



# Development of methodological tools to better understand biocontrol products for the control of tomato grey mold (ABA PIC project, 2021-2022)

<sup>1</sup>Klervi Crenn, <sup>1</sup>Emilie Hascoët, <sup>1</sup>Antoine Menil, <sup>1</sup>Claudie Monot, <sup>1</sup>Marie-Catherine Muzellec, <sup>1</sup>Mathilde Merrer, <sup>1</sup>Florian Podeur, <sup>1</sup>Céline Hamon, <sup>1</sup>Marie Turner, <sup>2</sup>Marianne Sellam

<sup>1</sup>Vegenov, 1040 Penn ar Prat, 29250 Saint Pol de Léon, France, email: [crenn@vegenov.com](mailto:crenn@vegenov.com);

<sup>2</sup>ACTA 149 rue de Bercy 75595 Paris cedex 12 France

# What is Vegenov?

- **Applied research centre** specialized in **plant** science
- Founded in **1989** by the fresh vegetable producers in **Brittany**
- **Non-profit organization** (Association loi 1901)
- **Working on more than 50 species :**



Vegetable species



Fruit and tree species



Industrial and field crop species



Ornamental species



Aromatic, medicinal, perfume, threatened and model plants

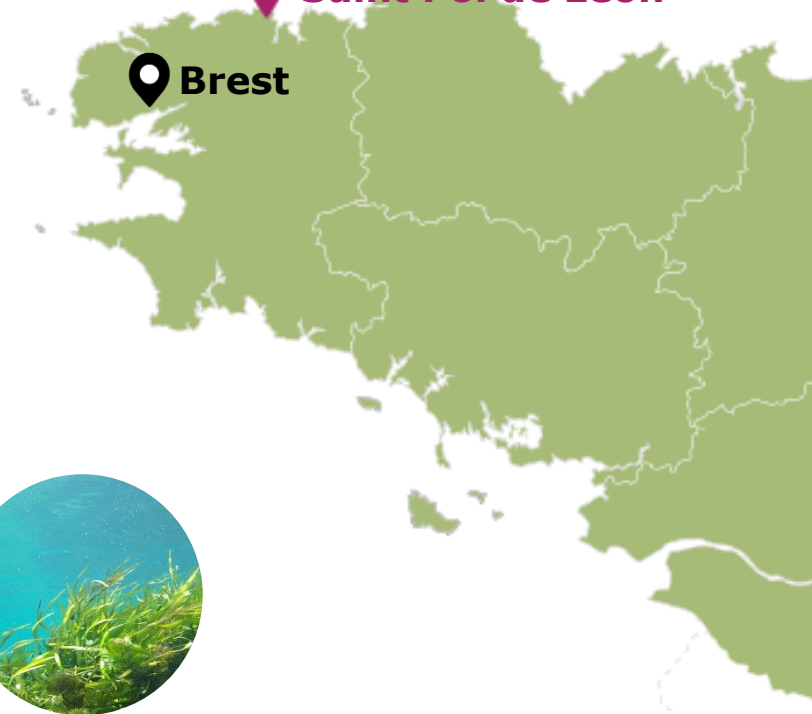


Micro-algae  
Macro-algae



 **Saint Pol de Léon**

 **Brest**



# What is Vegenov?



Realization of **R&D projects** on **3 thematic axes**:

- Plant Improvement and Traceability
- Plant Health
- Product Quality

Cutting-edge **equipments**:



700 m<sup>2</sup> of greenhouses



200 m<sup>2</sup> of growth chambers



In vitro laboratory and its 4 growth chambers



Molecular biology laboratory



Biochemistry laboratory





# Context of the project :

## ABA PIC :

Acceleration of **B**iocontrol and **A**gricultural equipment for **I**ntegrated **C**rop **P**rotection



**Financed** by the France Relance program : 2 million euros



**From** June 2021 to December 2022



**Coordinated** by ACTA

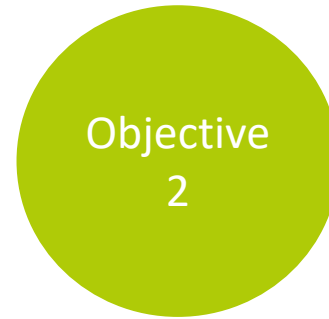
and **involving** several technical institutes partners :



➔ **A methodological project with 4 objectives:**



- ✓ Develop and test tools for monitoring biocontrol organisms and substances in the agrosystem: focus on microorganisms and VOCs



- ✓ Develop and test methods for studying the factors that condition the success of the use of biocontrol



- ✓ Improve experimental capacities on the methods of application of biocontrol products (sprayers, etc.)



