

Improving shelf life of viticulture-relevant biocontrol and biostimulant microbes using CITROFOL® AI as liquid carrier

Teresa Berninger¹, Carolin Stern¹, Victoria Sevillano, Óscar González-López^{2*}

¹ Jungbunzlauer Ladenburg GmbH

² University of La Rioja, Department of Food and Agriculture

Abstract

Bacillus velezensis and *Trichoderma harzianum* are relevant microorganisms used in viticulture as biocontrol agents against pathogens of trunk (e.g. *Phaeoacremonium minimum*), leaves (e.g. *Plasmopara viticola*) or fruit (e.g. *Botrytis cinerea*), or as biostimulants, improving the resilience of plants against biotic or abiotic stressors through different direct and non-direct interactions.

In this biotechnological approach, formulation plays a crucial role. Controlling water activity in the product, thus stabilising microbial viability is key to ensuring effective application. We present the benefits of the citrate ester CITROFOL® AI (triethyl citrate) as a novel bio-based carrier liquid in microbial formulations. CITROFOL® AI is safe for humans and the environment, thus offering a promising base for sustainable treatments in viticulture.

Commercial products containing *B. velezensis* and *T. harzianum* formulated as wettable powders (WP) or suspension concentrates (SC) were used for viability tests and compared with the same microorganisms prepared as dispersion concentrates (DC) 1:10 ration in CITROFOL® AI. The formulations were subjected to a demanding storage test at 40°C for 24 weeks. Microbial viability was monitored by plate counting periodically.

B. velezensis showed a high overall robustness during storage. However, comparing liquid products, the cell viability in the SC formulation declined by approximately one order of magnitude more than in the DC formulation in CITROFOL® AI. *T. harzianum* generally was highly susceptible during storage. However, the cell viability after 24 weeks was two orders of magnitude higher when formulated as DC in CITROFOL® AI compared to the WP. Thus, CITROFOL® AI improved the shelf life of both microorganisms tested.

Keywords: Formulation; Viticulture; Citrate ester; Biocontrol; Biostimulant