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# Tobacco crop protection against Blue mold : What strategy with Organic and Biocontrol products ?

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# Outline

- Context
- Objectives
- Materials & methods
- Results and discussion
- Conclusion

# Blue Mold : one of the most important diseases

- *Peronospora tabacina* : un fungus that affects tobacco (greenhouse & **field**)



Yellowish spots on the upper side



Sporulation gray-blue on the lower face

- **Outbreaks in all regions**

# Blue Mold : one of the most important diseases

- Favourable conditions:

HR > 70%

T°C 16° - 23°C

Cloudy weather

Free water on leaves

Susceptible tobacco

Young leaves

- Impact: loss of yield and quality : 5 -20% (average)
- Could destroy 100% of the field

# Context in France

- Reduction of conventional CPA & their impacts (toxicology + environment)
- Prophylaxis + IPM + Need of preventive treatments
- Few CPAs + Resistance + a threat for their renewal:

Commercial product	Composition	Firm	Dose for application	Organic?	Biocontrolle?
ACROBAT M DG	Dimethomorph 90 g/kg + Mancozeb 600 g/kg	BASF	2.5 kg/ha	-	-
BION MX	Acibenzolar-S-methyl 4 % + Metalaxyl-M 38,76 %	SYNGENTA	0.4 kg/ha	-	-
RANMAN TOP	Cyazofamid 160 g/L	ISK BIOSCIENCES / BELCHIM	0.5 L/ha	-	-
PREV-B2 /PREV-AM = LIMOCIDE= ESSEN'CIEL	Orange oil 60 g/L	VIVAGRO	3 L/ha	☑	☑

➔ We are looking for new Eco-Friendly solutions



# Objective

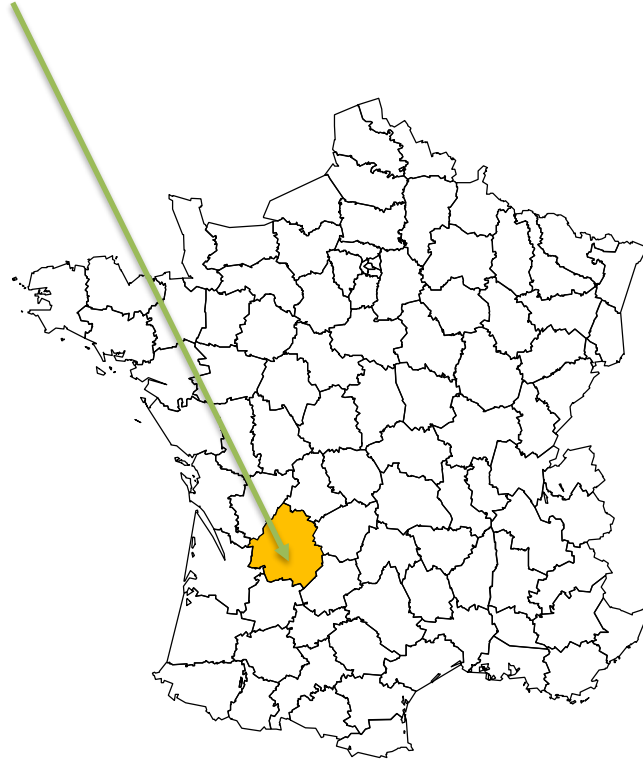
- To find new eco-friendly solutions
- To offer complementary solutions to conventional crop protection
- To be present in new profitable markets
- To avoid the selection of resistance



