Title Control of postharvest diseases on citrus fruit by preharvest application of the biocontrol agent *Pantoea agglomerans* CPA-2 Part I. Study of different formulation strategies to improve survival of cells in unfavourable environmental conditions

Author Teresa Paula Cañamás, Immaculada Viñas, Josep Usall, Carla Casals, Cristina Solsona and Neus Teixidó

Citation Postharvest Biology and Technology, Volume 49, Issue 1, July 2008, Pages 86-95

Keywords Citrus decay; Additive; Formulation; Osmotic adaptation; Postharvest decay; Biocontrol; *Penicillium digitatum*; *Penicillium italicum*; Food Coat; Fungicover

Abstract

The objective in the present study was to investigate the survival and effectiveness of different biological agent *Pantoea agglomerans* formulations against *Penicillium* spp. with different preharvest treatments. Results indicated a high sensitivity of non-adapted and osmotic-adapted *P. agglomerans* cells to environmental conditions in the field, resulting in preharvest treatments which were ineffective against *Penicillium* spp. In the second part of this study, dry conditions and solar radiation were identified as important environmental conditions that seriously affect populations of *P. agglomerans* cells. Different formulation strategies were tested in order to improve the resistance of cells to unfavourable environmental conditions. Osmotic-adapted *P. agglomerans* cells in the presence of 25 g L^{-1} of NaCl in the production medium [osmotic-adapted treatment (P25)] or at water activities (a_w) of 0.98 [osmotic-adapted treatment (P98)] had higher survival rates than non-adapted cells, when these cells were sprayed on oranges and stored in hermetically sealed chambers at a low RH of 43%. Among seven additives tested, the presence of 5% Fungicover in the bacterial suspension improved adherence and persistence of *P. agglomerans* cells on oranges exposed to unfavourable conditions. Therefore, while *P. agglomerans* cells sprayed alone had log values of 0.5 CFU cm^{-2}, in combination with Fungicover the population level of *P. agglomerans* cells reached log values of 5 and 4.2 CFU cm^{-2}, at 0 and 24 h after application. Lyophilised cells showed greater resistance to unfavourable environmental conditions than fresh cells. The present study has demonstrated that the formulation improvement can provide better performance of biocontrol agents under environmental conditions non-conducive for growth and survival.