

The rainfastness of photodynamic inactivation products against *Colletotrichum orbiculare*

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INTRODUCTION

- Plant pathogens and other pests account for a 17-30% loss in crop yield globally.
- Anthracoze is a devastating plant disease caused by pathogens such as the fungus *Colletotrichum orbiculare*.
- Currently, copper-based pesticides and antifungals are used to combat *Colletotrichum* infections; however, these strategies can have harmful effects such as chemical runoff and the development of antifungal resistance. Therefore, new management strategies are needed.
- Antimicrobial Photodynamic Inactivation (aPDI) is a promising pathogen management strategy that is shown to be effective against various pathogens.
- LPI-6786 is a newly developed aPDI product that utilizes photosensitizer Magnesium Chlorophyllin (MgChln), a chlorophyll derivative that generates singlet oxygen that when exposed to light kill pathogens.
- Rainfall is a critical environmental factor to consider when assessing product efficacy. In this study, the rainfastness of new aPDI product, LPI-6786, is assessed.

OBJECTIVE

The primary objective of this study was to investigate the rainfastness of new aPDI product, LPI-6786 at 3, 7 and 24 hours after product application.

METHODS

Nicotiana benthamiana plants were used as a model host in this study and were grown to the 5-8 leaves stage under greenhouse conditions at the University of Guelph.

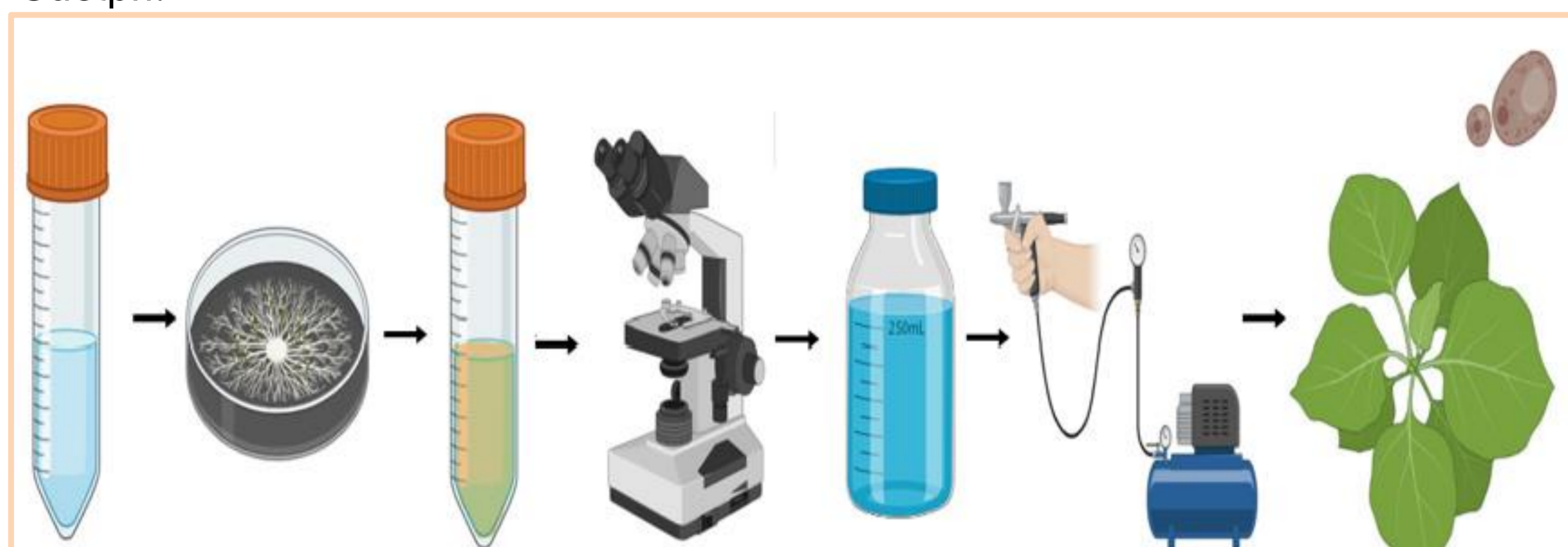


Figure 1: *Nicotiana benthamiana* inoculation with *C. orbiculare*: Plants were inoculated with *C. orbiculare* using a hand sprayer 24 hours before product applications.

