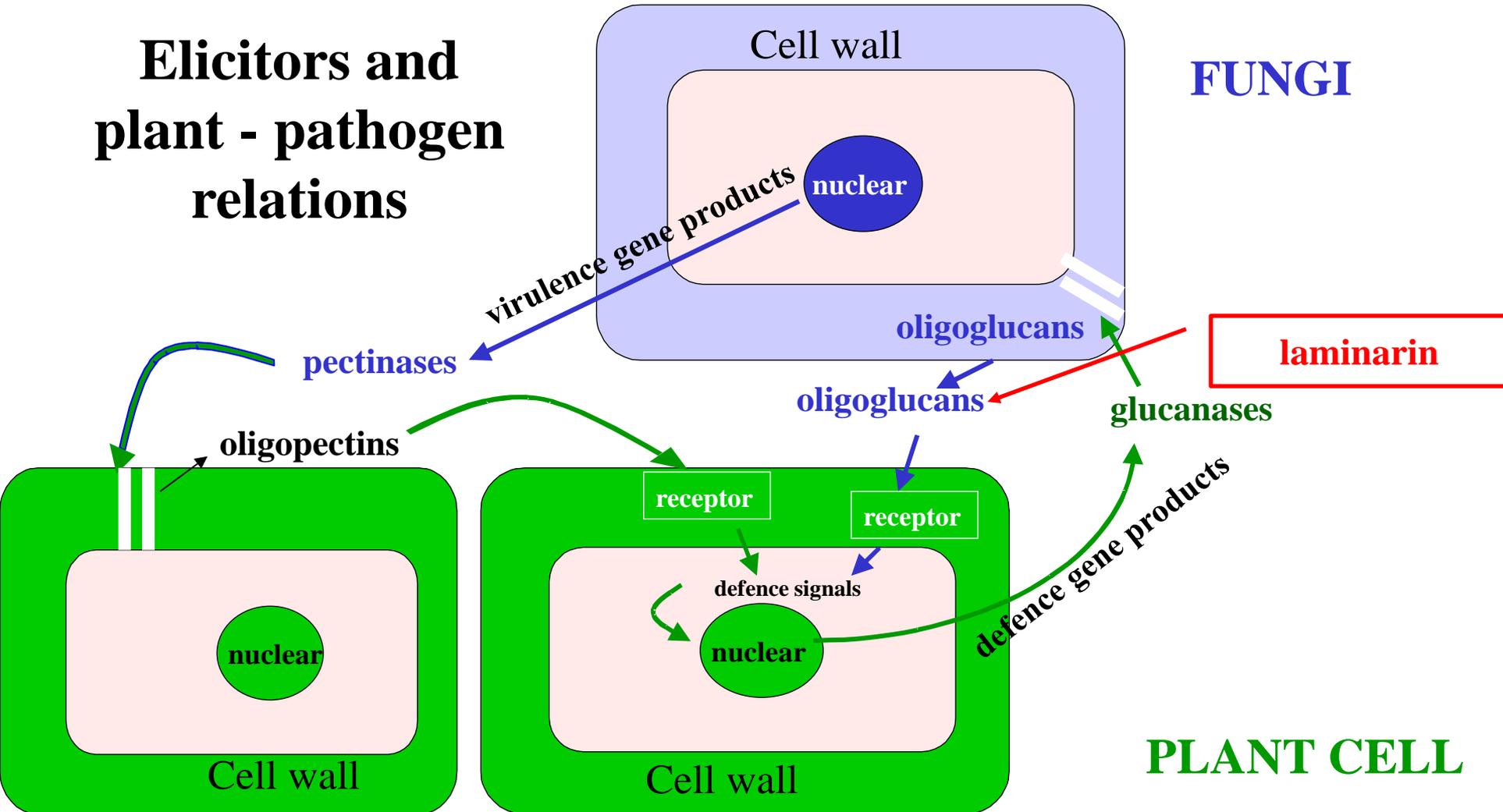
A natural non toxic molecule



Laminarin is a chain of glucose, basic unit of sugar, similar than oligosaccharide from Fungi.

Plant cell reactions

Elicitors and plant - pathogen relations



Scientific collaboration.



Tobacco

(IBMP Strasbourg; CNRS)



Grape

(INRA Dijon)



Wheat

(IBP Orsay; CNRS)

dicotyledones

monocotyledones

A wide spectrum of potential interest

Virus / Tobacco



Water

laminarin

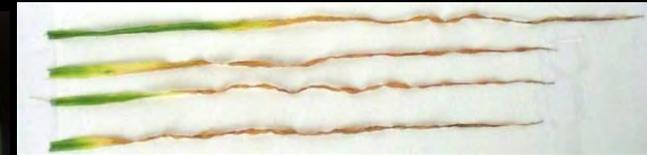
Bacteria / Tobacco



Water

laminarin

Fungi / Wheat



Water

laminarin

laminarin stimulates most of the potential reactions that plants may use to protect themselves. This gives protection against a wide range of pathogens.

