Photodynamic Inactivation of *Pseudomonas syringae* pv. *tabaci* in Greenhouse Conditions

Geovanna Zaro[1], Maidah Qadar[1], Jun Liu [2], Michael Fefer [2], Lisa Steele [2], Katerina Serlemitsos Jordan[1]

[1]University of Guelph, Plant Agriculture; [2]Nutrien Ag Solutions, gzaro@uoguelph.com

Introduction

Antimicrobial resistance in plant pathogenic bacteria, driven by the excessive use of copper and antibiotics, highlights the need for sustainable pathogen control alternatives. Photodynamic inactivation (PDI) has emerged as a promising solution. LPI-6786, a PDI agent, utilizes magnesium chlorophyll (MgChln), a chlorophyll derivative that generates singlet oxygen under light exposure, to effectively kill-pathogens.

Pseudomonas syringae, a major bacterial pathogen affecting a wide range of crops, poses significant challenges to plant health. This study aims to evaluate the effectiveness of LPI-6786 in controlling *Pseudomonas syringae* pv. *tabaci* on *Nicotiana benthamiana* under greenhouse conditions.

Materials & Methods

- This study was conducted at the University of Guelph, Ontario, using *Nicotiana benthamiana* as a model host. Plants were grown under controlled greenhouse conditions until they developed 5–8 leaves.

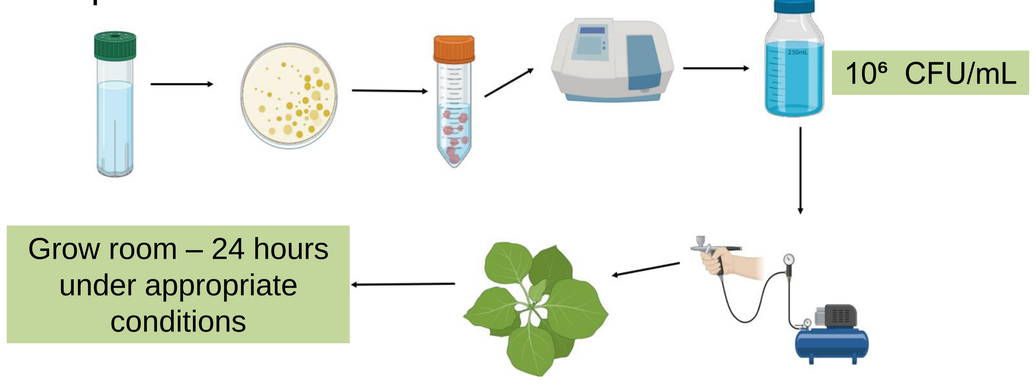

Figure 1. Inoculation of *Pseudomonas syringae* pv. *tabaci*.

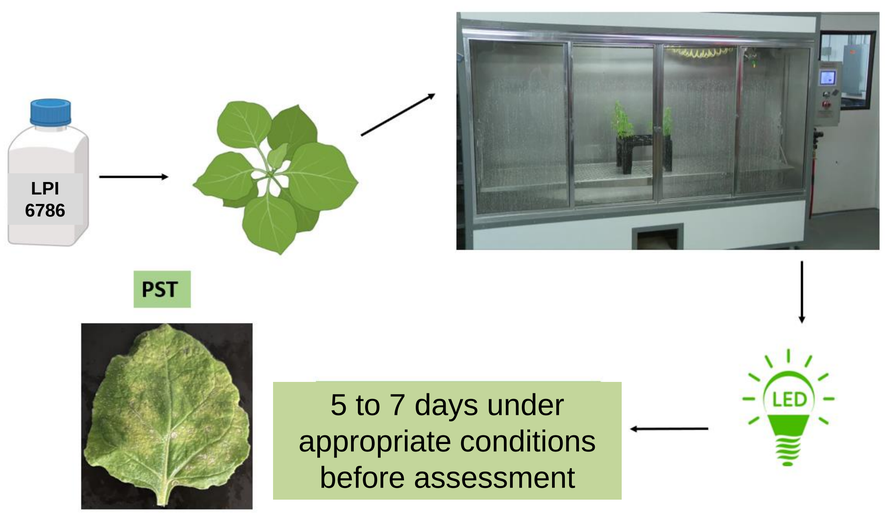

Figure 2. Treatment application.

- The severity of *Pseudomonas* lesions was visually evaluated, measuring the % of the affected area on the entire plant, with ratings ranging from 0 to 100%. Disease symptoms included yellow and brown lesions, foliar discoloration, and leaf deformities.

