

Chemosensitization of *Fusarium graminearum* to Chemical Fungicides Using Cyclic Lipopeptides Produced by *Bacillus amyloliquefaciens* Strain JCK-12

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Fusarium head blight (FHB) caused by infection with *Fusarium graminearum* leads to enormous losses to crop growers, and may contaminate grains with a number of *Fusarium* mycotoxins that pose serious risks to human and animal health. Antagonistic bacteria that are used to prevent FHB offer attractive alternatives or supplements to synthetic fungicides for controlling FHB without the negative effects of chemical management. Out of 500 bacterial strains isolated from soil, *Bacillus amyloliquefaciens* JCK-12 showed strong antifungal activity and was considered a potential source for control strategies to reduce FHB. *B. amyloliquefaciens* JCK-12 produces several cyclic lipopeptides (CLPs) including iturin A, fengycin, and surfactin. Iturin A inhibits spore germination of *F. graminearum*. Fengycin or surfactin alone did not display any inhibitory activity against spore germination at concentrations less than 30 µg/ml, but a mixture of iturin A, fengycin, and surfactin showed a remarkable synergistic inhibitory effect on *F. graminearum* spore germination. The fermentation broth and formulation of *B. amyloliquefaciens* JCK-12 strain reduced the disease incidence of FHB in wheat. Furthermore, co-application of *B. amyloliquefaciens* JCK-12 and chemical fungicides resulted in synergistic *in vitro* antifungal effects and significant disease control efficacy against FHB under greenhouse and field conditions, suggesting that *B. amyloliquefaciens* JCK-12 has a strong chemosensitizing effect. The synergistic antifungal effect of *B. amyloliquefaciens* JCK-12 and chemical fungicides in combination may result from the cell wall damage and altered cell membrane permeability in the phytopathogenic fungi caused by the CLP mixtures and subsequent increased sensitivity of *F. graminearum* to fungicides. In addition, *B. amyloliquefaciens* JCK-12 showed the potential to reduce trichothecenes mycotoxin production. The results of this study indicate that *B. amyloliquefaciens* JCK-12 could be used as an available biocontrol agent or as a chemosensitizer to chemical fungicides for controlling FHB disease and as a strategy for preventing the contamination of harvested crops with mycotoxins.