



INNOVATIVE AND DISRUPTIVE TECHNOLOGY FOR A BETTER AGRICULTURE



fytofend
Pioneering Biological Alternatives

GÉRALDINE VAN AUBEL, RESEARCH MANAGER – Opleiding fytolicensie NAC, 15 November 22



I. FYTOFEND PRESENTATION

Industrial plant

Research Dep.



+450 m² lab

Operational Dep.



+1,200 m² prod and form area



+400 m² offices → registration

FYTOWEB

Gewasbeschermingsmiddelen en Bemestingsproducten



Research center

- To perform bioassays on cells and seedlings (with pathogens)
- To increase our scientific data package on COS-OGA
- To investigate candidates for new low risk active substances



Our aim

At global level:

- Biocontrol Key Player
- Plant Defence Inducer Leader

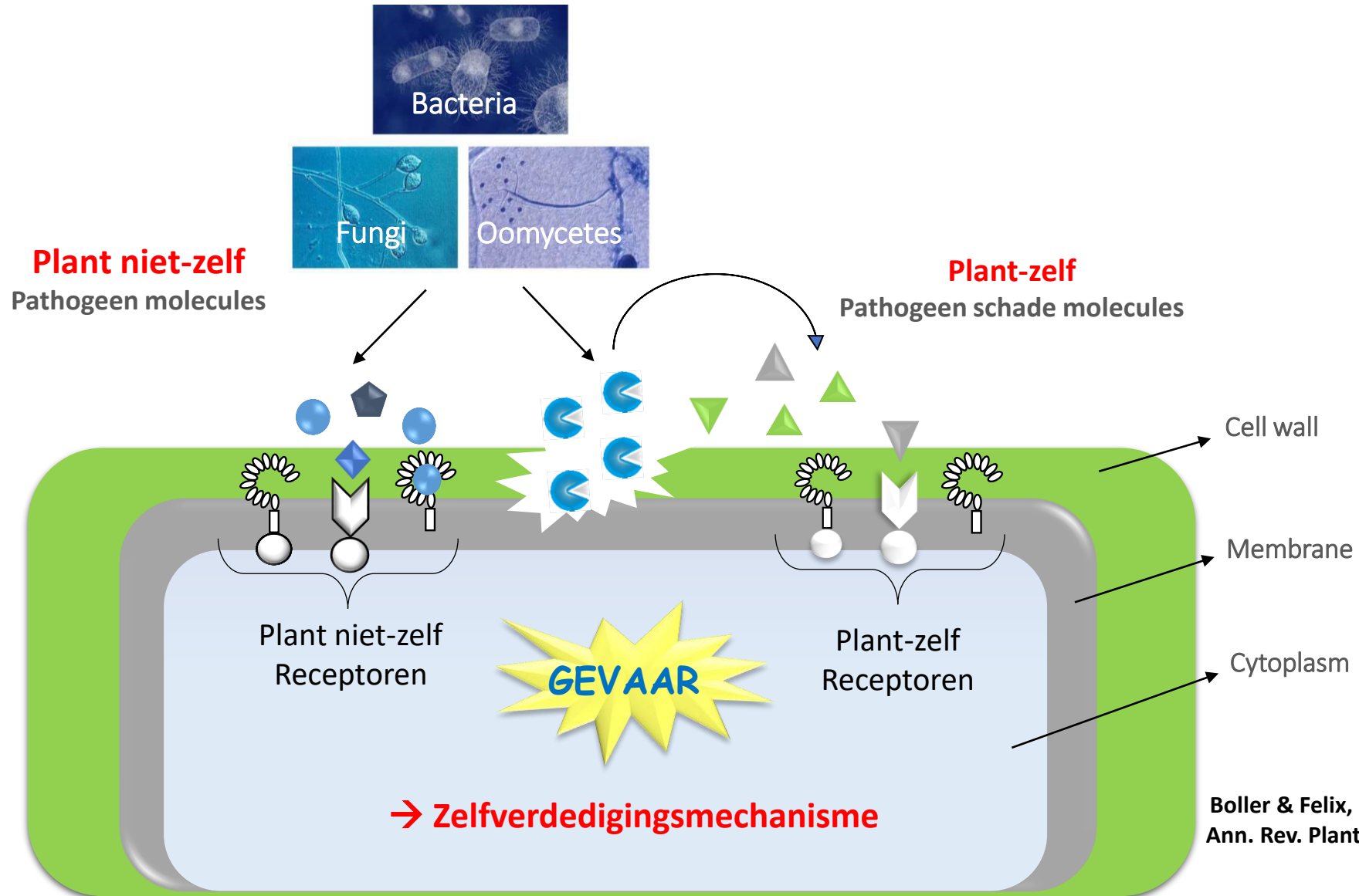




fytoSave

II. TECHNICAL PRESENTATION

Plant-Pathogen interaction and plant immunity



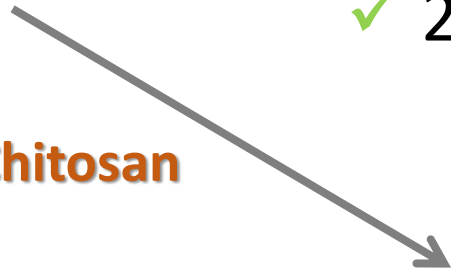
Boller & Felix, 2009
Ann. Rev. Plant Biol.

COS-OGA concept

- ✓ Complex of oligosaccharides (complex sugars)
- ✓ 2 sub-components (COS and... OGA)

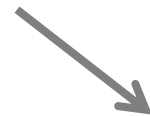


Chitosan

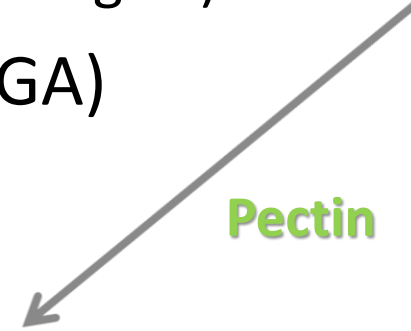


COS

Recognized by plant receptors
Mimics the presence of **pathogens**
Non-self molecules



Pectin



OGA

Recognized by plant receptors
Mimics **degradation** of **plant cell wall**
Self molecules



Emergency signal

State of premunition

Mobilization of a wide range of plant defences

Scientific signature

Induced resistance in plants against insects and diseases
IOBC-WPRS Bulletin Vol. 89, 2013
pp. 403-407

COS-OGA, a new oligosaccharidic elicitor that induces protection against a wide range of plant pathogens

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Contents lists available at [ScienceDirect](#)

Plant Science

journal homepage: www.elsevier.com/locate/plantsci



Plant immunity induced by COS-OGA elicitor is a cumulative process that involves salicylic acid

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Crop Protection 65 (2014) 129–137



Contents lists available at [ScienceDirect](#)

Crop Protection

journal homepage: www.elsevier.com/locate/cropro



COS-OGA: A novel oligosaccharidic elicitor that protects grapes and cucumbers against powdery mildew

Géraldine van Aubel^a, Raffael Buonatesta^b, Pierre Van Cutsem^{a,*}

^a Unit of Research in Plant Cellular and Molecular Biology, University of Namur, Rue de Bruxelles 61, B-5000 Namur, Belgium