Systemic protection.

- ✓ Laminarin induces systemic protection. **New formed organs** are equally protected.

Regulatory status.

- ✓ Laminarin is included in Annexe I - 91/414/CE Directive (22/01/05).
- ✓ **No toxicological residues → no Pre Harvest Interval**
- ✓ **No Tox, No Ecotox, N classification**

Preventive.

- ✓ Laminarin has **preventive action** and therefore must be applied before the plant is attacked by the targeted pathogen.
- ✓ **3 days** after laminarin application, plant defences are established.

The optimal rate must be carefully followed.

- ✓ Under the optimal rate, the efficiency decreases.
- ✓ No advantage to use higher rate.

Efficient on resistant strains (to fungicides).

- ✓ Defences induced by laminarin are **efficient on different types of fungi**, due to its multi target mode of action (*phytoalexine, hydrolases, lignin*) and its indirect mode of action (*Salicylic acid, Jasmonic acid*)

Principle of laminarin use

Laminarin can be included in protection strategies as a complementary tool to produce better while maintaining the objective of highest possible return for the grower.

Laminarin finds its place in the 3 following positionings:

- ✓ **Diseases with no solutions** : bacteria (Fire blight), virus.
- ✓ **Residue issues** : in conventional farming, the 4th criteria for fruits and vegetable production for growers (after quality, yield, labour) due to higher food chain requirements.
- ✓ **Organic farming** : an innovative solution when clean protection products are rare.

Vacciplant®

Fruits and vegetables



Composition : 45 g of Laminarin per litre

Registration in France : AMM n° 2080019 :

- Strawberry powdery mildew (Oïdium du fraisier)
- Fire blight of apple, pears, Quince tree and Nashi (Feu Bactérien).
- Apple scab (Tavelure du Pommier)

Other registrations :

- Registered in Belgium against storage diseases, application in France for the South zone of Europe in July 2012.

No classification :

Pre Harvest Interval (DAR) : 0 day

Vacciplant is a biocontrol product and benefits from NODU and green IFT in France