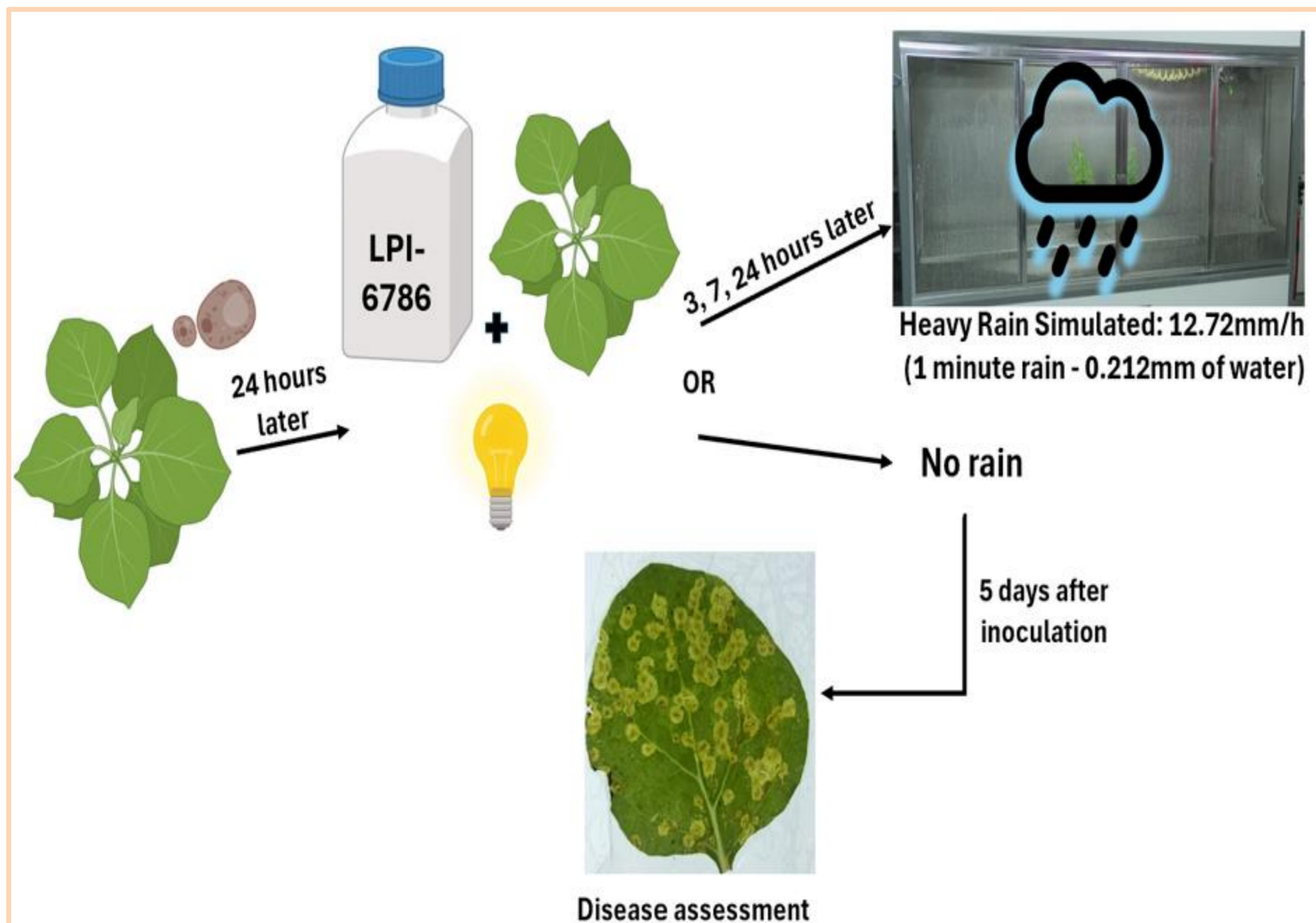


Figure 2: Rainfastness trial methods: Varying concentrations of LPI-6786 were applied to inoculated plants using a foliar spray. Plants were then subjected to the equivalent of heavy rainfall at 3, 7 and 24 hours after product application and then exposed to light. 5 days later, the infection was quantified by counting visible lesions and the number of lesions per cm² of the leaf area was assessed using ImageJ.

Treatments included water (negative control), 0.11% LPI-6786, 0.22% LPI-6786, and 0.5% Cueva (positive control).

RESULTS

Disease incidence (Lesions/cm²): Effect of rainfall on efficacy of LPI-6786 on anthracnose

- No rain:** All LPI-6786 treatments demonstrated significantly lower disease rate than the negative water control (Figure 3).
- Rain 3, 7 and 24 hours after product application:** Both LPI-6786 concentrations (0.11% and 0.22%) remained statistically more effective than water in reducing disease lesion area ($p < 0.05$). LPI-6786 treatments also showed significant improvements in efficacy compared to 0.5% Cueva, with Cueva treatments having no statistically significant differences from the water control at rainfall 3 and 24 hours after product application.

