



# PRESTOP<sup>®</sup>

The biological fungicide

Practical guide

**LALLEMAND**

LALLEMAND PLANT CARE

# What is PRESTOP® ?

PRESTOP® is a concentration of mycelium and spores of *Clonostachys rosea* (previously named *Gliocladium catenulatum*) strain J1446 ( $2.10^8$  CFU\*/g), a fungus that is naturally present in soil and decomposing organic matter.

The strain J1446 is the result of research by Lallemand Plant Care and has been isolated for its fungicidal properties..



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Clonostachys rosea strain J1446

\*CFU: Colony Forming Units. Living units able to multiply.



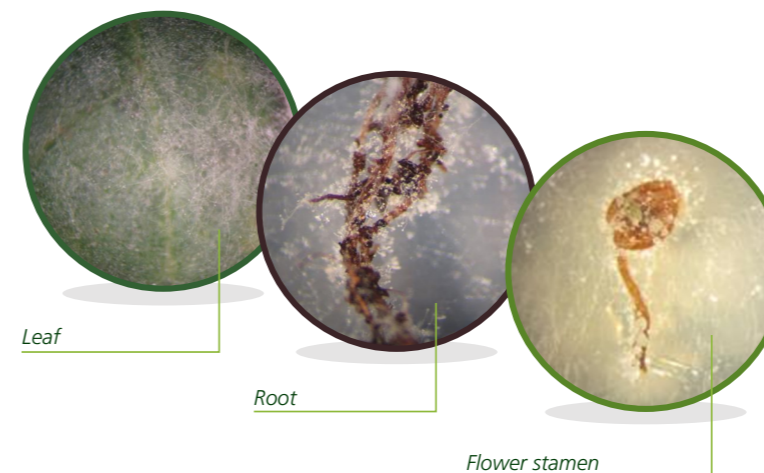
Clonostachys rosea J1446 on a Petri dish (SDA medium)

## Modes of action

### Rapid colonisation and competition

*Clonostachys rosea* J1446 has the capability to **rapidly colonise** the roots and aerial parts of a plant (leaves, stems and flowers).

In just a few hours after spraying, the fungus becomes physically attached to the plant, it starts its germination process and the growth of its mycelium. Consequently it first provides protection against pathogens through spatial and trophic **competition**.



Leaf

Root

Flower stamen



Colonisation of plant organs by *Clonostachys rosea* J1446.

### Saprophytism

*Clonostachys rosea* J1446 is a **saprophytic** fungus.

It develops on dead tissues, usefully acting as a protective barrier against the entry of pathogenic fungi.



Control PRESTOP®

Attack on wounded plant parts by pathogenic fungi

### Population Management



Clonostachys rosea J1446

Source Lallemand Plant Care

Botrytis cinerea

Source Ciliberti et al., 2015

Populations of *Clonostachys rosea* J1446 are able to grow in many environmental conditions (humidity and temperature). This ubiquitous ability gives it a clear advantage in combatting pathogenic fungi.

In adverse conditions, the beneficial fungus is able to maintain a sufficient population awaiting more favourable conditions for its growth.

### Persistence of action

*Clonostachys rosea* J1446 survives on all organs of the plant.

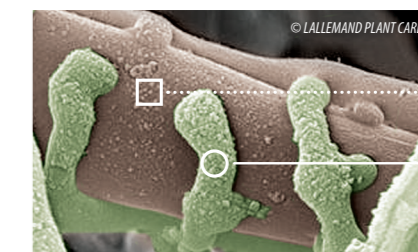
A concentration of  $2.10^8$  CFU/g has been determined by Lallemand research to ensure a **sufficient population**, for optimal protection over:

- > 3 to 4 weeks on aerial plant parts.
- > 4 to 6 weeks in the soil and different solid growing media (peat, rockwool, coir, etc.).

### Hyperparasitism

*Clonostachys rosea* J1446 is a **hyperparasitic** fungi. It develops at the expense of pathogenic fungi.

The hyphae of *Clonostachys rosea* J1446 wrap themselves around the pathogenic fungus and degrade its cell walls by secretion of enzymes ( $\beta$  1,3 glucanase, chitinase).