- ✓ Develop biocontrol positioning know-how on the basis of diagnosis, monitoring and anticipation of the dynamics of pests, diseases and crop auxiliaries



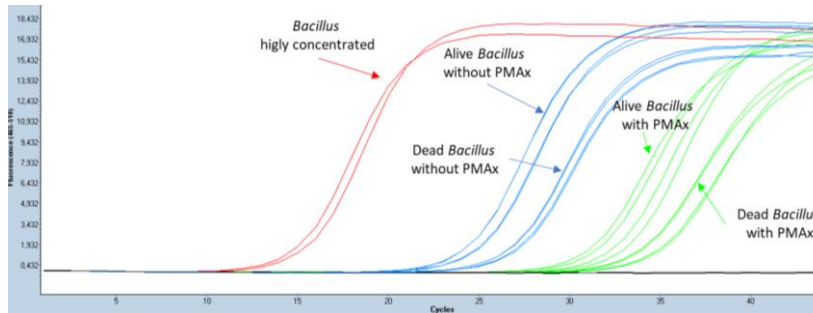
# Focus on methodological tools developed to better understand biocontrol products for the control of **tomato grey mold** :

Monitoring of microorganisms by qPCR: Pathogenic and BCA

- Detection and quantification of ***Trichoderma atroviride*, *T. viride*, *Bacillus velezensis* QST713**

➔ Vegenov can now monitor more than 50 microorganisms species

- Distinction of viable and non-viable microorganisms (PMAxx™) : encouraging results that need to be validated





# Focus on methodological tools developed to better understand biocontrol products for the control of **tomato grey mold** :

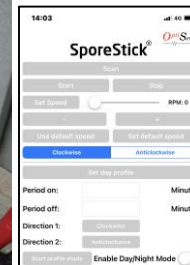
Monitoring of microorganisms: Pathogenic and BCA

- Comparison of spore trappers tools for air sampling and spore monitoring in greenhouses and field conditions

**Burkard**



**Rotorod**  
(here attached on a Burkard)



**Spornado**







# Focus on methodological tools developed to better understand biocontrol products for the control of **tomato grey mold** :

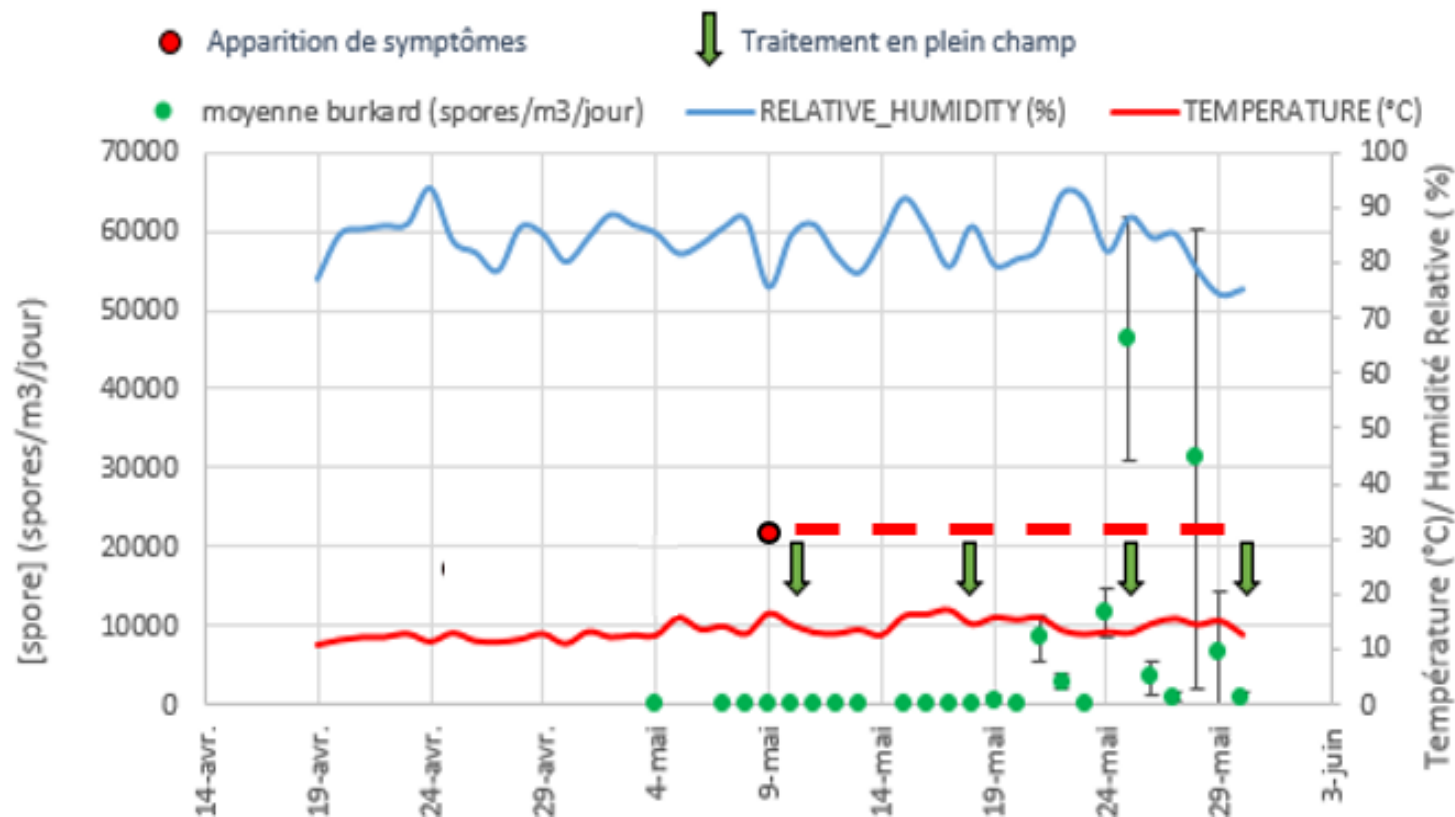
**Example: *Peronospora destructor*** (Allium downy mildew)

