

## ABSTRACT

Innovative Strategies for the Sustainable Management of Rice Blast (*Pyricularia oryzae* Cav.) and Sheath Blight (*Rhizoctonia solani* Kühn) Diseases in Guyana

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The study was carried out in Guyana (i) to identify blast resistant germplasm and mechanisms of resistance (ii) to identify resistant and slow blighting genotypes for sheath blight and (iii) to study the efficacy of botanicals, bioagents and new generation fungicides against blast and sheath blight (SB) diseases. Of 103 rice germplasm lines, 11 showed highly resistant to resistant reactions to blast. Genotype FL-127 consistently expressed high blast resistance. Additive Main Effects and Multiplicative Interaction (AMMI) analysis revealed that genotype main effect strongly influenced the resistance than the environment. Study of differential expression of proteins in resistant (FL127) and susceptible (Rustic) genotypes revealed the up-regulation of proteins related to defense, stress, transcription and photosynthesis in FL 127. Of the 101 genotypes evaluated against SB, genotypes FG12-56 and GR1631-35-16-1-2-1-1 recorded immune to resistant reactions, consistently. Twelve genotypes exhibited very resistant to resistant reactions. Of these, 13 and 11 genotypes showed slow blight development and low apparent rate of disease development, respectively. The AMMI analysis showed that genotypes main effect and genotype by environment (GxE) interactions were almost equal. This revealed that GxE interactions influence the resistance. The botanicals, bioagents and new generation fungicides were evaluated against blast and SB. The extracts of Black sage at 10%, Bael at 15% and Madar plant at 5% reduced blast infection in field experiments; Likewise Lemon grass and Thick leaf thyme at 15% reduced SB under greenhouse and field conditions. The bioagent, *Bacillus cereus* OG2L and *B. subtilis* OG2A significantly reduced blast; while *B. cereus* OG2L effectively reduced SB. The new generation fungicides, Antracol 70WP and Nativo 75 WG, showed superior control against blast; while the same fungicides along with Serenade 1.34 SC effectively reduced SB. The treatments found to be effective in disease control also showed positive influence on growth and yield of rice.

Keywords: rice disease management; blast; sheath blight; resistant; AMMI; 2-D DIGE; MALDI-TOF (MS); plant products; bioagents; new generation fungicides.