Pathogenic fungus *Rhizoctonia solani*

*Clonostachys rosea* J1446



# SUMMARY



**Effectiveness**.....Page 5



**Competitors**.....Page 6



**Registration**.....Page 7



**Application**

- Method** .....Page 8
- Dose** .....Page 9
- Timing**.....Pages 10 & 11
- Preparation** .....Pages 12 & 13



**Operating process**.....Pages 14 & 15



**Storage**.....Pages 16 & 17



**Compatibility**.....Page 18

## Effectiveness



**" It is not working. I did not see anything ... "**



*What have you been observing?  
 Why do you think the efficiency is not up to standard?  
 How did you apply the product, what dose and at what stage?  
 Have you made a mixture with another product or  
 a close intervention with another product?*

### ■ In general

The effectiveness of PRESTOP® is clearly its strong point!  
 If there is a problem with proven effectiveness, look at the **conditions of application**.  
 Today, **20% to 25% of the hectares developed** in the tomato *Botrytis* market in Almería (Spain) are covered by PRESTOP® applications, therefore its effectiveness cannot be doubted!

### ■ After identifying the origin of the farmer's problem

We suggest that together we follow the applications on your plots to show you the effectiveness of PRESTOP®.



## Competitors



" I use competitor products (biocontrol) "



For which uses (foliar or root)?  
For which targets (Botrytis or soil pathogens)?  
Which type of products (bacteria, fungi...)?



### Foliar Botrytis market (example: AMYLO-X)

*Clonostachys rosea* J1446 is a **saprophytic fungi**: it establishes on wounds and feeds on dead tissue. Thus it occupies space to the detriment of Botrytis and is parasitic when it comes in contact with the pathogen.

The *Bacillus amyloliquefaciens* contained in Amylo-X is an active substance that you can **consider as 'contact acting'**, it will secrete antifungal substances at the site where it is sprayed (flash effect).

Its operation is very different from that of *Botrytis*. It does not establish on moist wounds (quick drying).

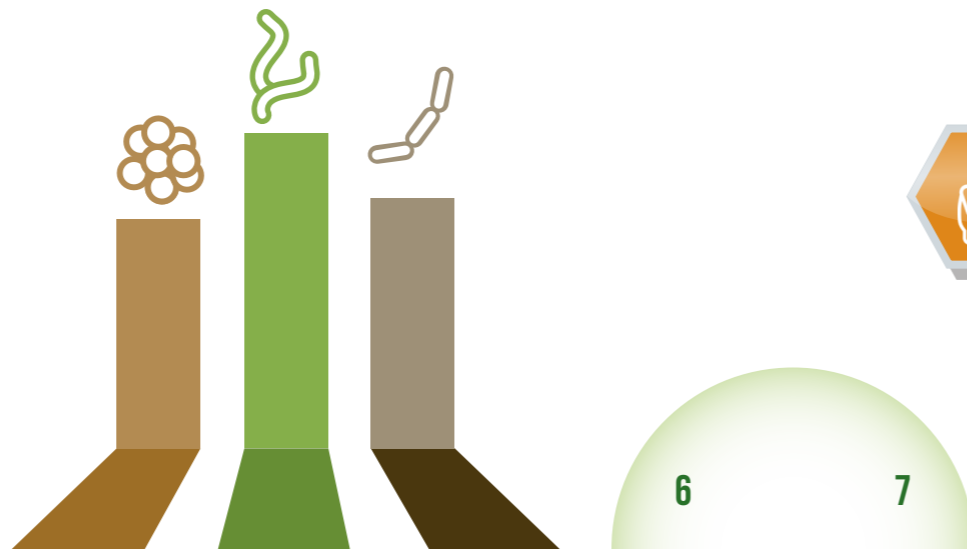
By contrast, *Clonostachys rosea* J1446 establishes on the wounds and forms a long-lasting protective barrier against *Botrytis*.



### Soil pathogens market (examples: TRISOIL, TRIANUM = Trichoderma)

The *Trichodermas* are fungi as with *Clonostachys rosea* J1446. Comparative trials have confirmed the very good efficacy of PRESTOP® compared to *Trichoderma* for soil use.

