

Abstract

Alternative control agents, including UV-type C (254 nm) irradiation, yeasts antagonistic to fungal growth, chitosan and harpin, were evaluated for their ability to induce resistance in cv. Red Delicious apple fruit against postharvest blue mold caused by *Penicillium expansum*. Freshly harvested and controlled atmosphere (CA)-stored fruit were treated with these agents at different doses and concentrations or with paired combinations of the agents. Treated fruit were inoculated with *P. expansum* 24, 48, or 96 h following treatment, and stored at 24°C in the dark. The fruit were evaluated for development of disease every 2 days for 14 days by measuring the diameter of lesions that formed. The area under the disease progress curve (AUDPC) was calculated and analyzed statistically. All treatments were effective in reducing the AUDPC; UV-C was most effective, followed by harpin, chitosan, and the yeasts, respectively. Regardless of treatment, fresh fruit were more responsive to treatments than CA-stored fruit. There was a clear time-dependent response of the fruit to the treatments, in which treatments applied 96 h before inoculation provided the best results. In a few situations, the combinations of agents did provide an additive effect, but no synergistic effects were detected. Moreover, disease severity in fruit treated by any combination was markedly better than that in the controls. Although the combinations of treatments was overall less effective than the single treatments, they did provide significant reductions of the progress of disease in comparison with the controls. Because the fungus did not come into contact with any of the control agents, this study showed conclusively that the agents studied were able to induce resistance in the fruit rather than merely inhibit the pathogen directly. It also showed, for the first time, that harpin is able to induce resistance in harvested apple fruit. The use of these control agents may minimize the costs of control strategies and reduce the risks associated with the excessive use of fungicides in harvested apple fruit.