Objective 1

Objective 4

## Burkhard

- **Early detection ++ (5 days before symptoms)**
- Higher frequency of sampling (automatically) : of interest for appreciating the dynamics of contamination
- Expensive system but energy self sufficient







# Focus on methodological tools developed to better understand biocontrol products for the control of **tomato grey mold** :

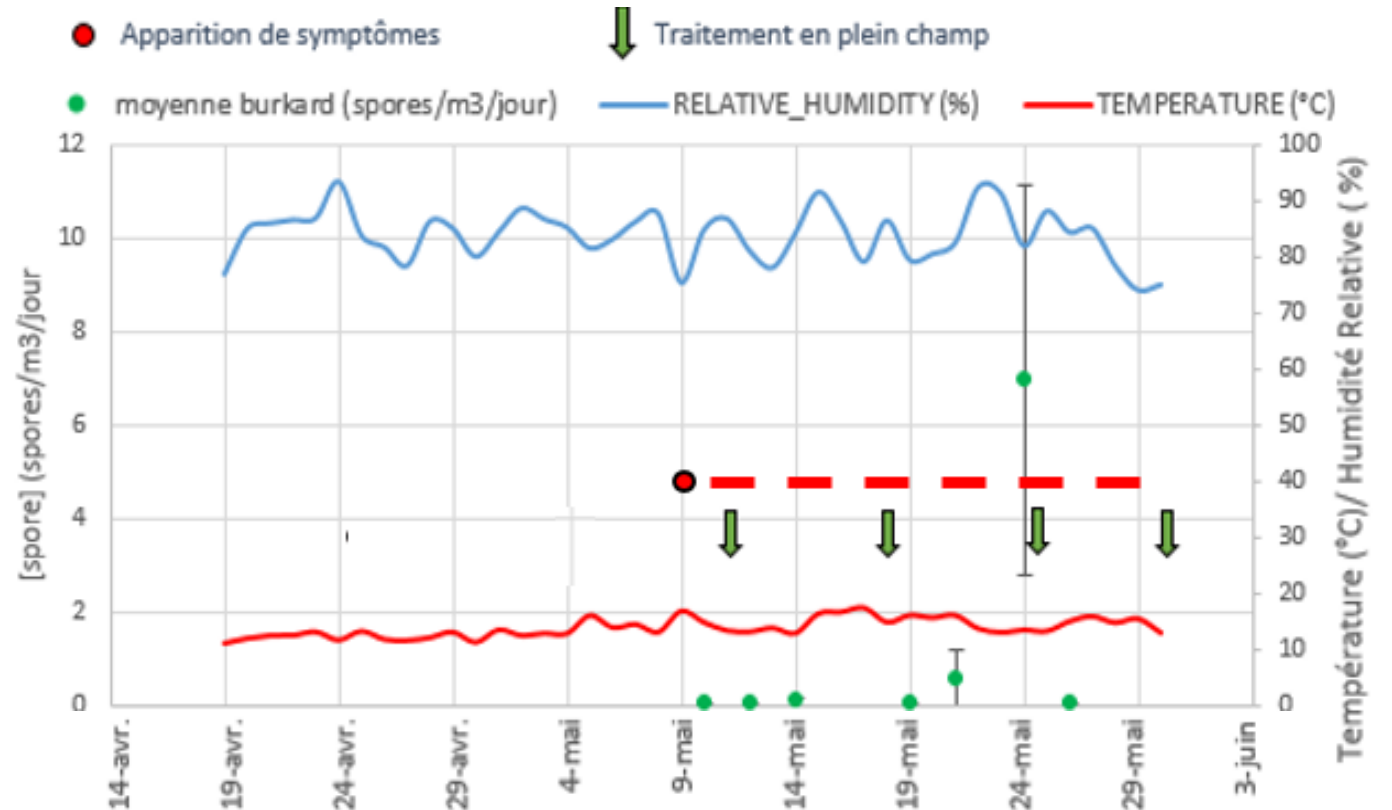
**Example: *Peronospora destructor*** (Allium downy mildew)