This can be explained by its very strong **colonizing power** of plant tissue and wounds (saprophytism).



## Registration



" Pre Harvest Interval (PHI), Re-entry Interval (REI) in treated plots, what are the regulations? "

The PHI of **3 days** was the default value for 'biocontrol' at the time of submission of the approval file. A specific request is in progress to obtain a PHI of 0 days in certain markets where this is not the case already.

Like other biocontrol products **the REI is 6 hours under cover and 8 hours in the open field**. Note: in certain markets the REI is 0 hours.



" I find it difficult to navigate my way through the spectrum of approvals for use... "



What are your pathogen issues?  
For which crops?

Our goal is to open up the **maximum spectrum of use** for PRESTOP®, which explains why we have an effective presence on many crops and targets!

We are at your disposal to enlighten you on the registered applications related to your crops and your problems.



" 6 applications maximum for strawberry grey mould is not enough... (10-month cycle) "

Do not hesitate to **combine PRESTOP® with other specialties** to ensure a good cover of protection within your programme.



" I use mains water which is chlorinated, does this have an impact on the fungus? Is there any influence on the fungus from the origin of the water (mains, borehole...)?"

Feedback from PRESTOP® users with different water types (wells, mains, boreholes...) shows that there is no impact **from the origin of the water on the effectiveness of the fungus.**



" I use PRESTOP® as a spray after using phytosanitary products, can there be an impact from the chemical residue in the tank on the functioning of the fungus? "

The volume of water added to the tank compared to the residue of the crop protection product will be at such a high level of dilution that it will have **no impact on the fungus.**

In the case of fungicides, it is nevertheless recommended to rinse the tank thoroughly (with a tank cleaning agent) before using PRESTOP®.



" I do not understand why the ground application rate is specific and not adapted according to the density of the plants..."

The recommended dose is based on a **dose** of microorganisms that **is exaggeratedly large and sufficient (expressed in CFU)** to cover all situations and densities at on average 1000 billion CFU per hectare.



" What are the application rates according to the method of application? "

The best way to apply PRESTOP® is by localised delivery (drip, irrigation system...). If the application is **localised** the dose is at **3 kg/ha.**

In the case of an **application undergoing a complete renewal** every 3 to 4 weeks one can also apply PRESTOP® at **3 kg/ha.**

The recommendation for a single **full application without renewal** is **5 kg/ha** (example: low density crops).



" Is it better to apply PRESTOP® at the beginning of the cycle or in the middle of the cycle? "



What is your goal when applying PRESTOP®?  
Do you have a problem of residues?  
Do you want to cut back on chemicals?  
Do you want to control disease pressure?

Objective foliar 1: Reduce the amount of pesticides

PRESTOP® is perfectly suited to programmes with the aim of the management of residues of synthetic products. Its usage will depend on your monitoring of residues.

Objective roots 2: Test the product to see if it works

In this case you can start your programme with preventative applications of PRESTOP® in order to exploit the different modes of action of the fungus and keep the possibility of intervening with synthetic products later if necessary (depending on the level of pressure).

Objective roots 3: Complementing the application of another product

We can help you build a programme which integrates PRESTOP® around your existing applications.



" Is it better to intervene in a preventive or curative way? "

The fungus combines several modes of action: colonisation of dead tissues and wounds (saprophytism), colonisation of plant organs (competition) and ability to parasitise pathogens (hyperparasitism). In order to exploit all these modes of action, the ideal is to apply PRESTOP® as a preventative measure.



" How long is the fungus active in the soil/leaf? "

As a general rule, and as stated in the approval dossier, the intervals to be observed are as follows **3 to 4 weeks on the foliage and 4 to 6 weeks in the soil.**

However, the interval between applications must be adapted according to the level of pathogenic pressure and the climatic conditions. It is important to ask your technician for advice on adapting your programme.



" Is it better to dip the plants or to spray on the bed for my applications to the soil? "



What would you rather do in terms of practices?  
What is the easiest thing for you to do?

An application **sprayed on the bed is easier** to achieve from a practical point of view (time, handling...). If you are already doing dipped rootball plants you can do the application completely by dipping.



