

Title Induction of systemic resistance by mixtures of antagonist bacteria for the management of crown rot complex on banana

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Abstract

Among nine native bacterial strains isolated from banana fruit surface and rhizosphere and six bacterial strains introduced from the culture collection, three native strains viz., non-fluorescent *Pseudomonas* (NFP₆), *Pseudomonas fluorescens* (Pf3a), and *Bacillus subtilis* (BS₁); and two bacterial strains from culture collection viz., *Azospirillum* (AS1) and *Azotobacter* (AZ1) have recorded maximum inhibition of mycelial growth of crown rot pathogens (*Lasiodiplodia theobromae* and *Colletotrichum musae*) under in vitro condition. When these effective bacterial strains were treated on banana fruits under in vivo, significant reduction of crown rot disease and increased shelf life of banana was observed. However, bacterial strains applied as three way combinations (NFP₆ + Pf3a + BS₁) had greater effect compared with individual and two way combination of bacterial antagonist treatments. The effect of crown rot disease reduction was also comparable to that of fungicide Benomyl (0.1%) both under cold and room temperature storage conditions. Besides, the induction of defense-related enzymes such as phenylalanine ammonia-lyase (PAL), peroxidase (PO), polyphenoloxidase (PPO), and the accumulation of phenolics in banana fruit due to the application of bacterial antagonists were also studied at five different time intervals viz. 0th, 1st, 3rd, 5th and 7th days after treatment. When banana fruits treated with bacterial antagonists (individually and also in different combinations) and challenge-inoculated with crown rot pathogens, up to fourfold increase in defense-related enzymes and 3.6 fold increase in phenolic content was observed compared with control. The activity of these defense-related enzymes and phenolic content had gradually increased from 1st day after treatment to 3rd after treatment and reached their peak on 5th day after treatment. Among the bacterial antagonists which have been applied individually and in different combinations, the banana fruits treated with three-way antagonist mixture, i.e., NFP₆ + Pf3a + BS₁ recorded maximum induction of defense-related enzymes and accumulation of phenolics compared with individual and two-way combination of antagonist mixtures. This study suggest that the increased induction of defense-related enzymes and phenolic content due to the treatment of

banana fruits with bacterial antagonists might have involved in the reduction of crown rot severity and in turn increased the shelf life of banana fruits.

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