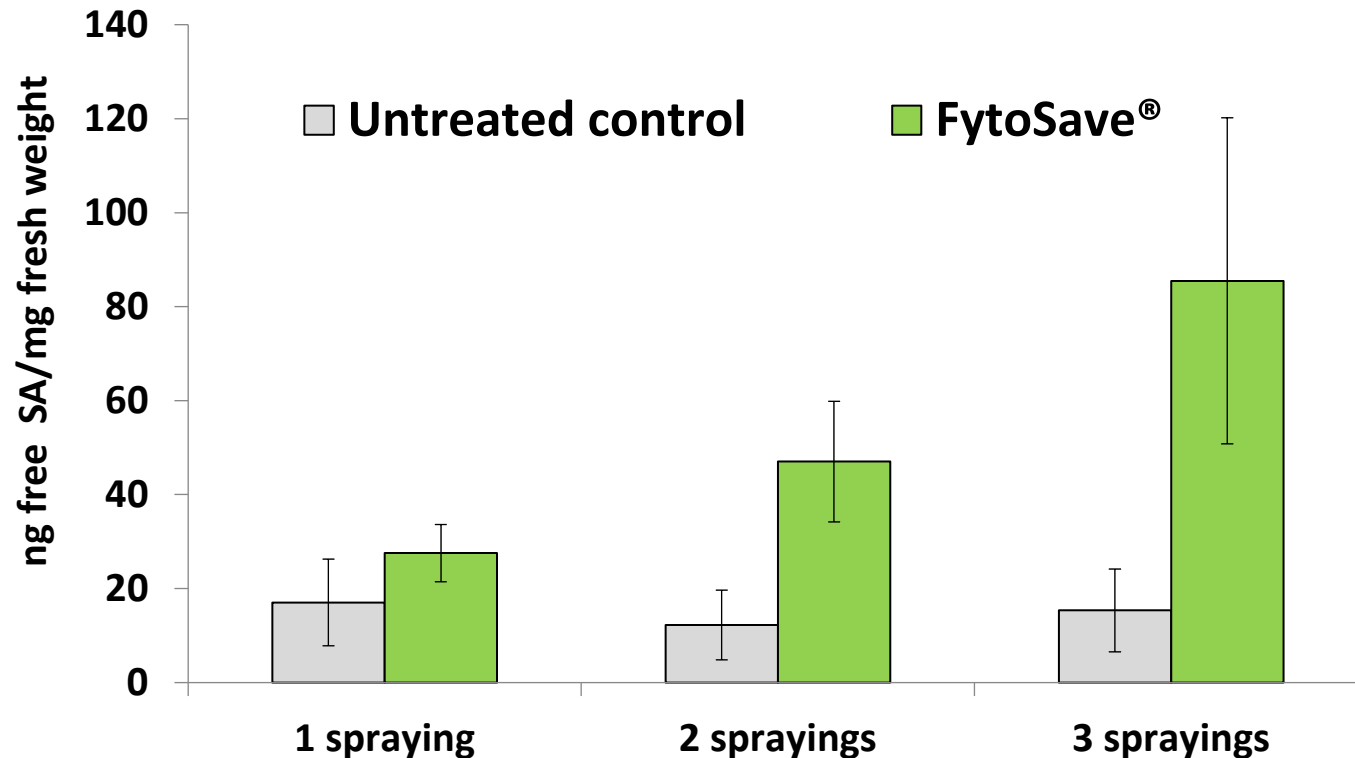
^b FytoFend SA, Rue Phocas Lejeune 25-6, B-5032 Isnes, Belgium



COS-OGA induces Salicylic acid production

Plant **hormone** involved in:

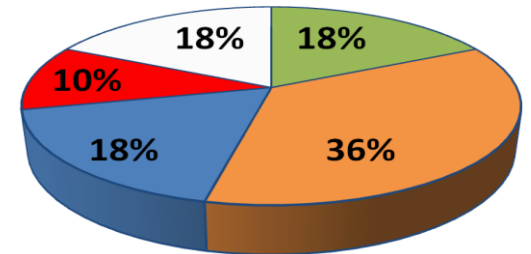
- **PR proteins** synthesis (**toxic** for fungi)



Proteomic study : MS

| Met. process | Protein name in Uniprot | Regulation |
|--------------------------------------|---|------------|
| Defense and stress response | Acidic 26 kDa endochitinase (CHIT3) | ++ |
| | Basic 30 kDa endochitinase (CHIT9) | + |
| | Glucan endo-1,3-beta-glucosidase A | +++ |
| | Subtilisin-like protease (P69 b) | +++ |
| | Subtilisin-like protease (P69 b) | ++ |
| | Subtilisin-like protease (P69 b) | +++ |
| Protein synthesis and folding | ER Luminal binding protein, BiP (Hsp 70) | + |
| | Heat shock protein 70 family Hsc 70 (Hsp 70) | + |
| | Heat shock cognate 70 kDa protein 2 (Hsp 70) | + |
| | Endoplasmin putative (Hsp 90) | + |
| DNA/RNA remodeling | MAR-binding filament-like protein 1 (MFP1) | ++ |
| | DEAD-box ATP-dependent RNA helicase | + |
| | DEAD-box ATP-dependent RNA helicase | + |
| Photosynthesis and energy metabolism | NADP-dependent glyceraldehydephosphate dehydrogenase subunit B (GPB1) | + |
| | Isocitrate dehydrogenase (IDH) | + |
| | Ribulose biphosphate carboxylase/oxygenase activase, chloroplastic (RuBisCO activase) | +++ |
| | Putative rubisco subunit binding-protein (60 kDa chaperonin alpha subunit) | + |

Proteins with significant variation sorted by metabolic process:



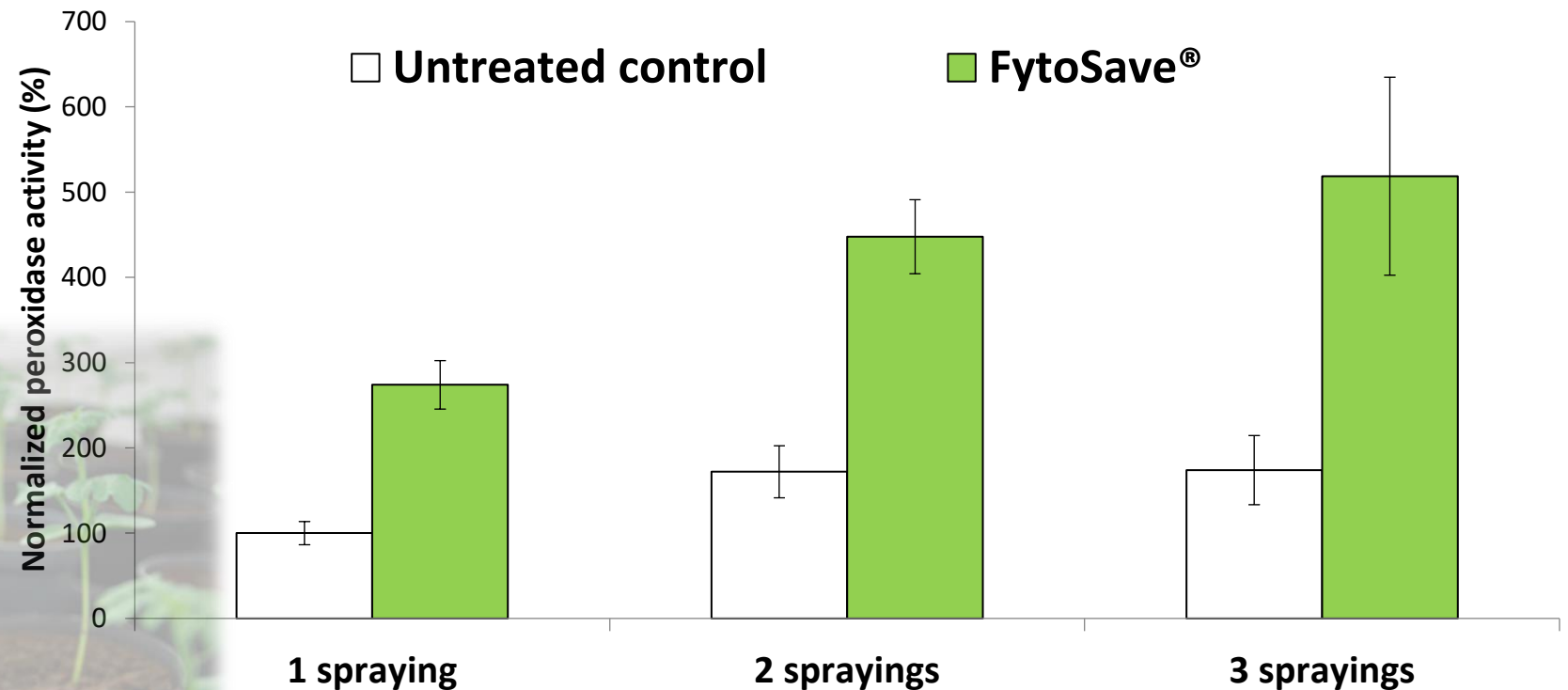
- Photosynthesis and energy metabolism
- Defense and stress response
- Protein synthesis and folding
- DNA/RNA remodeling
- Others