" If I drench on receipt, do I have to reapply at the beginning of the cycle? "

If drenching is carried out a **few days before planting** it is **not necessary to renew the application** of PRESTOP® at the start of the cycle. If it is several days before, you can contact your technician to adapt the renewal of your applications over the cycle.



### " Can the spraying pressure have an impact on the fungus? "

The numerous tests carried out with **conventional pressures** for spraying **of between 4 to 8 bars in tomato production have shown no negative influence** of these pressures on the effectiveness of the fungus.

Tests have also been carried out in large greenhouses with much higher spraying pressures (up to 18 bars at the end of the circuit and even 26 bars at the pump outlet) and no negative influence of these pressure levels has been detected.

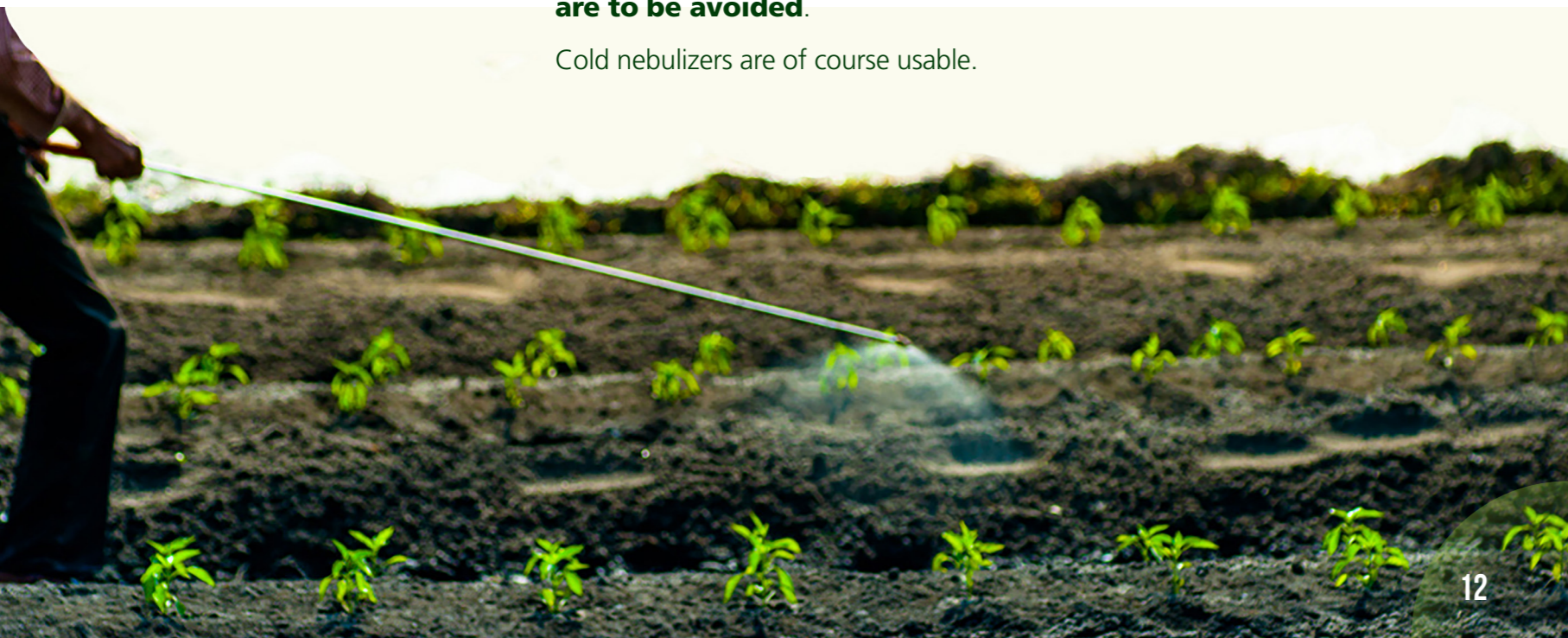
**The pressure levels usually encountered therefore do not have a negative influence on the fungus.**



### " Is there an influence of the water temperature? "

The use of hot nebulizers (pulsefog type) and **all water heating systems are to be avoided.**

Cold nebulizers are of course usable.



