# Biological control of postharvest diseases: hurdles, successes and prospects

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Acta Horticulturae 1001: 273-283. 2013.

## Abstract

Research has accelerated recently on biological control of postharvest diseases and has resulted in the development of several commercial products for controlling decays of temperate and subtropical fruits. The demand for alternatives to synthetic fungicides is much greater than the supply provided by these new technologies, including biological control. The development of a postharvest disease biocontrol product is a lengthy process involving many steps. The need for alternatives to synthetic fungicides and opportunities for biological control under controlled environmental conditions in storage have been the driving forces for research in this area. Research around the world has proven the effectiveness of biological control of postharvest diseases and, at the same time, identified its limitations. Many of these limitations result from knowledge gaps that can be addressed by additional research to better understand the mechanisms of biocontrol on fruit, microbial ecology of the fruit surfaces, and the survival of antagonists under adverse conditions. Additional research is also needed to prolong the shelf life of antagonists, determine the compatibility of biocontrol with other alternative treatments, and adapt biocontrol to various postharvest handling practices, and to new production technologies, such as mechanical harvesting, that may predispose fruit to decay. The greater use of biological control of postharvest diseases can be achieved by expanding the application of available products to new commodities and different pathogens. The products currently available were developed to control decays originating from wound infections; however, significant postharvest losses on various fruits may also occur from decays originating from latent infections that develop before harvest. Controlling these decays has become the new frontier for biological control. New approaches utilizing natural fruit wax and artificial membranes were developed to find antagonists effective in controlling latent infections under laboratory

conditions. The high cost of tests required for registration prohibited the commercial development of several effective biocontrol agents. A new framework is needed for streamlining the registration of low risk biocontrol agents without known deleterious effects to human health. This is especially relevant for those agents that are consumed with foods in large quantities (e.g., in apple cider, fruit juices, or with various cultured food products (probiotics)). Biological control of postharvest diseases has been accepted by the fruit industry as a viable alternative to synthetic fungicides, and products registered in the United States can be used on organically-labeled fruit.