- The experiment followed a completely randomized design. Data were analyzed using analysis of variance (ANOVA) to assess the significance of treatment effects.

Results

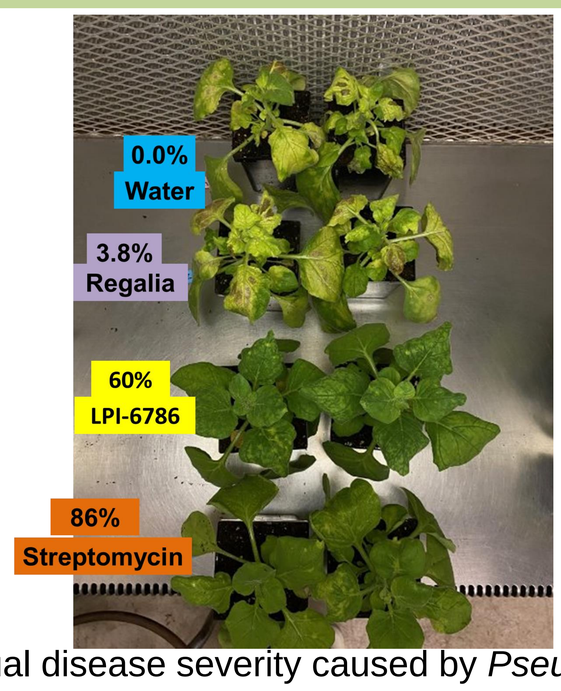

Figure 3: Visual disease severity caused by *Pseudomonas syringae* pv. *tabaci*.

The disease severity (Fig. 3) varied among the different treatments, which included water (negative control), 0.11% LPI-6786, 0.22% LPI-6786, 0.25% Regalia, and 0.06% Streptomycin (positive control). The treatments with 0.11% LPI-6786, 0.22% LPI-6786, and 0.06% Streptomycin showed a statistically significant reduction in disease area compared to the water and 0.25% Regalia treatments ($p < 0.05$). However, there were no significant differences in disease reduction between the two concentrations of LPI-6786, although both differed significantly from Streptomycin.

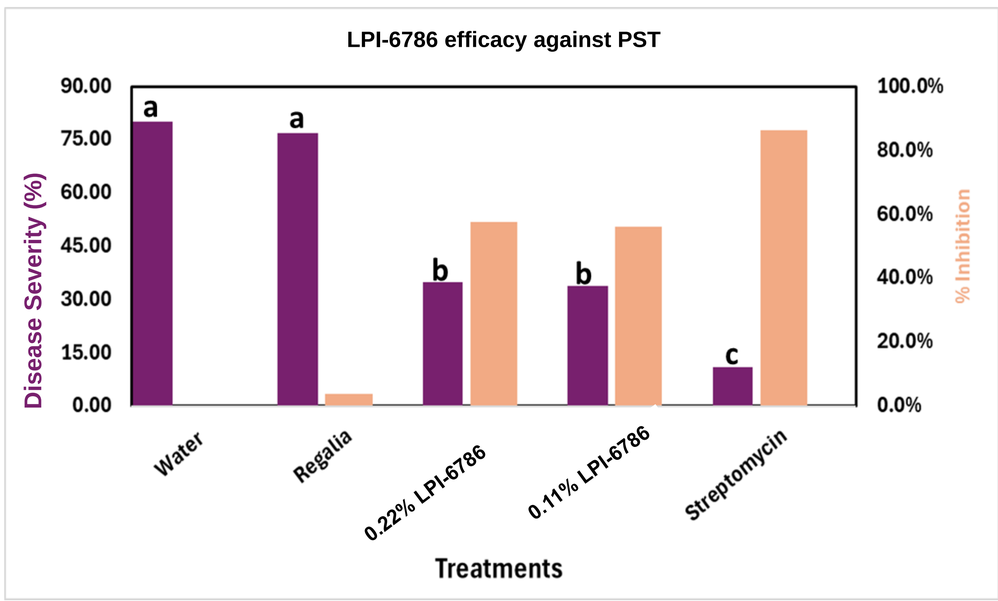

Figure 4: Effect of treatments on disease severity (%) and percent inhibition. Letters represent differences in disease severity following Tukey HSD at α = 0.05. No statistical analysis was performed for percent inhibition.

Conclusion

LPI-6786 at both 0.11% and 0.22% concentrations showed greater reduction in disease severity compared to Regalia and water controls. Although disease reduction was not as great as with streptomycin, the experimental product could be safer to use and reduce the risk of antibiotic resistance. These findings highlight LPI-6786 as a promising alternative for disease management in crop protection.