Positive regulation by COS-OGA is scored:
 + for 100 to 150%
 ++ for 150 to 200%
 +++ for 200 and 300%

COS-OGA induces Peroxidase production

Enzyme involved in:

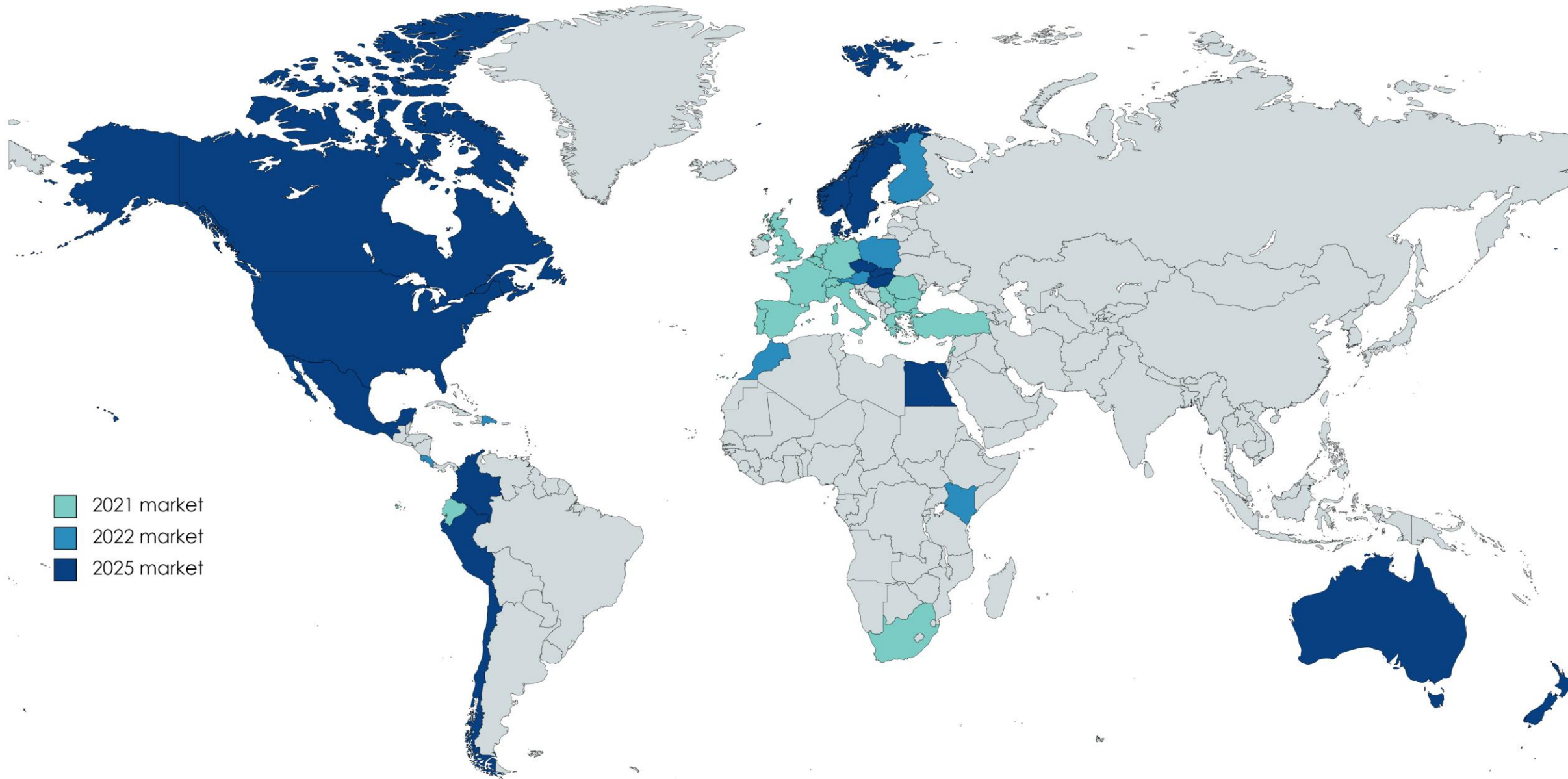
- Reactive Oxygen Species (H_2O_2) production (**toxic for fungi**)
- Callose and lignin deposition (**physical barrier**)



FytoSave[®] Identity

- 12.5 g/L COS-OGA (oligosaccharidencomplex, 10347P/B)
- Dosis : 2 L/ha ~ 1,1 L/ha haag
- Formuleringsstype : **SL** (Soluble liquid → gemakkelijk te gebruiken)
- Niet giftig ($LD_{50} > 2000$ mg/kg) → niet-geclassificeerd
- Geen residu: geen MRL, no pre-harvest interval
- Low risk (Art 47 of *Regulation n° 1107/2009*)
- Goedgekeurd voor biologische landbouw (Approved for Organic Farming , *Regulation 834/2007/EC*)
+ IPM (safe for bees and beneficials) → [Ecocert at international level](#)
- Preventief
- Cumulatief





- 2021 market
- 2022 market
- 2025 market

FytoSave[®] Main Targets – Plant defence induction



Grape >< Powdery Mildew and Downy Mildew



Cucurbits >< Powdery Mildew



Fruiting solanaceae >< Powdery Mildew + *Pseudomonas syringae*



Strawberry and other berries >< Powdery Mildew



Ornamentals >< Powdery Mildew

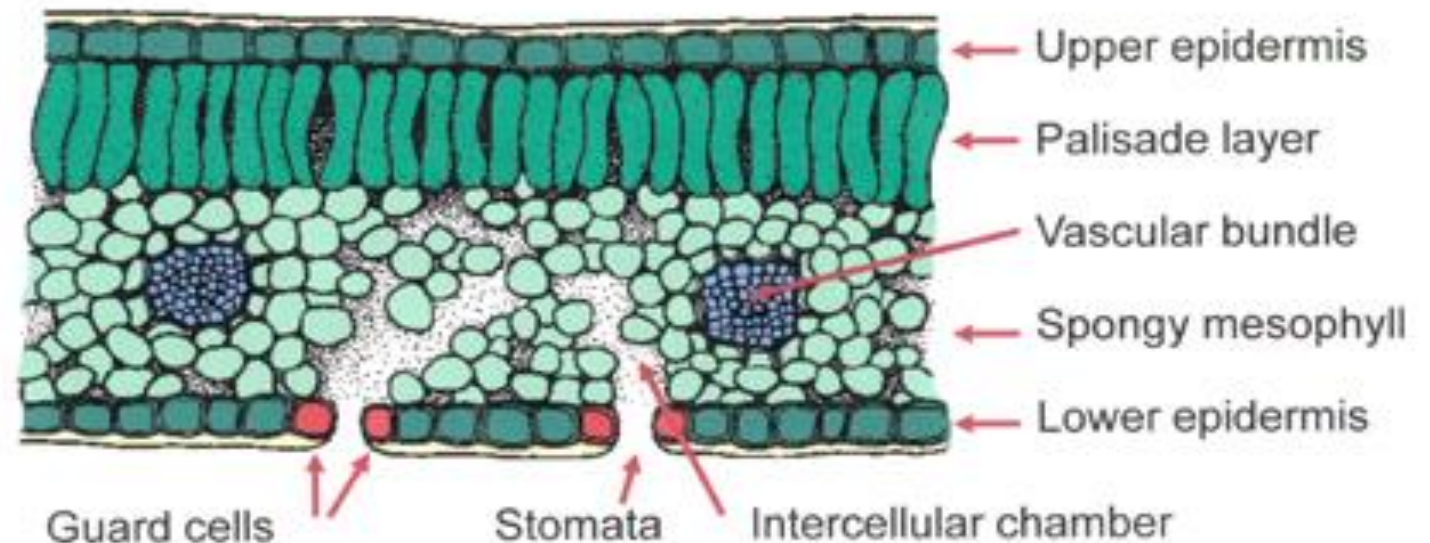


Leafy vegetables >< Powdery Mildew and Downy Mildew (Bremia)

