Development of Biological Nitrogen-Fixing Maize Lines with Improved Fall Armyworm Tolerance

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Abstract:

Objective: Maize is Zimbabwe's most important cereal crop, serving as a staple food for human consumption and a major component of livestock feed. However, maize production is constrained by the high cost of nitrogen fertilisers and substantial yield losses caused by fall armyworm (*Spodoptera frugiperda*). This study aims to develop a methodology for improving early-maturing maize landraces with enhanced biological nitrogen-fixing potential and tolerance to fall armyworm, thereby reducing production costs and improving resilience under climate-stressed conditions.

Methodology: The research involves the isolation and characterization of indigenous Bacillus *thuringiensis (Bt)* strains and the identification of vegetative insecticidal protein (Vip) genes with activity against fall armyworm. In parallel, maize landrace germplasm will be screened to identify elite, early-maturing lines with biological nitrogen-fixing potential and desirable agronomic characteristics. Candidate genes will subsequently be assembled and introduced into selected maize backgrounds using Gateway® cloning technology to facilitate the efficient construction of gene-expression vectors.

Expected Results: The study is expected to identify early-maturing maize lines with enhanced biological nitrogen-fixing potential and improved tolerance to fall armyworm.

Relevance and Conclusion: The overall goal is to contribute to the development of high-performing, climate-smart maize lines that require reduced dependence on synthetic nitrogen fertilisers and provide improved protection against fall armyworm. The resulting technologies could contribute to lower production costs, enhanced maize productivity, improved food and feed security, and more sustainable maize production in Zimbabwe.

Keywords:

Fall armyworm, *Spodoptera frugiperda,* biological nitrogen fixation, Bacillus *thuringiensis* (Bt), Vip proteins, Gateway® cloning, climate-smart agriculture, maize, yellow maize.