# Materials & methods



# Location : Bergerac – 24100 France







# M & Ms

- Experiments: 2009-2019 / late plantation / natural infection
- Experimental design : RCB/RIB (2018-2019), 3 replicates (2009-2013) & 4 replicates (from 2014)  
Plots : 20 to 32 m<sup>2</sup> (since 2015)
- Type of tobacco: Flue cured variety ITB 3304 then ITB 683 (from 2015)
- 4 applications/10-12 days & 6 applications (organic and biocontrol)/7-8 days
- Normal conditions of production in the area except Blue mold treatments
- Evolution of the protocol (included unchecked control then excluded from 2014)
- At least 2 notations: frequency and intensity. 1<sup>st</sup> notation : 1 wk after 1<sup>st</sup> spots
- Statistical analysis on raw data: STATIGRAPH, Silena/ t-test -Anova test NMK or Tukey LSD 95

# Tested products

Tested products	Commercial products	Composition	Firm	Dose for application /ha	Organic	Biocontrol	Remarks
Registered Products	ACROBAT M DG	Dimethomorph 90 g/kg + Mancozeb 600 g/kg	BASF	2.5 kg	-	-	
	BION MX	Acibenzolar-S-methyl 4 % + Metalaxyl-M 38,76 %	SYNGENTA	0.4 kg	-	-	
	PREV-B2 /PREV-AM = LIMOCIDE= ESSEN'CIEL	Orange oil 60 g/L	VIVAGRO	3 L	yes	yes	
Fertilizers	ELISTIM	Fertilizer with yeast fractions 9%, free amino acids 32%, N 10%, P2O5 5.5%, K2O 3.5%	JOUFFRAY DRILLEAUD	150 g/hl of slurry	yes		Stimilator of Natural defence of pLants (Yeast polysaccharide)
	PROVAL PK2	Fertilizer wth : P2O5 32%, K2O 12%	PROVAL				
	VIVALGUE	seaweed Ascophyllum nodosum fertilizer + Mg 5% + B 0,8%	VIVAGRO	1 L	yes		Physiostimulant
	VIVACUIVRE	CuSO4 18% ZN 1,2% B 1% Mn 0,2%	VIVAGRO	4 L	yes		
Additives	HELIOSOL	Terpenic alcohols 665 g/L	ACTION PIN	0.2 L/hL			
	FIELDOR MAX	Ethoxylated soybean oil 790 g/L	INTERAGRI	0.2 L/hL			

# Tested products C<sup>td</sup>

Tested products	Commercial products	Composition	Firm	Dose for application /ha	Organic	Biocontrol	Remarks
Pojects: non registered products	SC74	Copper sulphate 124 g/L		4 L & 6 L (from 2015)	yes		
	SC75	Copper oxide 750 g/kg		1 kg	yes		
	SC76	Copper hydroxide 400 g/L		1.15 L	yes		
	SC62	Potassium phosphonates 755 g/L		1.5 L p 4 L (from 2014)		yes	
	FT1708	H2O2 35%		4 L, 2 L & 1 L (from 2019)	+/- yes	yes	
	FT1703	soufre ( Sulphur ) 700 g/L		6 L	yes	yes	
	PH310	H2O2 20% stabilised		2 L	+/- yes	yes	
	TF1803	COS-OGA ( COS-OGA ) 12,5 g/L		4 L	yes	yes	Elicitor