Objective 1

Objective 4

## Rotorod

- **No early detection (0 day before symptoms)**
- Very low concentration of spores during sampling (low trapping efficacy?) + manual sampling frequency
- Intermediate cost and not energy self-sufficient (battery replacement every 4-5 days)





# Focus on methodological tools developed to better understand biocontrol products for the control of **tomato grey mold** :

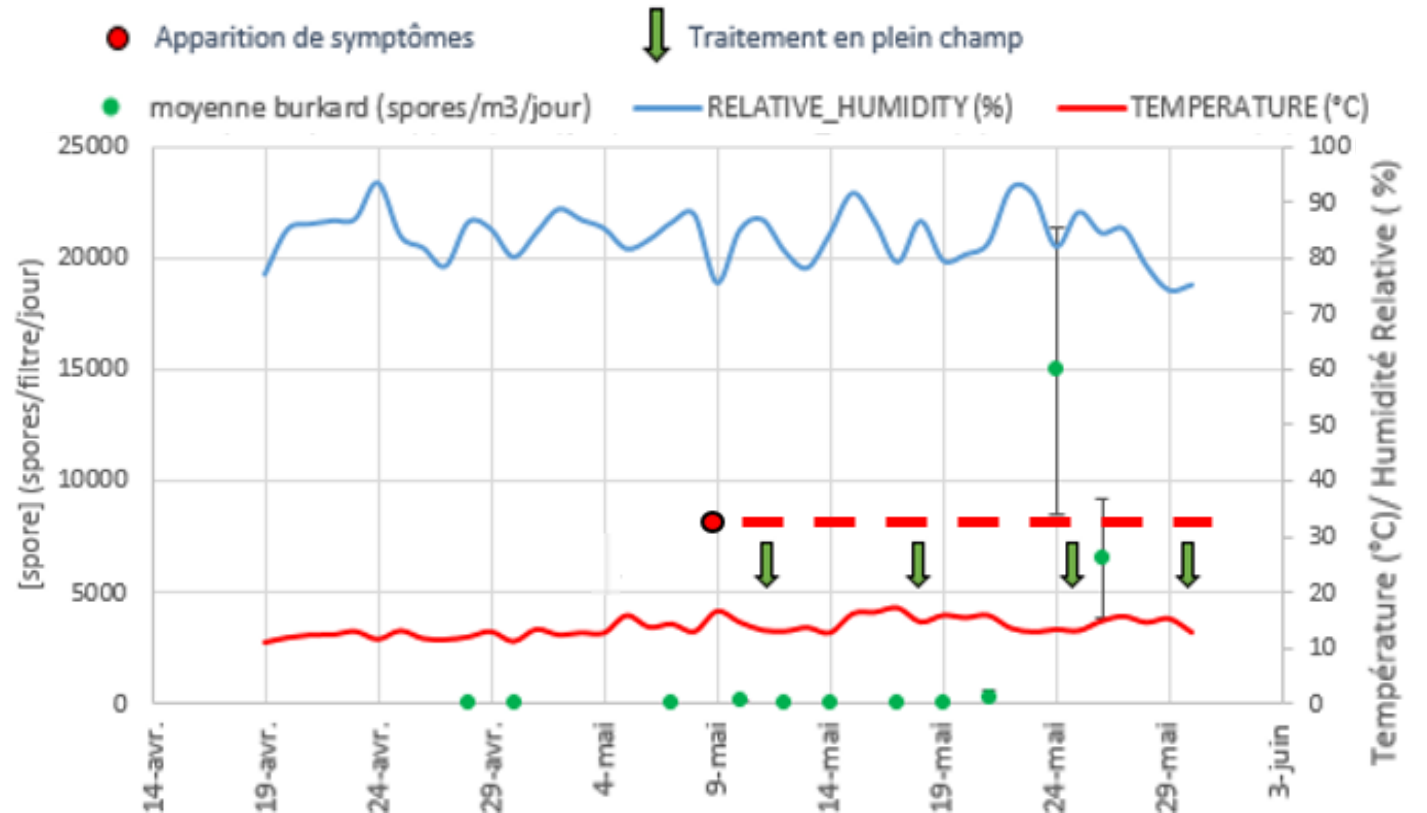
**Example: *Peronospora destructor*** (Allium downy mildew)