### " How long can I keep my PRESTOP® in suspension? "



*Why do you want to keep it in suspension?  
For how long?*

If it is to prepare **the mixture in the evening and then spray it the next morning** there is **no risk** for the fungus.



### " There are difficulties with getting it into suspension... "

The formulation of PRESTOP® WP has been modified to ensure better mixing into suspension. To date, we have no knowledge of **any suspension problems and therefore no nozzle clogging problems with this improved formulation.**

We continue with the concept of a powder that has to be diluted with water ideally through carrying out of a premix (bucket) including for drip irrigation systems (fertigation) with a low volume of water.



### " Can the size of the filters have an impact on the population ? "

There will never be a filter size fine enough to affect the cell structure of the fungus. **Filter sizes, even the finest, have no influence on the cellular integrity of the *Clonostachys rosea* J1446.**

The improved formulation of PRESTOP® WP now allows easier mixing into suspension (no clumps of pellets and undissolved powder) which could historically be the cause of the nozzle clogging phenomena.



### " How long after spraying will the fungus be active? "

As soon as the conditions are favourable for the germination of the fungus (temperature and humidity) it will germinate and quickly colonise the leaf surface (a few hours). One application **1 to 2 days** before conditions are favourable for the development of pathogens such as *Botrytis* is ideal.

**OBJECTIVE : ANTICIPATION !**



### " Is the fungus leachable? "

(example: drainage on perlite in an above-ground drip system)



**Do you think this practice washes away diseases?  
Why do you think pathogens are not leachable  
and PRESTOP® is?**

A microorganism is not a synthetic active ingredient. **Microorganisms remain in contact with clay particles and organic matter** in the growing media. **NO LEACHING!**



### " Does tillage have an impact on the fungus? "

(example: application of PRESTOP® then shallow tillage before sowing bulbs)

**Tillage has no impact** on *Clonostachys rosea* J1446. However, it is ideal to apply PRESTOP® at the beginning of the crop cycle



### " Is there an ideal operating temperature? "

The fungus has a range of activity which is **extremely large (temperature and humidity)** and will enter a phase of **germination and mycelium growth prior to the pathogens** that it targets if it is applied preventively.

Depending on the crop and the pathogen in question, ask your technician for more details.





" If the bag is opened how long can I keep the fungus? "

Humidity is the major enemy of *Clonostachys rosea* during storage (and not temperature) because it will favour the germination of the resting bodies (conidia). **The bag must be resealed properly, placed in an airtight box and refrigerated for use within one month of opening.**



" Is the storage temperature important? If I do not have a fridge how long can I keep it at ambient temperature? Is there a risk if the cold chain breaks? "

The important thing is to avoid exposure to moisture and heat to insure a perfect stability of PRESTOP®.



" Can PRESTOP® be frozen? "



Why do you want to freeze it?

PRESTOP® can be stored in this way under precisely measured conditions (strict control and rapid lowering of temperature). As these conditions cannot be fully guaranteed in normal use (standard freezers), it is not recommended to freeze PRESTOP® in order to avoid damaging the living cells and affecting the stability of the product.