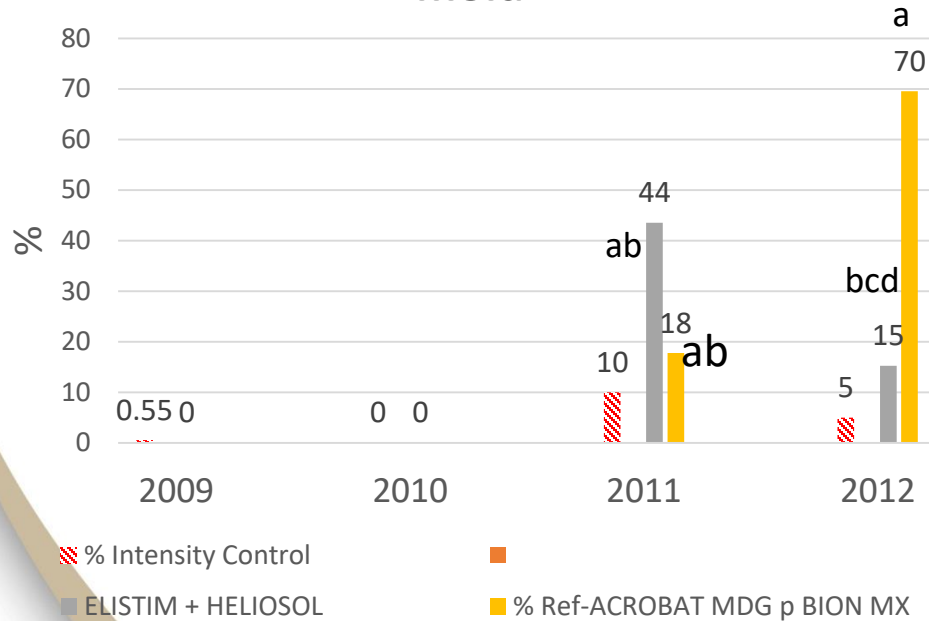


# Results & Discussion



# Fertilizer ELISTIM

## % Efficacy for the intensity of Blue mold

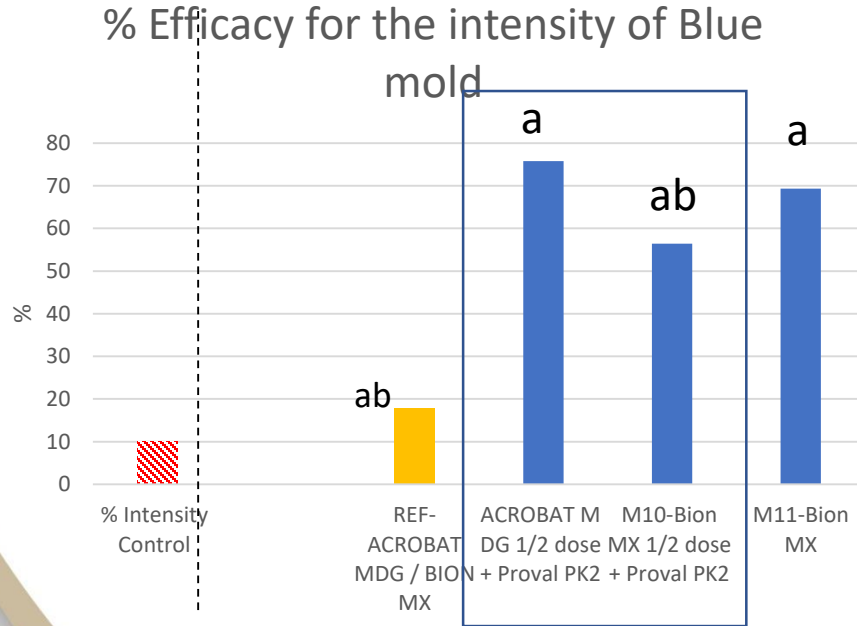


**2009 & 2010 : Low infection - no result**  
**2011: NSD**  
**2012: efficacy Elistim SD Ref.**

**➔ Irregular efficacy and status of biostimulant difficult to recommend in crop protection**



# Fertilizer PROVAL PK2



½ conventional products + Proval PK2 NSD from Ref