Objective 1

Objective 4

## Spornado

- **Early detection +++ (10 days before symptoms)**
- Manual sampling frequency
- Low cost and passive (no energy requirement)





# Focus on methodological tools developed to better understand biocontrol products for the control of **tomato grey mold** :

Factor that may condition the efficacy of BCA :  
 - after different abiotic stresses

Objective 2a



**Temperature impact:**  
 Optimal = 18/20°C N/D  
 Decrease = 10/12°C N/D  
 Increase = 30/32°C N/D



**pH impact:**  
 Optimal = 6-7  
 Decrease = 5  
 Increase = 8



**Humidity impact:**  
 Optimal = 70-75%  
 Decrease = 50 and 60%  
 Increase = 100%



**Leaching impact:**  
 Optimal = 0 mm  
 Rain 1 = 20 mm  
 Rain 2 = 100 mm



**UVA & UVB impact:**  
 No stress = no UV  
 Stress = UV 10 or 100%

**Protection efficacy**



100%

0%

	control	10-12°C	30-32°C	pH 5	pH 8	Humidity				Leaching		UVA 100%	UVB 10%
						50%	60%	75%	100%	20 mm	100 mm		
Chemical control	100.0	100.0	100.0	100.0	100.0	97.7	100.0	98.4	100.0	99.2	83.4	100.0	100
<i>Bacillus</i> 3	96.8	99.2	95.7	92.5	97.0	93.6	99.0	59.2	87.2	13.3	-1.1	86.0	64,5
<i>Trichoderma</i> 2	98.6	73.0	100.0	89.1	91.1	87.8	74.9	79.2	98.3	98.3	98.3	75.1	0





# Focus on methodological tools developed to better understand biocontrol products for the control of **tomato grey mold** :

Factor that may condition the efficacy of BCA :

- ability to stimulate plant defense

Objective 2b

**Scientific question :** Does the tomato variety impact plant defense induction?

Choice of 8 varieties :

→ Representatives of varieties grown by producers in the Breton vegetable sector

→ Variety resistance

HR : High resistance

IR : Intermediate resistance

	ToMV	ToTV	TSWV	<i>Passalora fulva</i>	<i>Fusarium oxysporum f. sp. lycopersici</i>	<i>Fusarium oxysporum f. sp. radicis-lycopersici</i>	<i>Verticillium albo-atrum</i>	<i>Verticillium dahliae</i>	<i>Meloidogyne arenaria, Meloidogyne incognita, Meloidogyne javanica</i>
Admiro	0-2			A-E	0,1		x	x	
Codino	0-2		x	A-E	0,1	x	x	x	
Confiance	0-2	x	x	A-E	0,1		x	x	
Plaisance	0-2			A-E	0,1	x			
Tomawak	0-2				0	x	x	x	
Damaress	0-2		x	A-E	0,1	x	x	x	
Duelle	0-2			A-E					x
Sweetelle	0-2			A-E	0				x



# Focus on methodological tools developed to better understand biocontrol products for the control of **tomato grey mold** :

Factor that may condition the efficacy of BCA :