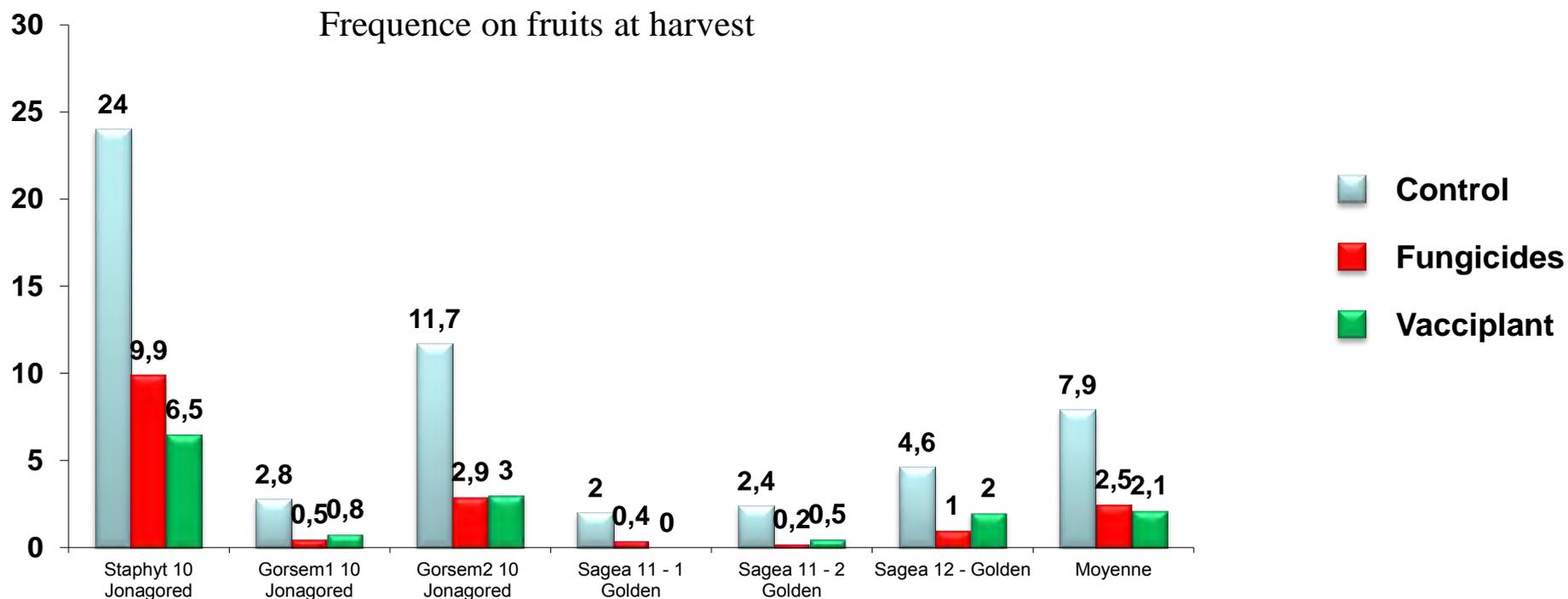
ZNT : 5 m

DRS : 6 hours



Minimum

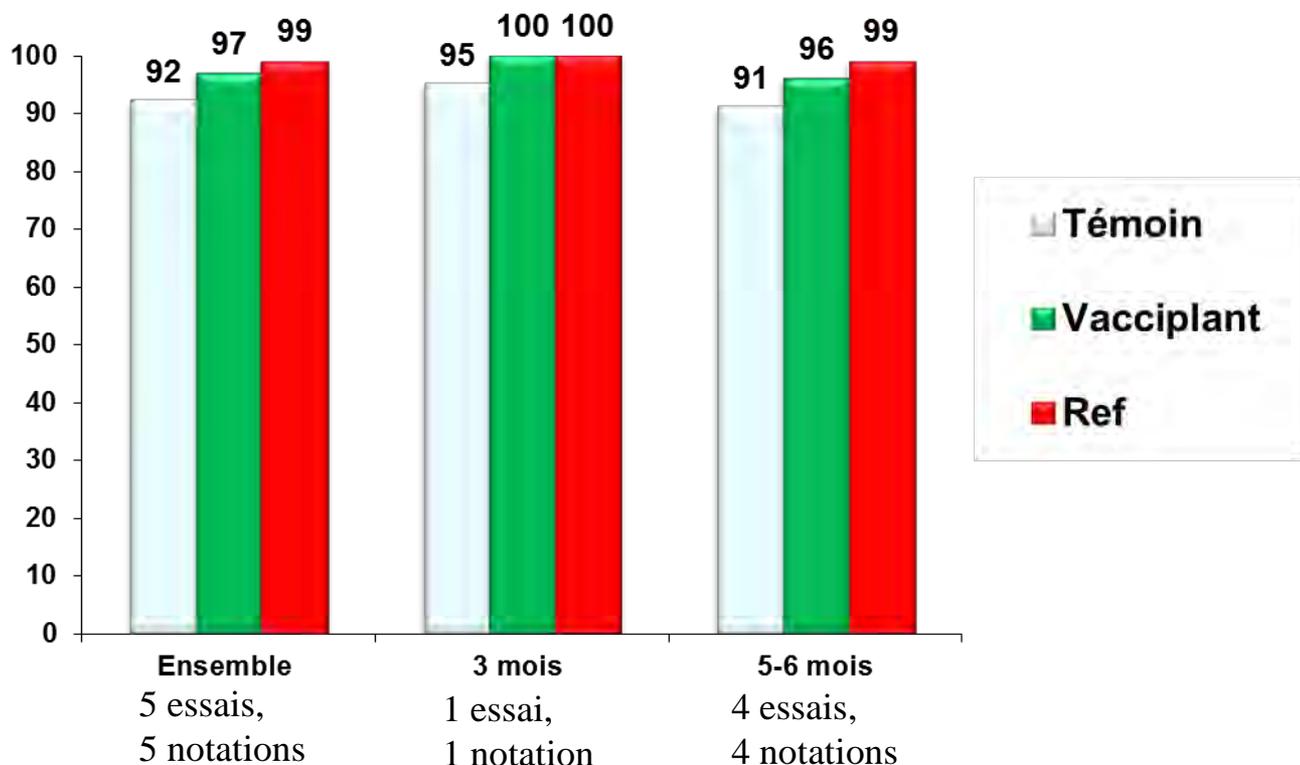
Synthesys of 6 trials with effective disease pressure



The reliability of Vacciplant protection program is confirmed in each trial.