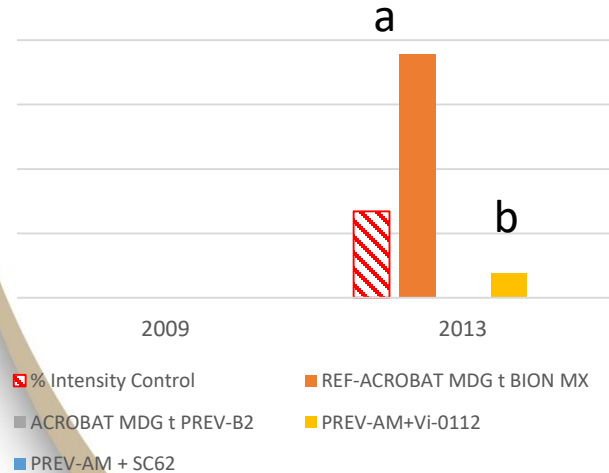
Only one year trial

➔ status of biostimulant difficult to recommend in crop protection

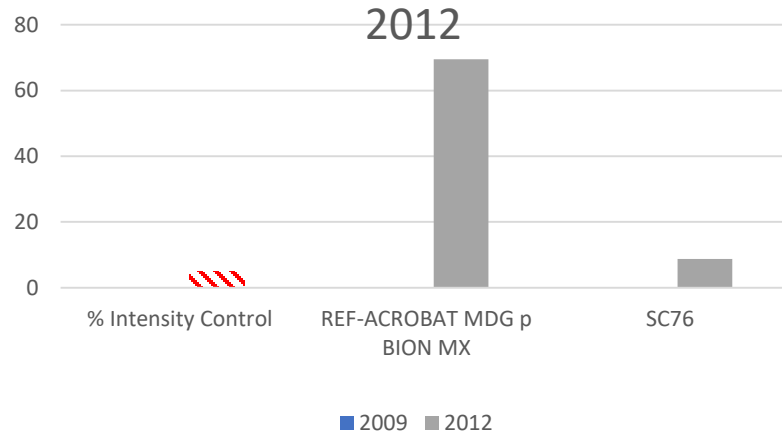


# PREV-B2-PREV-AM & COPPER ALONE

### % Efficacy for the intensity of Blue mold

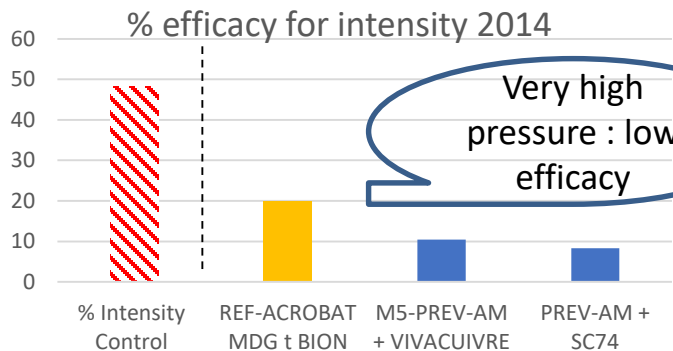


### % efficacy for intensity 2009 &

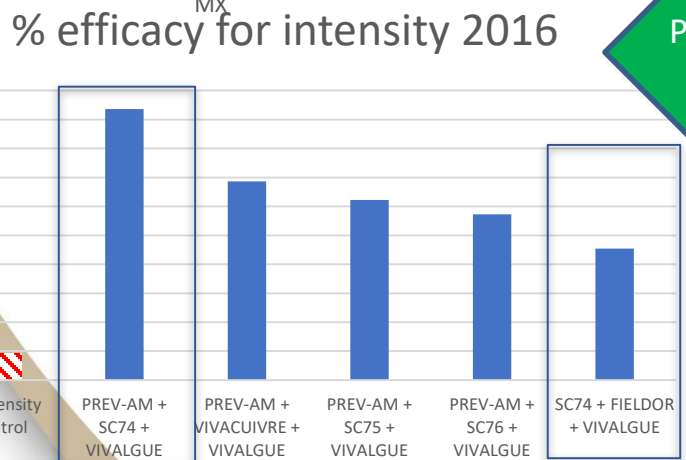
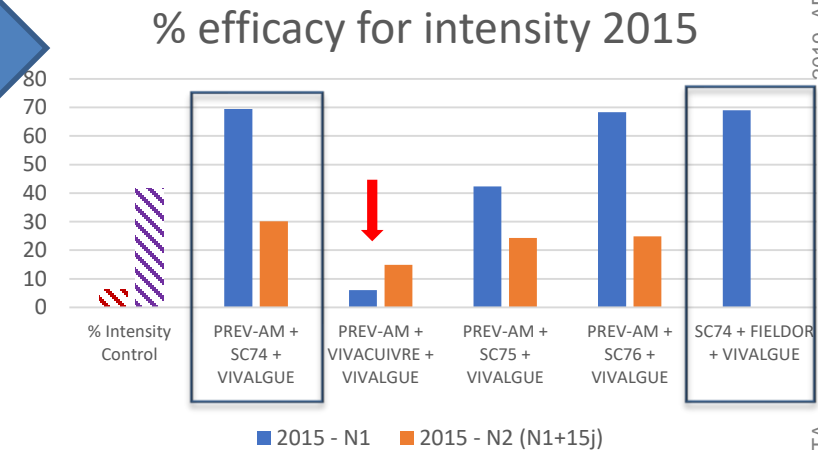