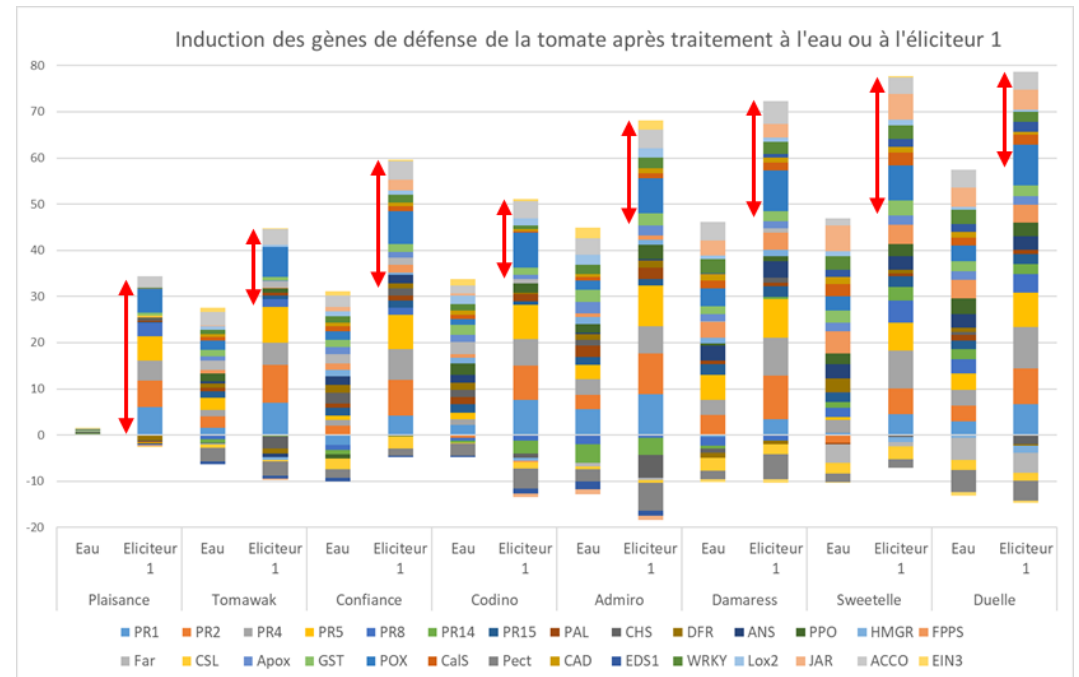
- ability to stimulate plant defense

Objective 2b

**Scientific question** : Does the tomato variety impact plant defense induction?

Results (stacked histograms)

- ➔ Very contrasting constitutive defense level
- ➔ All varieties respond to elicitor 1, but with variability
- ➔ Plaisance variety presented the highest level of induction





# Focus on methodological tools developed to better understand biocontrol products for the control of **tomato grey mold** :

Factor that may condition the efficacy of BCA :

- when combined with other phytosanitary : conventionnal (C) or biopesticide (B)

Objective 2c

		Sulfur (B)	Sulfur (B)	Fatty acid (B)	COS-OGA (B)	Essential oil (B)	Potassium hydrogen carbonate (B)	Cyazofamide (C)	Bupirimate (C)
	<b>Alone</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>52</b>	<b>24</b>	<b>0</b>	<b>26</b>
<b>Bacillus 1</b>	<b>97</b>	50	38	76	100	62	74	83	57
<b>Bacillus 2</b>	<b>14</b>	9	18	33	26	76	44	-7	5
<b>Bacillus 3</b>	<b>100</b>	94	90	4	98	28	92	93	73
<b>Trichoderma 1</b>	<b>40</b>	38	63	24	33	72	42	61	28
<b>Trichoderma 2</b>	<b>82</b>	87	82	93	79	88	56	88	94
<b>Trichoderma 3</b>	<b>76</b>	85	85	67	78	84	62	76	88

**Protection efficacy when combined:**

- High decrease**
- Moderate decrease**
- No evolution**
- Increase**



## Conclusions:

**Methodology acquired and/or improved by the various partners**

→ Available for future private or public projects

**Webinars organized early 2023**

→ Replay available on the Acta website (in French)





**THANK YOU VERY MUCH!  
MERCİ À TOUS!  
MERSİ BRAS!**

**CONTACT:**

**KLERVI CRENN**

**PROJECT MANAGER IN PLANT HEALTH**

**[CRENN@VEGENOV.COM](mailto:CRENN@VEGENOV.COM)**