LALFRESH S, (*Clonostachys rosea* strain J1446), a post-harvest biofungicide for the control of *Monilinia laxa* and *M.fructicola* on stone fruits.

Matthieu Morel
LALLEMAND PLANT CARE, France.
mmorel@lallemand.com

abstract

Post-harvest losses of stone fruit, are mainly (90%) due to Brown Rot, caused by three species of Monilinia: *Monilinia laxa*, *M. fructicola* and *M. fructigena*. Post-harvest symptoms of this disease start from latent infections of green fruit which causes fruit brown rot during storage and transport to market. Currently the post-harvest control of this disease is mainly managed by pre-harvest chemical sprays, followed by post-harvest applications of chemical fungicides (countries where these products are allowed). Despite years of research to find alternative and no residue solutions, no commercial microbial fungicides were on the market. LALFRESH S, based on the fungus *Clonostachys rosea* strain J1446 (>1 x 10^9 cfu/g), recently received the first approval in France. This use of this strain of *C. rosea* for postharvest control of Brown Rot on stone fruits, is patented technology: EP3351106A1, WO2018234280. Other strains of *Clonostachys rosea* f.sp *rosea* are patented for the use as biocontrol agents (EP3044307B1).

C. rosea J1446 displays multiple modes of action to suppress pathogens. Rapid colonization of the fruit surface allows very efficient competition for nutrients and space with the pathogen. *C. rosea* J1446 is furthermore acting as a mycoparasite. The appressorium-like structures help *C. rosea* to adhere to and coil around the surface of the pathogenic fungal hyphae. The antagonist penetrates the pathogenic host hyphae, to derive nutrients from it and thus destroying it. Efficacy studies were conducted over the past 6 years with this product. The aim of these studies was to find the best application method, which will allow effective control of Brown Rot during storage and transportation to the market.

Keywords: *Clonostachys rosea*, *Monilinia laxa*, *Monilinia fructicola*, *Monilinia fructigen*a, biological, control, efficacy, biofungicide.

introduction

The 3 species of Monilinia *(Monilinia laxa*, *M. fructicola*, and *M. fructigena)* which causes “Brown rot” on stone fruits is by far one of the most serious diseases in stone fruit production. The economic impact of this disease is valued at 900 M€/year in Europe.

For farmers, in addition to prophylactic methods, pre-harvest applications of chemical products remain the standard practice to control this disease, as contamination occurs systematically in the orchard before the harvest. Nevertheless, the efficacy of chemical control remains partial (depending on the disease pressure) so that even when treatments have been applied at the right time, problems of rot may occur after harvest (it’s not unusual to have 30 to 40% fruit loss despite a major chemical program applied in the orchard). Today we are facing the challenge of having a biocontrol product (free of residues) based on a microorganism, for post-harvest application on stone fruits, which is able to control Monilinia. The Plant Care Unit of the Lallemand Group, www.lallemand.com has been focusing its time and energy for many years to demonstrate that a fungus called *Clonostachys rosea* J1446 (registered as LALFRESH S) is able to control “brown rot” and has proven its excellent efficacy level against Monilinia on stone fruits (Peach, Nectarine, Plum and Cherry). Farmers have now access to a new tool to reduce post-harvest losses related to this disease.

Hyphae of *C. rosea* J1446 roll around pathogenic fungal structures indicating hyperparasitism.

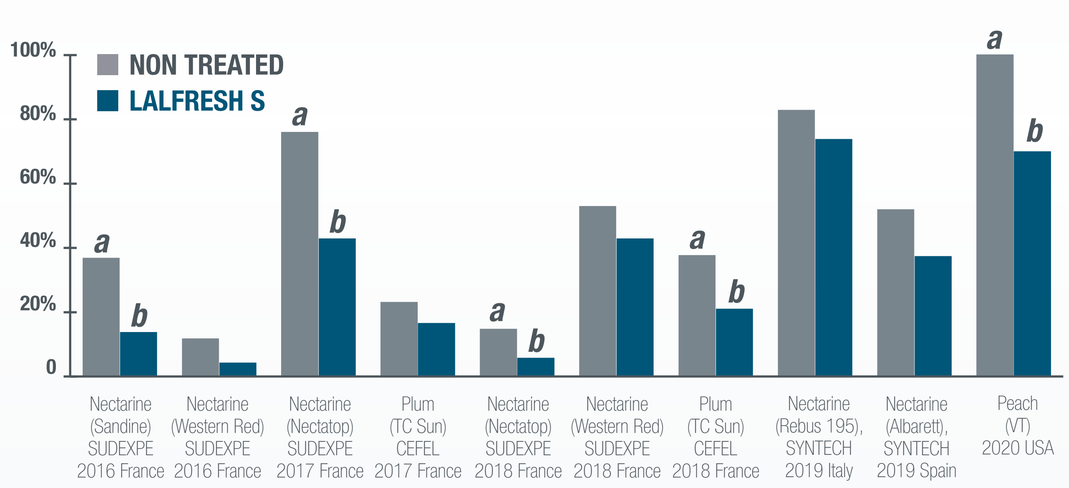
results

Summary of 10 trials conducted between 2016 to 2020

Efficacy 2 weeks post treatment

Storage	20-22°C
Dose	9 g/t mixed in water
Method of application	Manual or automatic spraying