Low efficacy

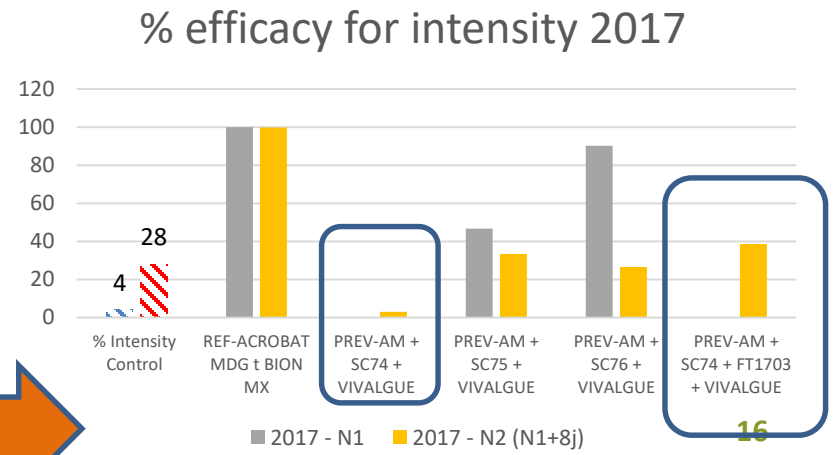
# Association PREV-AM & COPPER



PREV-AM ↑ persistence



PREV-AM ↑ efficacy

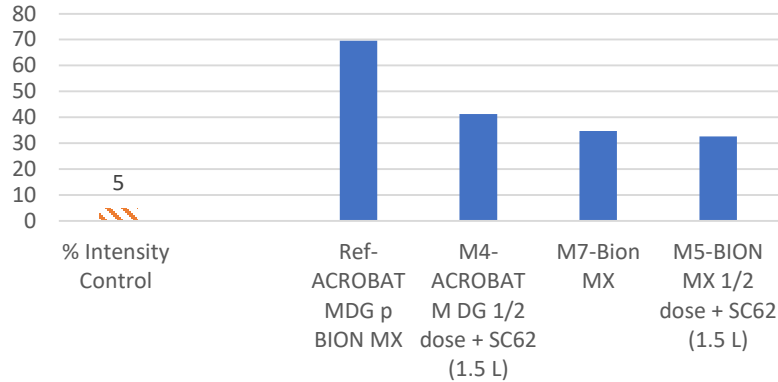


Sulphur ↑ persistence

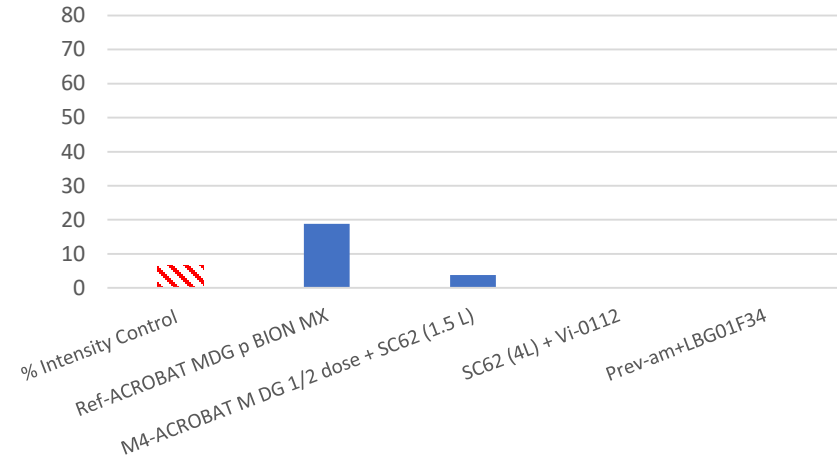


# SC62 : potassium phosphonate

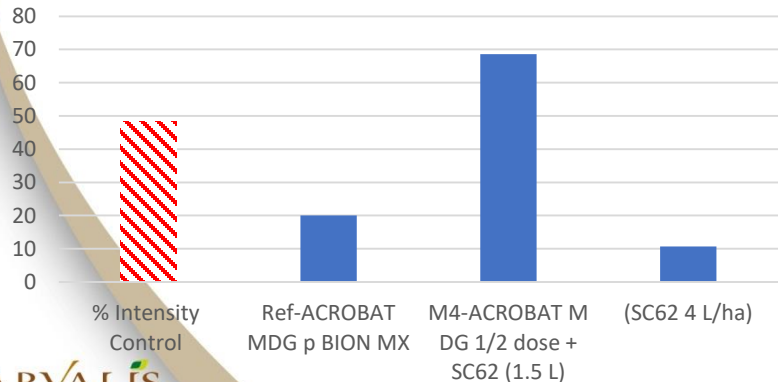