Technical instructions



- **3 preventive** sprayings
- **Interval of 7-10 days** between sprayings
- Foliar sprayings **to reach the stomata**
 - Pressure (5-10 bars)
 - High water volumes





Summary – Efficacy data on grape



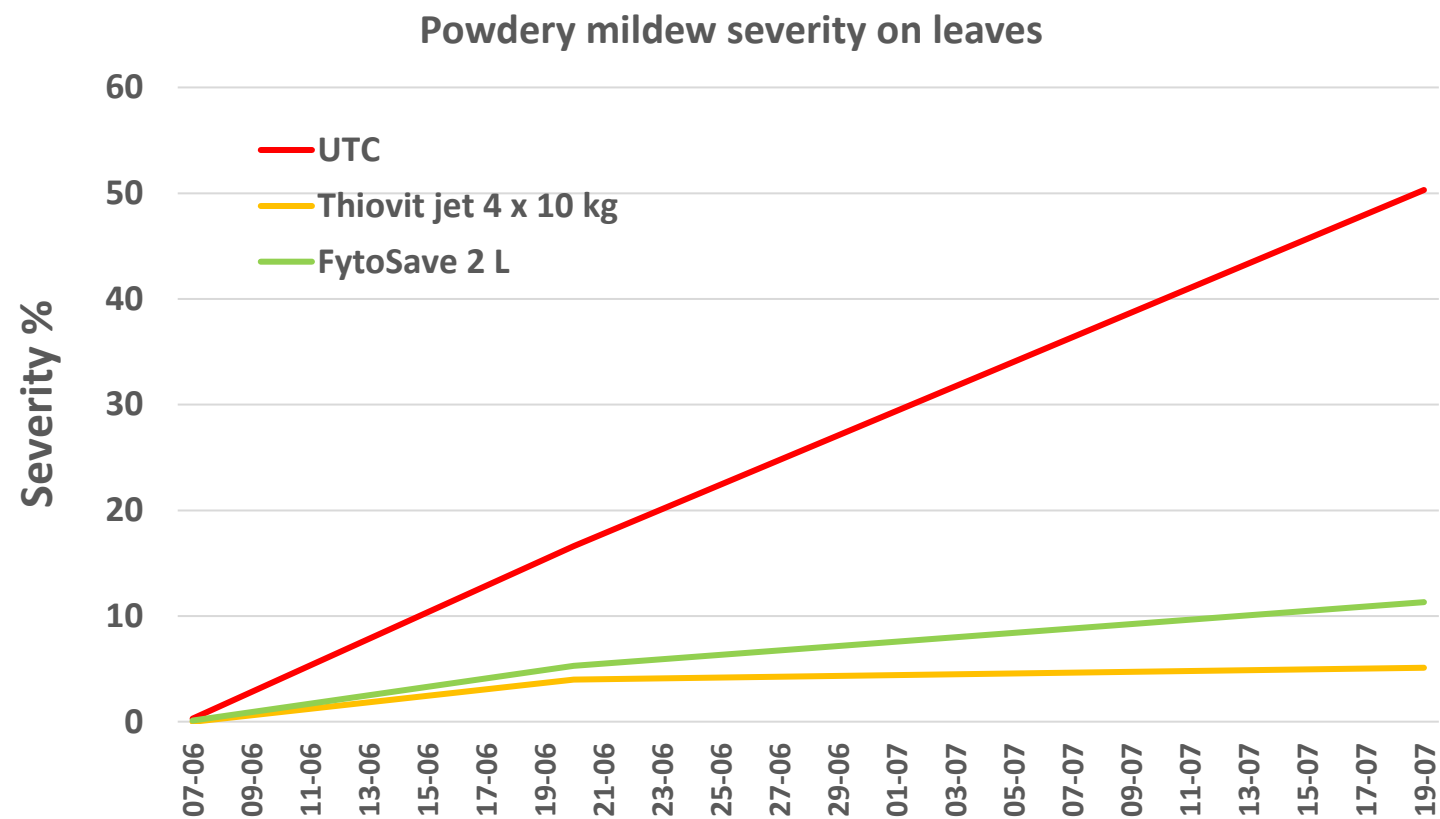
| Efficacy | Leaves | Bunches |
|----------------|--------|---------|
| Downy mildew | 25-80% | 30-80% |
| Powdery mildew | 40-85% | 45-85% |

Partial efficacy on powdery and downy mildew | **multi-skilling**
Partial efficacy on **leaves** and **bunches** | **systemicity**
Key tool for **OF** and **IPM** | **flexibility**



GEP trial, field (Brachetto)
Italy, 2012
High disease pressure

Efficacy on Powdery mildew on Leaves





Efficacy on
grape



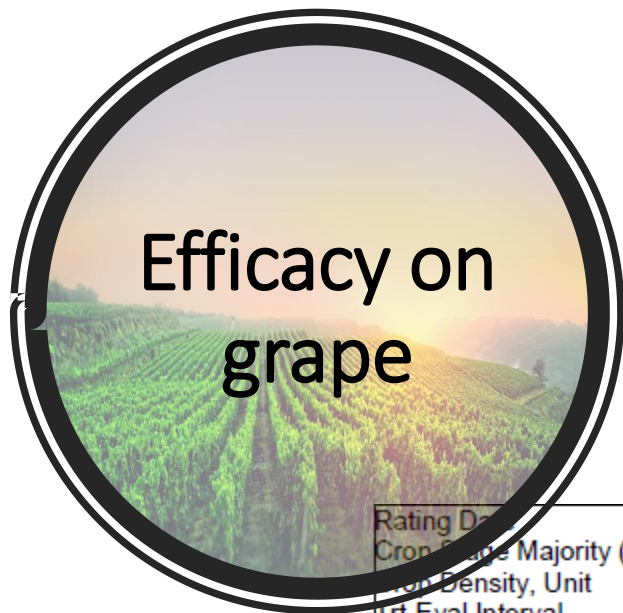
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GEP trial, field
(Chardonnay)
France, 2013
Moderate disease pressure

| Treatment Name | Active ingredient(s) | Batch number | Content of a.i nominal | Formulation type |
|----------------|----------------------|--------------|------------------------|------------------|
| FYTO11 | COS-OGA | 130131 | 12.5 g/L | SL |
| MICROTHIOL | Soufre micronise | 12-091-01 | 81 % | WP |

Table 3- Application Schedule

| Treatment No. | Product / Formulation | Rate of product/ha | | Dosage a.i. in g/ha | Timing |
|--|--|--------------------|----|---------------------|---|
| 1 | Untreated | - | | - | - |
| 2 | MICROTHIOL | 12.50 | kg | 10 125 | A1-A8 |
| 3 | MICROTHIOL | 5.00 | kg | 4050 | A1-A8 |
| 4 | MICROTHIOL | 5.00 | kg | 4050 | A1, A3, A5, A7 |
| 5 | MICROTHIOL | 5.00 | kg | 4050 | A1-A8 |
| | FYTO11 | 2.00 | l | 25 | |
| 6 | MICROTHIOL | 5.00 | kg | 4050 | A1, A3, A5, A7 |
| | FYTO11 | 2.00 | l | 25 | |
| | FYTO11 | 2.00 | l | 25 | A2, A4, A6, A8 |
| 7 | FYTO11 | 2.00 | l | 25 | A1-A8 |
| Application timing and spray volume | | | | | |
| A1 | At first risk following local practices and according to local recommendations | | | Spray volume | 400-600 L/ha |
| A2-A8 | 10+-1DALA (at least 8 applications – check with SD if more are needed) | | | | According to local practice and equipment |