Cumulative % of wasted fruit 14 jours (+/-3 days) **post treatment**



Significant difference at 5%

Fruit waste **reduced by up to 50%** vs control, 15 days post application

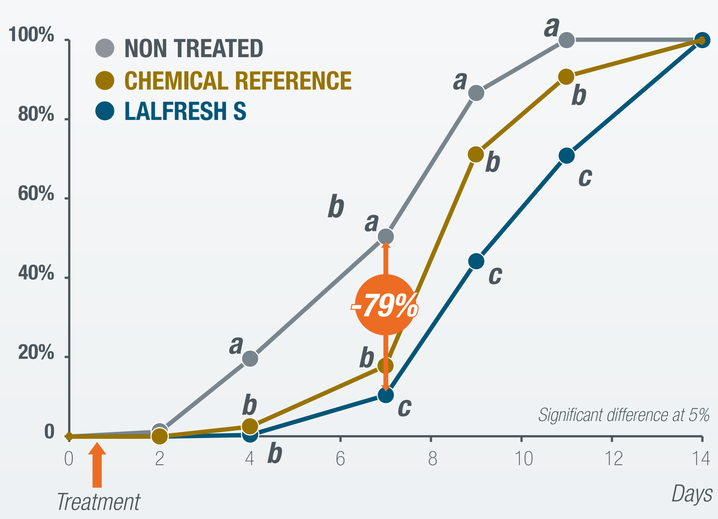
10 GEP trials were carried out in the main stone fruit-producing countries, and LALFRESH S have always showed a significant reduction of wasted fruits (caused by Brown rot) on at least one assessment period in every trial.

(Here is a summary of all the GEP trials concerning the % of brown fruit compared to an untreated control at + or - 14 days after product application).

Trial for ‘Monilia control’ on Peaches. USA (2020)

Varieties	Late
Storage	20°C
Target	*Monilinia laxa*
Doses	**LALFRESH S**: 9 g/t; 3 L/ton **Untreated Control**: 3 L/ton **Fludioxinil** (20.4%): 4.7 ml/t; 3 L/t

Cumulative % of wasted fruits (at room temperature 20°C)



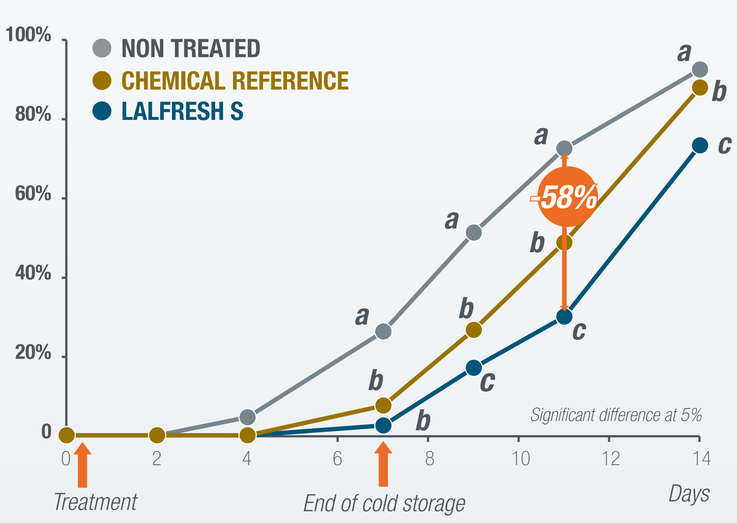
Significant difference at 5%

In trials where LALFRESH S was compared with the standard Fludioxonil-based chemical solution, the results were often equivalent or very close to this chemical solution.

Trial for ‘Monilia control’ on Peaches. USA (2020)

Varieties	Late
Storage	4°C (7 days)
Target	*Monilinia laxa*
Doses	**LALFRESH S**: 9 g/t; 3 L/ton **Untreated Control**: 3 L/ton **Fludioxinil** (20.4%): 4.7 ml/t; 3 L/t

Cumulative % of wasted fruits (at cool temperature during 7 days)



Significant difference at 5%

(Example of a trial carried out in the United States with fruit stored at room temperature and refrigerated temperature where LALFRESH S was equivalent or superior to the chemical solution over the entire fruit evaluation period).

conclusion

LALFRESH S was approved since June 2023 for post-harvest use in France at the rate of 9g/ton of fruits applied with a specific sprayer which deliver 2-3 liter of water per ton of fruits. The equipment is set up on the fruit packing lines so that the product can be applied safely after harvest. It’s the first biocontrol solution approved for post-harvest use on stone fruit to control brown rot in France. It is clearly an additional tool for growers to manage post-harvest losses caused by this major disease. It also enables better management of pre-harvest chemical applications in the orchard by reducing the number of potential residues left by these chemical products in the fruit. In countries where the application of post-harvest chemicals is authorized, it will enable these molecules to be replaced.