% efficacy for intensity 2012



% efficacy for intensity 2013



% efficacy for intensity 2014

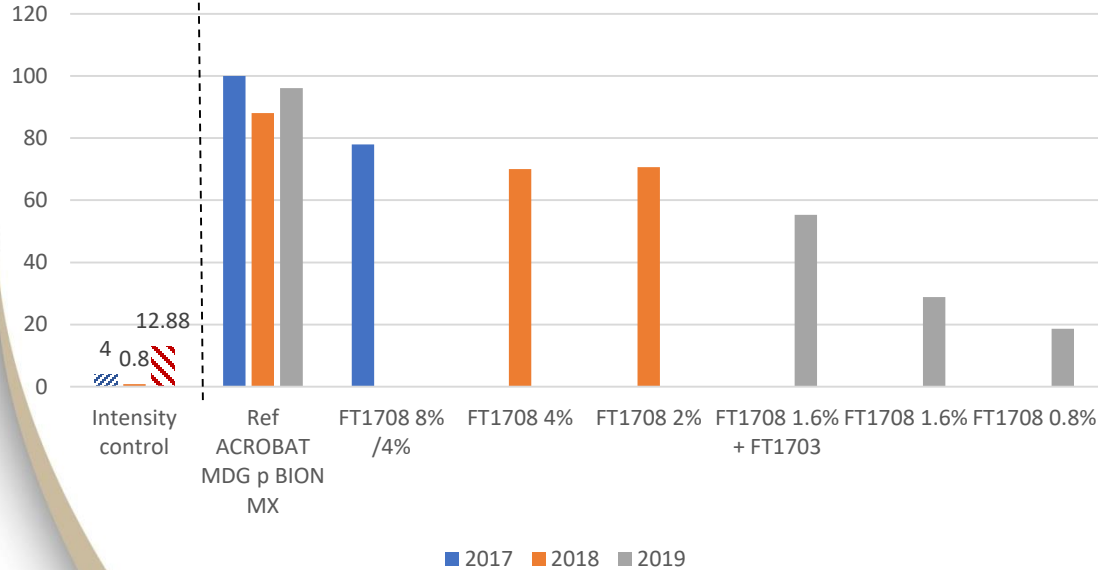


**SC62 alone : low efficacy**  
**In association with conventional products : ↗ efficacy especially in high pressure (systemic)**