Efficacy on Powdery mildew on Leaves

GEP trial, field
France, 2013
Moderate disease pressure

| Rating Date | 11 Jul 13 | 18 Jul 13 | 18 Jul 13 | 26 Jul 13 | 26 Jul 13 | 06 Aug 13 | 21 Aug 13 | 21 Aug 13 |
|---|-------------------|------------------|------------------|------------------|------------------|------------------|-------------------|-------------------|
| Crop Stage Majority (BBCH) | 71 | 73 | 73 | 77 | 77 | 79 | 83 | 83 |
| Planting Density, Unit | 30 % | 30 % | 30 % | 30 % | 30 % | 30 % | 30 % | 30 % |
| Trt-Eval Interval | 10 DA-F | 7 DA-G | 7 DA-G | 4 DA-H | 4 DA-H | 5 DA-I | 12 DA-J | 12 DA-J |
| Transformation Description | DeTrans | DeTrans | Trans | DeTrans | Trans | DeTrans | DeTrans | Trans |
| 1 Untreated Check | 0.13a (0.0%) | 1.12a (0.0%) | 0.20a (0.0%) | 3.63a (0.0%) | 1.56a (0.0%) | 14.58a (0.0%) | 29.47a (0.0%) | 25.85a (0.0%) |
| 2 Microthiol 12.5kg/ha ABCDEFGH | 0.00b (100.0%) | 0.15a (87.1%) | 0.01a (97.0%) | 0.22b (93.9%) | 0.02b (99.0%) | 0.51b (96.5%) | 1.41c (95.2%) | 0.27c (98.9%) |
| 3 Microthiol 5kg/ha ABCDEFGH | 0.00b (100.0%) | 0.19a (83.5%) | 0.01a (95.5%) | 0.60b (83.6%) | 0.08b (94.7%) | 1.40b (90.4%) | 3.39c (88.5%) | 1.31c (94.9%) |
| 4 Microthiol 5kg/ha ACEG | 0.00b (100.0%) | 0.77a (31.0%) | 0.10a (49.4%) | 1.07b (70.5%) | 0.20b (87.2%) | 2.24b (84.6%) | 6.21c (78.9%) | 3.15c (87.8%) |
| 5 Microthiol 5kg/ha ABCDEFGH FYTO 11 2L/ha ABCDEFGH | 0.00b (100.0%) | 0.63a (43.8%) | 0.05a (75.9%) | 1.08b (70.2%) | 0.19b (87.6%) | 1.84b (87.4%) | 5.10c (82.7%) | 2.20c (91.5%) |
| 6 Microthiol 5L/ha ACEG FYTO 11 2L/ha ACEG FYTO 11 2L/ha BDFH | 0.00b (100.0%) | 0.15a (86.4%) | 0.00a (97.7%) | 0.58b (84.0%) | 0.08b (95.2%) | 1.45b (90.1%) | 5.49c (81.4%) | 2.50c (90.3%) |
| 7 FYTO 11 2L/ha ABCDEFGH | 0.00b (100.0%) | 0.56a (50.4%) | 0.05a (72.9%) | 1.78b (50.9%) | 0.42b (72.7%) | 4.64b (68.2%) | 16.04b (45.6%) | 12.02b (53.5%) |
| LSD (P=.05) | 0.064 | 0.736 | 1.448t | 1.330 | 2.258t | 2.911 | 5.926 | 5.842t |
| Standard Deviation | 0.043 | 0.496 | 0.975t | 0.895 | 1.520t | 1.960 | 3.989 | 3.932t |
| CV | 241.02 | 97.47 | 81.43 | 70.0 | 53.43 | 51.46 | 41.6 | 31.19 |
| ARM Action Codes | | | TA[17] | | TA[24] | | | TA[44] |
| P(Bartlett's X2) | | 0.02* | 0.123 | 0.005* | 0.11 | 0.001* | 0.016* | 0.255 |
| Replicate Prob(F) | 0.4155 | 0.1789 | 0.1982 | 0.0654 | 0.0518 | 0.2467 | 0.8694 | 0.8830 |
| Treatment Prob(F) | 0.0043 | 0.0869 | 0.0435 | 0.0008 | 0.0003 | 0.0001 | 0.0001 | 0.0001 |



Efficacy on Downy mildew



| Trt No. | Type | Treatment Name | Form Type | Rate | Rate Unit | Other Rate | Other Rate Unit | Appl Code |
|---------|------|-----------------|-----------|------|-----------|------------|-----------------|-----------|
| 1 | CHK | Untreated Check | | | | | | |
| 2 | FUNG | TRIMANOC 80 WP | WP | 2 | kg/ha | 1600 | g A/ha | ABCDEFGH |
| 3 | FUNG | FYTO11 | SL | 2 | L/ha | 25 | g A/ha | ABCDEFGH |

GEP trial, field (Grenache)

