

Title Biological and integrated control of postharvest blue mold (*Penicillium expansum*) of apples by *Pseudomonas syringae* and cyprodinil

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### Abstract

In an attempt to develop fungicide (thiabendazole)-resistance management strategies, experiments were carried out to determine if the control of blue mold (*Penicillium expansum*) in 'Empire' and 'McIntosh' apples could be achieved by a biocontrol agent, *Pseudomonas syringae* and enhanced by integrating a biocontrol agent and a reduced-risk fungicide, cyprodinil, in a cold storage, and in a subsequent shelf-life study. The *Ps. syringae* at a concentration of  $1.4 \times 10^8$  CFU ml<sup>-1</sup>, or cyprodinil at a concentration of 20 µg ml<sup>-1</sup> were effective against blue mold caused by thiabendazole (fungicide)-sensitive and -resistant *P. expansum* in cold storage for 30 days and in the subsequent shelf-life study at 20 °C for 6 days in 'Empire' and 'McIntosh' apples. Cyprodinil was effective in both the co-treatment, where fungicide or biocontrol agent and pathogen inoculum were applied together, and the post-inoculation treatment, where fungicide or biocontrol agent applied 20 h after inoculation. *Ps. syringae* was more effective as a co-treatment than as a post-inoculation treatment. All of the eight combinations, two concentrations of the biocontrol agent ( $3.0 \times 10^7$  and  $6.0 \times 10^7$  CFU ml<sup>-1</sup>) and four concentrations of the fungicide (5, 10, 20, and 40 µg ml<sup>-1</sup>) were more effective than either the *Ps. syringae* or cyprodinil alone on blue mold caused by the isolates of *P. expansum* collected from Ontario. Integrated control was efficient in controlling blue mold of apple and could be considered for disease control strategies to manage thiabendazole-resistant *P. expansum* and also for reducing fungicide residues on fruit.