# FT1708 – PH310 : Hydrogen peroxide

% efficacy for intensity



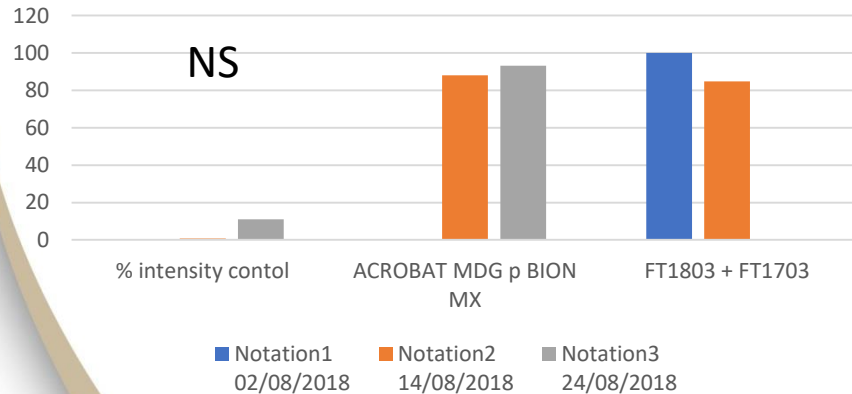
- Dose effect
- FT1703 (sulphur) ↗ Efficacy but phytotoxicity (association or up to 2%)
- PH310 : no efficacy : need to adapt the dose

NS (2018)

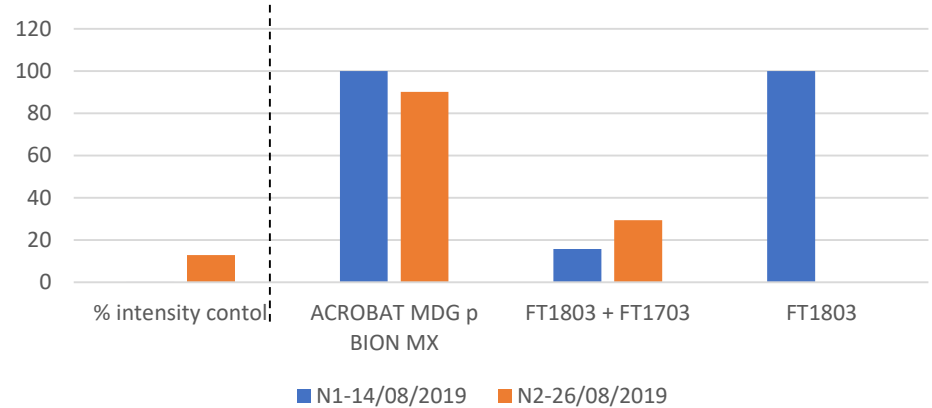


# FT1803 : COS-OGA

### % Efficacy for the intensity of Blue mold 2018



### % Efficacy for the intensity of Blue mold 2019



Good efficacy in 2018, non persistent  
2019: mid efficacy non persistent  
Results need confirmation



## Conclusion

- New eco-friendly solutions for the future ongoing registration (copper, H<sub>2</sub>O<sub>2</sub>, sulphur)
- Need to be associated for more efficacy
- New MOA for resistance management
- ↘ IFT (Treatment Frequency Index) for Biocontrol products
- Extra-cost to be lower by the development of

biocontrol

31/10/2019



# Recommendations

- Phytotoxicity: avoid over-dosage of sulphur, orange oil and H<sub>2</sub>O<sub>2</sub>



# Future WORK

H2O2, FT1803 trials to be continued

# Acknowledgements





# Thanks for your attention!!!



## BIOCONTROLE