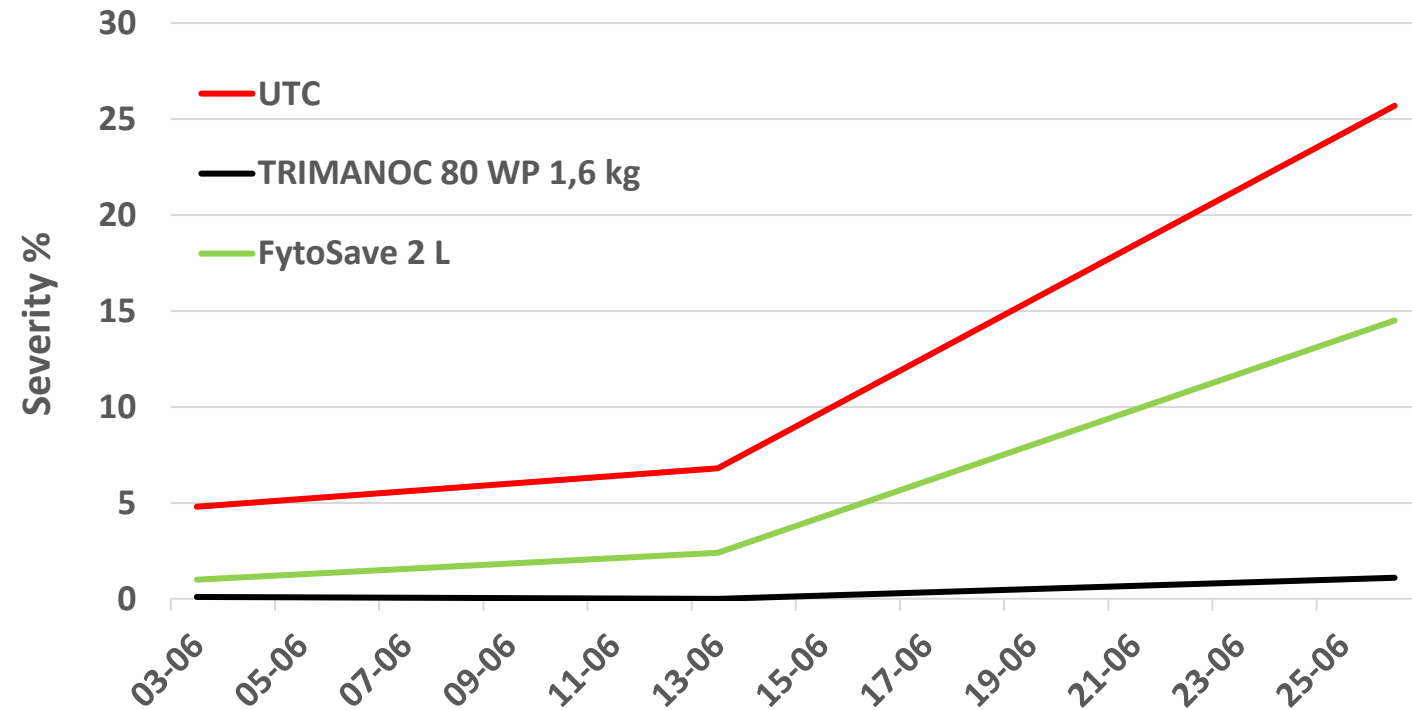
France, 2013

Moderate disease pressure



**GEP trial, field (Grenache)
France, 2013
Moderate disease pressure**

Efficacy on Downy mildew on Leaves



Positioning on Grape



Organic Vs PM

**4 x FytoSave
+ Sulphur
@ 2 kg/ha**

**Sulphur
@ full dosis**

**4 x FytoSave
+ K-bicarbonate
@ 2,6 kg/ha**

Organic Vs DM

**4 x FytoSave
+ Copper
@ 350 g/ha**

**Copper
@ full dosis**

**4 x FytoSave
+ Copper
@ 350 g/ha**

IPM Vs DM & PM

**4 x FytoSave
+ 70% cyflufenamid – difenconazole –
mandipropamide – ...**

**Chemical protection
@ full dosis**

**4 x FytoSave
+ 70% cyflufenamid – difenconazole –
mandipropamide – ...**

In Switzerland

Strategie Andermatt IP

| Krankheiten | C | E | F | G | H | I | J | K | L | M | |
|---|--|----------------------------------|-----------------------------------|--|---------------------------------|---------------------------------|---|-------------------------------|-------------------------------|-------------------------------|-----------------|
| | Austrieb | Blätter entfaltet | Gescheine sichtbar | Gescheine wachsen | Einzelblüten trennen sich | Blüte | Beginn Fruchtentwicklung | Trauben 50% Grösse | Traubenschluss | Farbumschlag | |
| Wasservolumen in Liter (turbo) | 600 (150) | 600 (150) | 800 (200) | 1000 (250) | 1200 (300) | 1600 (400) | 1600 (400) | 1600 (400) | 1600 (400) | 1600 (400) | |
| Erste Anwendung vor der Primärinfektion | Bei Regenwetter Intervalle von 6 bis 9 Tagen, sonst alle 10 bis 14 Tagen (Zuwachs 3 bis 4 Blätter) | | | Während der Blüte Behandlungsintervalle zwischen 6 bis 9 Tagen | | | Erneuerung nach 15 bis 20 mm Niederschlag oder maximal 10 Tagen | | | | |
| Falscher Mehltau | 2,25 l Algisure | 2,25 l Algisure | 3 l Algisure | 3,75 l Algisure | 4,5 l Algisure | 6 l Algisure | | | | | |
| | 0,2–0,5 kg Airone WG 55–140 g Cu | 0,2–0,5 kg Airone WG 55–140 g Cu | 0,4–0,7 kg Airone WG 110–200 g Cu | 0,4–1 kg Airone WG 110–280 g Cu | 0,4–1 kg Airone WG 110–280 g Cu | 0,4–1 kg Airone WG 110–280 g Cu | 1 kg Airone WG ca. 280 g Cu | 1 kg Airone WG ca. 280 g Cu | 1 kg Airone WG ca. 280 g Cu | 1 kg Airone WG ca. 280 g Cu | |
| Falscher und Echter Mehltau | | | | | 1,25 l FytoSave | 1,5 l FytoSave | 2 l FytoSave | 2 l FytoSave | 2 l FytoSave | 2 l FytoSave | |
| Echter Mehltau | Tiefer Druck | | | | | | 5 kg Vitisan | 5 kg Vitisan | 5 kg Vitisan | 5 kg Vitisan | |
| | | | | | | | + 0,2% Prev-B2 | + 0,2% Prev-B2 | + 0,2% Prev-B2 | + 0,2% Prev-B2 | |
| Hoher Druck | 2,4 kg Netzschwefel Stullin | 2,4 kg Netzschwefel Stullin | 3,2 kg Netzschwefel Stullin | 4 kg Netzschwefel Stullin | 4,8 kg Netzschwefel Stullin | | | | | | |
| | | | | | | | + 1–3 kg Netzschwefel Stullin | + 1–3 kg Netzschwefel Stullin | + 1–3 kg Netzschwefel Stullin | + 1–3 kg Netzschwefel Stullin | |
| Botrytis | | | | | 0,4 kg Botector | | | | | 0,4 kg Botector | 0,4 kg Botector |



fytoSave

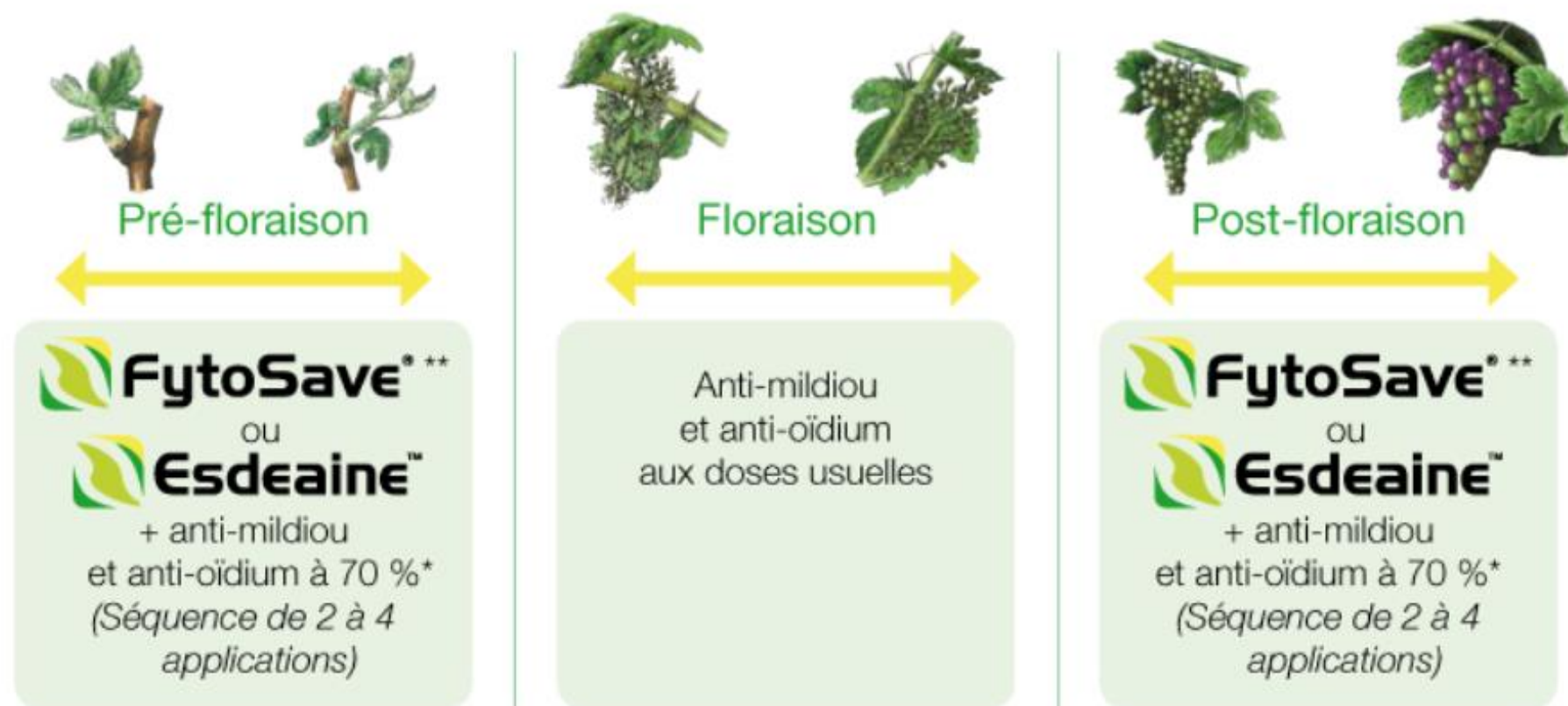
In France: insights from the french market



Comment intégrer FytoSave dans votre programme de protection ?

