General Technical Dossier

Laminarin

The choice to produce better ...

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.
Plants are under various multi-source attacks

Natural mechanism

cold, hail, wind

UV

Pathogens attack

bacteria

Fungi.

virus

Wounds/injuries

vectors
microbial agents

insects

herbivores

wounds

nematodes

Pathogens attack
1. Plant natural defense mechanisms

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 aggressor.

Phytoalexins inhibit the development of fungi.

Plants produce defence proteins (PR proteins) that attack fungus cell walls.
1. Plant natural defense mechanisms

Plant cell reactions

Elicitors and plant-pathogen relations

- Cell wall glucanases
- Oligoglucans
- Pectinases
- Oligopectins
- Defence signals
- Nuclear

Fungi

PLANT CELL

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

A natural non toxic molecule
Elicitors and plant-pathogen relations

2. Laminarin: mode of action

Cell wall

- Glucanases
  - Oligoglucans

- Pectinases
  - Oligopectins

- Receptor
  - Defence signals
  - Defence gene products

Fungi

- Nuclear
  - Virulence gene products
  - Laminarin

Plant cell reactions
2. Laminarin: mode of action

Scientific collaboration.

- Tobacco (IBMP Strasbourg; CNRS)
- Grape (INRA Dijon)
- Wheat (IBP Orsay; CNRS)

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

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.
3. Laminarin : features

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.

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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 deseases, application in France for the South zone of Europe in July 2012.

No classification: Pre Harvest Interval (DAR): 0 day

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

ZNT: 5 m
DRS: 6 hours

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5. Vacciplant : trial results

Synthesys of 6 trials with effective disease pressure

Frequency on fruits at harvest

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

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Vacciplant alone against apple gloeösporium

5. Vacciplant : trial results

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

La nature qui stimule la nature.
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

La nature qui stimule la nature.

- **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 Annex II of Regulation (EC) No 889/2008 and thus cannot 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!