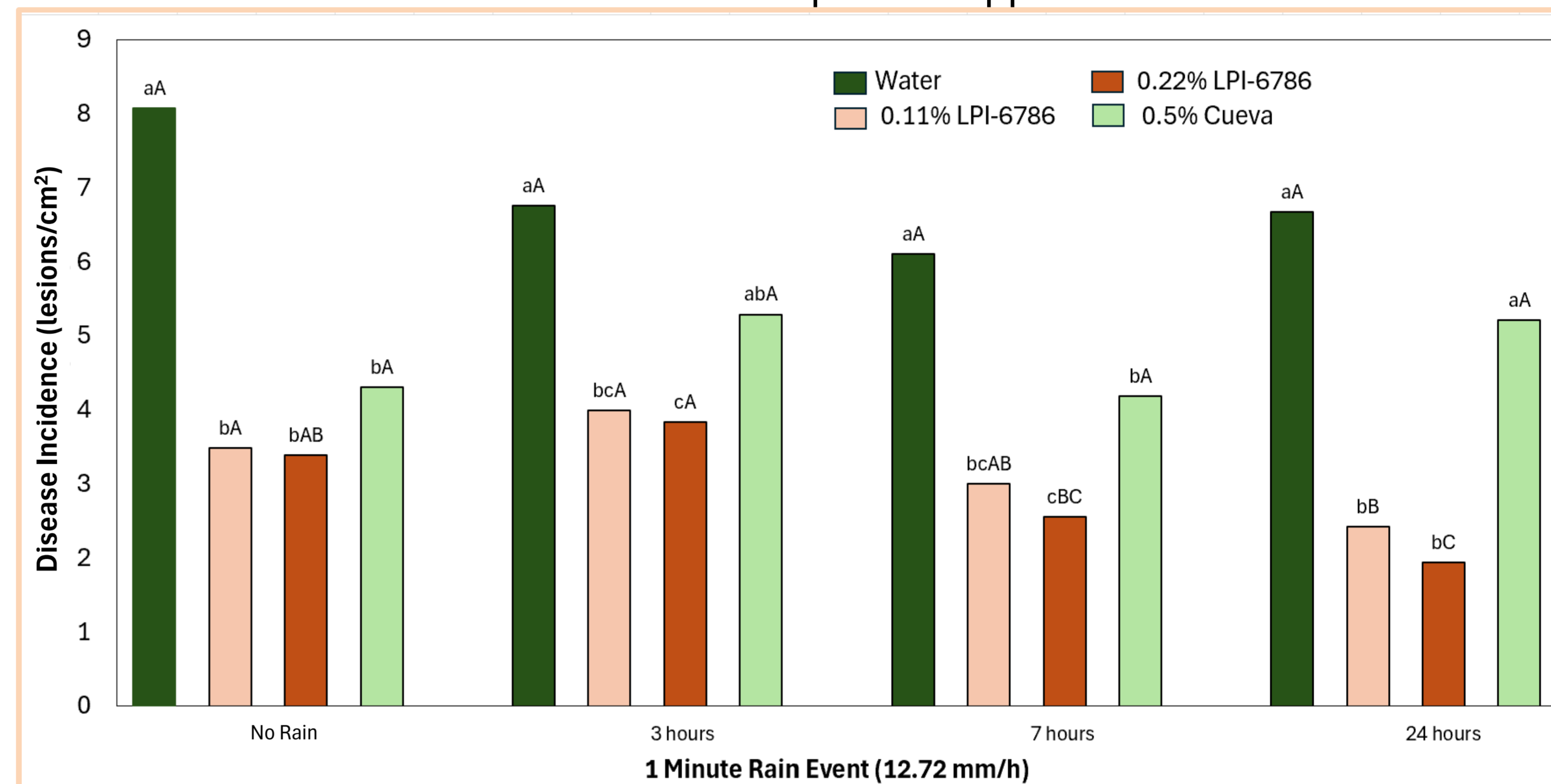


Figure 3: Effect of simulated rainfall on the efficacy of LPI-6786 in controlling anthracnose in *Nicotiana benthamiana*. Letters represent treatment differences following Tukey HSD at $p < 0.05$ with upper case letters comparing the same treatment between the different groups and lower-case letters representing the difference between treatments within the same group.