2 stratégies de positionnement :

- Utiliser FytoSave ou Esdeaine pour réduire les doses des fongicides conventionnels et utilisables en agriculture biologique



PROTÉGEZ NATURELLEMENT VOTRE VIGNE

Grâce à Bastid et Blason, solutions de biocontrôle
à base d'ingrédients d'origine naturelle, vos vignes sont protégées
contre l'oïdium et le mildiou



Biocontrols

Bastid et Blason sont composés de pectine de fruits et
de carapaces de crustacés. Intégrés au sein d'un programme de protection,
ils permettent de réduire les doses des solutions conventionnelles.

Pour tout savoir sur Bastid et Blason, rendez-vous sur : www.syngenta.fr

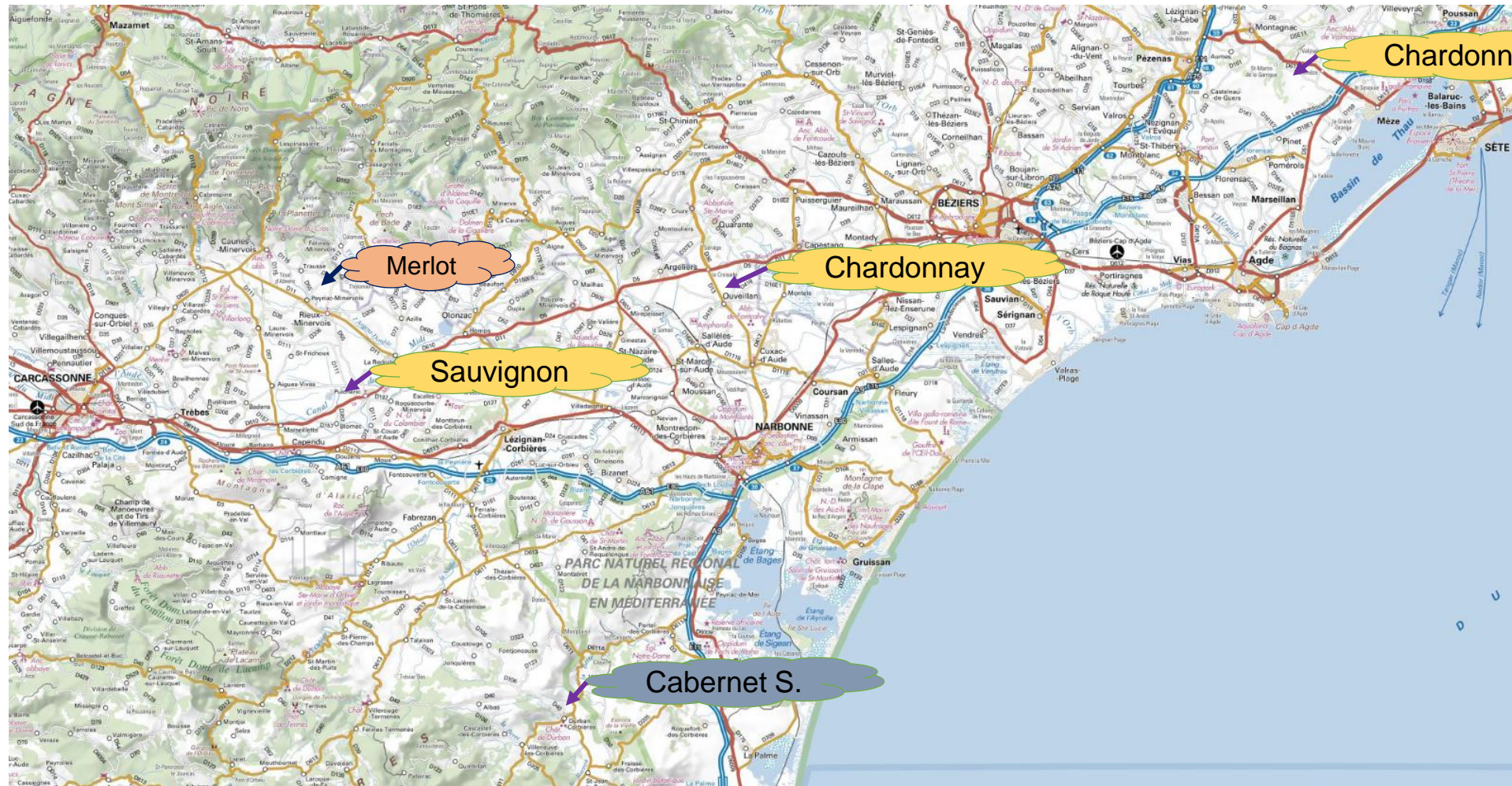
 **Bastid**®  **Blason**®

 **syngenta**®

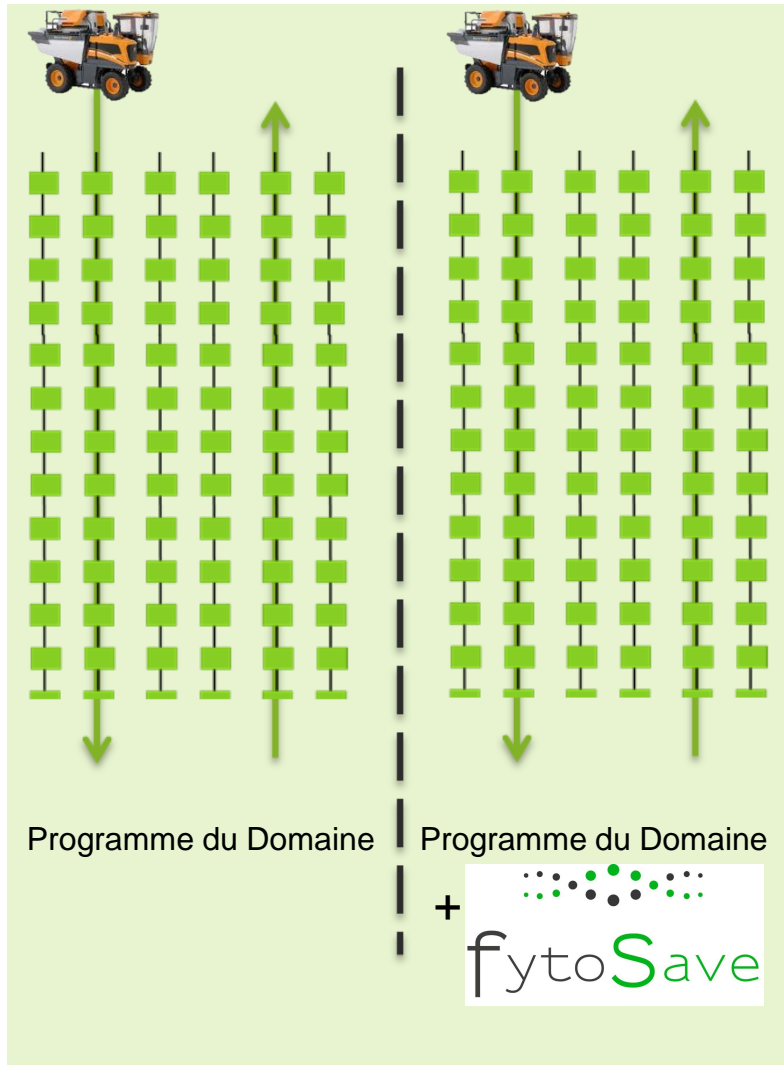




Plot sites 2019



Systematic program comparison



- Sequence of preventive protection
- BLASON reinforcement from the beginning of the protection (T1 or T2) until flowering-fruit setting
- If the equipment allows it, adapt the dose at the beginning of the protection.



