

Title Boron improves the biocontrol activity of *Cryptococcus laurentii* against *Penicillium expansum* in jujube fruit

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Abstract

Boron in the form of potassium tetraborate was effective for control of blue mold rot caused by *Penicillium expansum* in jujube fruit. The control activity was positively correlated with the concentration of boron solution. Boron at 0.5% enhanced the biocontrol efficacy of the antagonistic yeast *Cryptococcus laurentii* against *P. expansum*. Analysis of population dynamics demonstrated that growth of *C. laurentii* was not significantly influenced by boron in the fruit wounds. *C. laurentii* multiplied quickly, regardless of whether the yeast was used alone or combined with boron. An *in vitro* study showed that boron at 0.25% even stimulated the growth of *C. laurentii* at the end of incubation period. By comparison, mycelial spread of *P. expansum* in the culture medium was completely inhibited by boron at 0.25%. Using the fluorescent probe rhodamine 123, we found that the mitochondrial membrane potential collapsed significantly after boron treatment. This indicated that boron inhibited the growth of *P. expansum* by targeting the mitochondria of the fungal pathogen. Taken together, our data suggest that the enhancement in biocontrol efficacy of *C. laurentii* may be related to the differential influence of boron on the antagonistic yeast and the fungal pathogen.