Vacciplant alone against apple gloeösporium

% of healthy fruits after 3 to 5 month storage

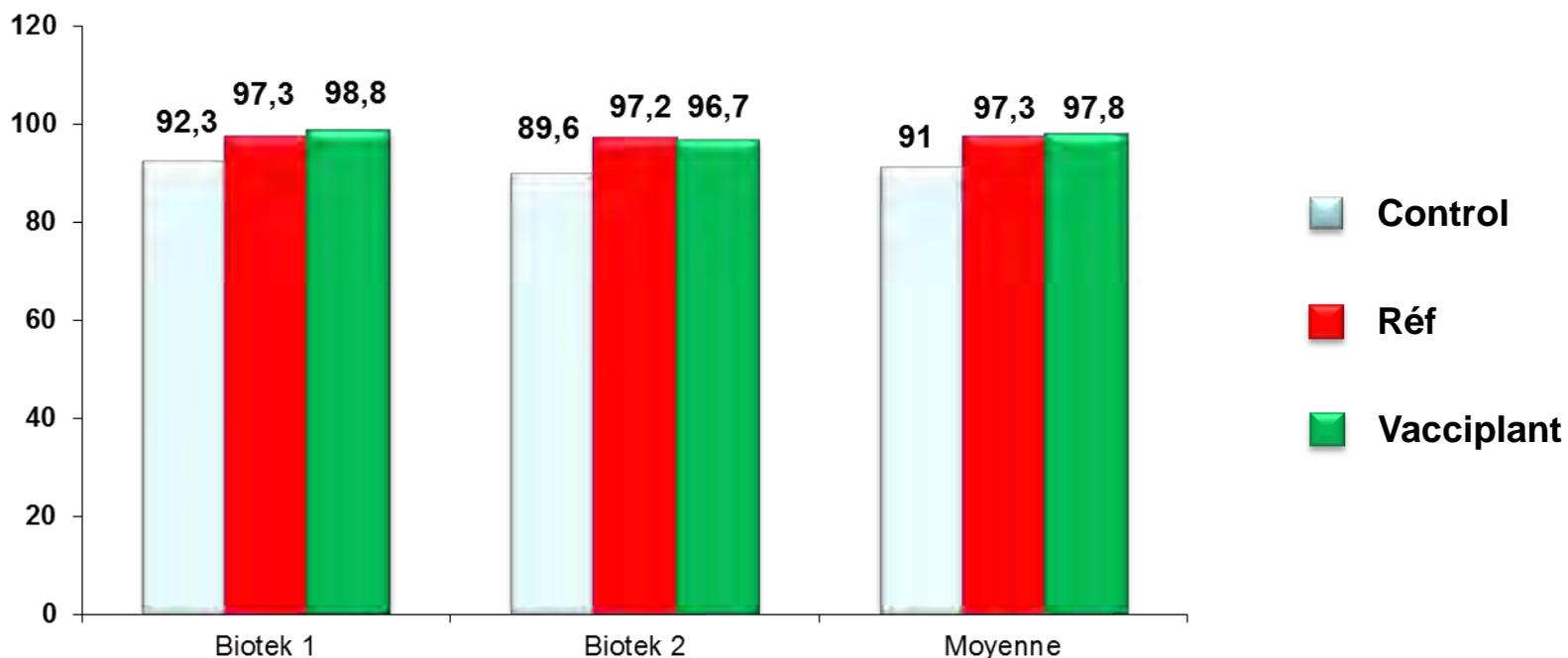


Vacciplant used alone is as efficient as fungicides against Gloeösporium after 3 month storage.

Vacciplant alone against storage apple scab

Essais Biotek, Pologne, 2011, Jonagold

% of healthy fruits after 3 to 5 month storage



Vacciplant used alone shows a protection against scab during storage.

Today

Laminarin has been studied on numerous crops and against various pathogens.

Cereals



Vegetables



Fruits



Grape



Approval update

- **June 2008** : Goëmar requested for Laminarin to be listed in Annex II of Regulation (EC) No 889/2008
- **14th and 15th December 2011** : the Expert Group on Technical Advice on Organic Production (EGTOP) appointed by the UE Commission in June 2009 concluded that Laminarin should be included in Annex II.
- **April 2013** : Laminarine is still not listed in in Annex II of Regulation (EC) No 889/2008 and thus can not be used in organic farming...



The UE does not want to include Laminarin and other new substances in the Annex II until that document has been reviewed regarding low risk and basic substances explaining this slow process.

The US system is much more efficient with autorisation provided in one year.

To answer agriculture new challenges

- Markets and society are expecting an agriculture **respectfull of Human and its environment.**

In the meantime :

- It is necessary to **maintain productivity and profitability** of farming

To answer this challenge,

Vacciplant exists but still needs administrative approval for organic farming !