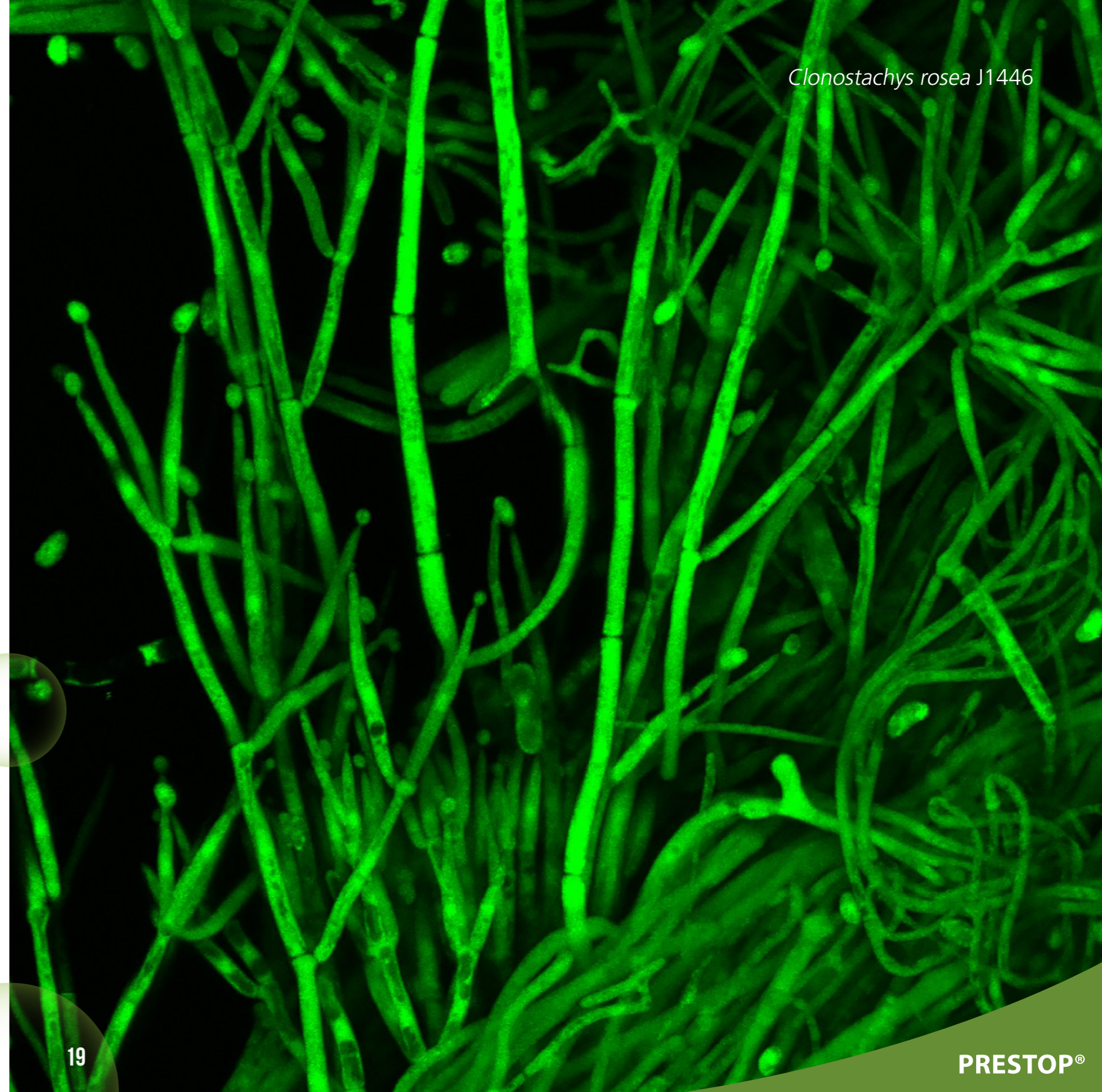
### " Can I mix PRESTOP® with other biocontrol microorganisms? "

Mixing two microorganisms selected for their strong colonising power will inevitably lead to competitive phenomena. **Mixing is not a good way to add value to your application.** A delay of 7 days between the two applications of microorganisms is ideal.



### " Is there an impact on macroorganisms ? "

**PRESTOP® is IPM compatible.** In particular, bumblebees, an especially sensitive insect, are used as a vector for PRESTOP® on strawberries without any impact on these macroorganisms.



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Lallemand is a family owned, Canadian company that develops, produces and markets microorganisms and derivatives for applications in:



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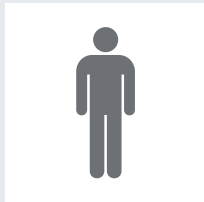
BREWING



BIOFUEL & DISTILLED SPIRITS



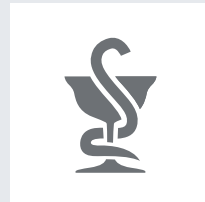
BIO-INGREDIENTS



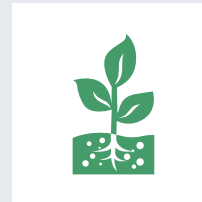
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## LALLEMAND PLANT CARE

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