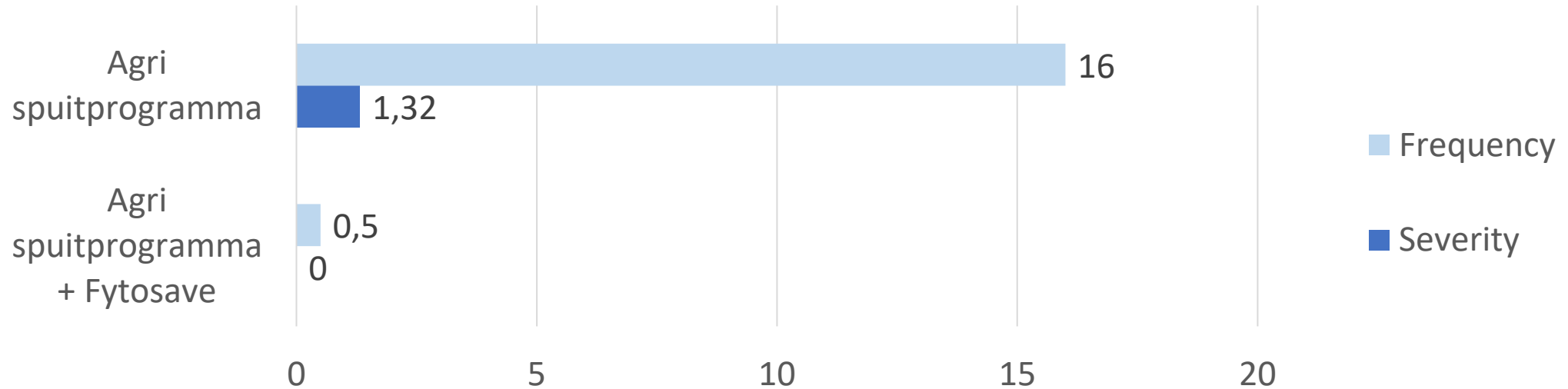
| Doses indicatives | 2 l /ha avec Adaptation à la surface foliaire | | 2 L |
|--|---|-----------|-----|
| Dose réellement appliquée (réduction par fermeture buses sur la base concentration et volume pleine végétation) | 1L | 1,2 à 1,5 | |
| | ← 4/5 applications → | | |



Big plot trial FytoSave (Dep 34) Chardonnay July 23 rating



Aantasting van valse meeldauw op druivenbladeren



July 23 rating on 200 grape bunches per condition clustered among 4 lines.

| Dates | April 23 | May 2 | May 15 | May 23 | June 8 | June 13 | June 24 |
|-------------------|----------------------------|----------------------------|----------------------------|----------------------------|------------------------------|----------------------------|------------------------------|
| Products and dose | Copernico 1.25 + Thiovit 5 | Copernico 1.25 + Thiovit 5 | Copernico 1.25 + Thiovit 5 | Copernico 1.25 + Thiovit 5 | Copernico 1.25 + Thiovit 7.5 | Copernico 1.25 + Thiovit 5 | Copernico 1.25 + Thiovit 7.5 |
| Blason | | 2L/HA | 2L/HA | 2L/HA | 2L/HA | | |



Yields and economical impacts FytoSave



| Partners | Varieties | Number of sprayings | Yield with reference kg/ha | Yield with FytoSave kg/ha | Additional Yield kg / hl* | Earning/ha* including FytoSave |
|----------|------------|---------------------|----------------------------|---------------------------|---------------------------|--------------------------------|
| Grower 1 | Cabernet S | 3 | 9070 | 9409 | + 340 kg/ha = 2,4hl | + 210 € |
| Grower 2 | Chardonnay | 4 | 4240 | 5272 | +1032 kg/ha = 7,4 hl | + 910 € |
| Grower 3 | Merlot | 4 | 18182 | 20522 | + 2340kg = 16,7hl | + 2394 € |
| Grower 4 | Sauvignon | 5 | 12773 | 13533 | + 760 kg/ha = 5,4 hl | + 669€ |
| Grower 5 | Chardonnay | 5 | 12000 | 12320 | + 320 kg/ha = 2,3 hl | + 95€ |

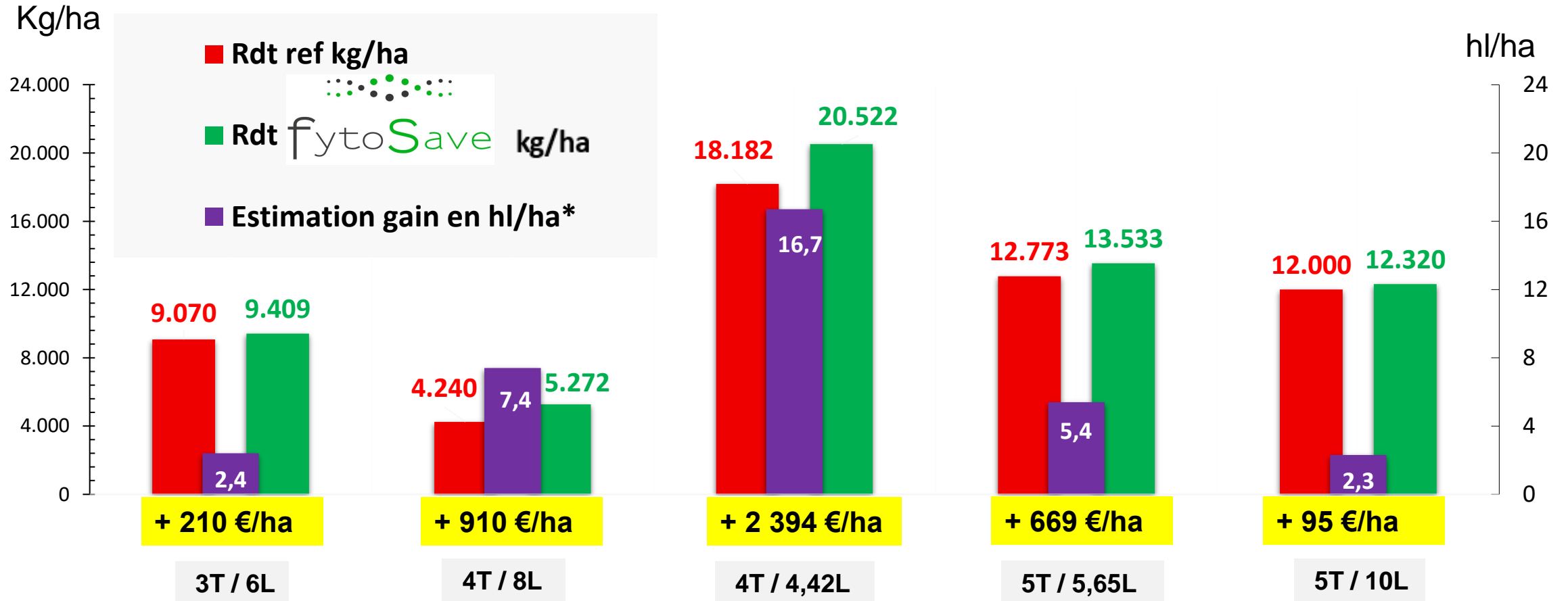
* Estimations:

140 kg = 1 hl

Earning/ hl in organic farming: 150 €/hl

FytoSave end user price 2019: 25 €/l












GP 2019 Analyse des résultats



Feedback van franse gebruikers

→ <https://www.facebook.com/watch/?v=238674930740494>

FytoSave[®] Key points

-  Geregistreerd als **GBM (10347P/B)**
-  Efficiënt tegen echte/valse meeldauw
-  Bijkomende positieve effecten (**groen effect**)
-  **Geen residu, geen MRL**
-  Geen risico op resistentieopbouw
-  Niet beïnvloed door UV en regenvastheid
-  Geen fytotoxiciteit
-  **Stabiel** bij kamertemperatuur
-  Toegelaten in OF en belangrijk instrument voor **IPM**
-  **Gepatenteerde** technologie
-  Solide wetenschappelijke achtergrond

Bedankt voor uw aandacht



fyto fend

Pioneering Biological Alternatives