- Visual disease severity:** The group subjected to a simulated rainfall event 3 hours after LPI-6786 application exhibited a slightly higher severity of disease compared to the group with no rainfall (Figure 4).
- Based on these observations, LPI-6786 protects against disease development 3, 7 and 24 hours after rainfall with results showing better effectiveness when simulated rain occurs at least 7 hours after product application.
- We recommend applying LPI-6786 at least 7 hours prior to anticipated rainfall to maximize efficacy.

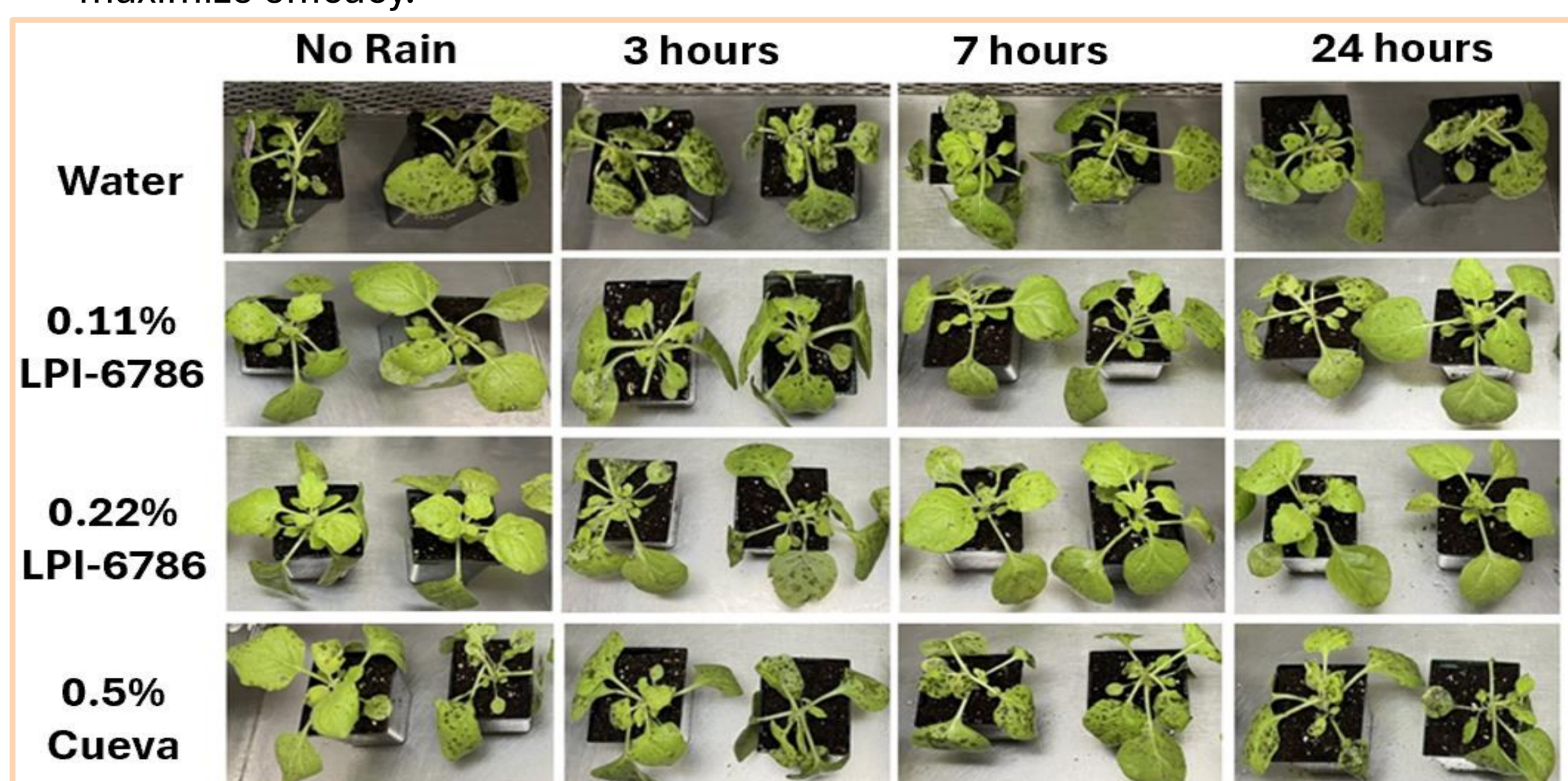


Figure 4: The severity of anthracnose disease in *Nicotiana benthamiana* after simulated rainfall following treatment applications

CONCLUSION

LPI-6786, at both concentrations tested, provides protection against anthracnose disease even under rainfall conditions. The product showed higher efficacy than the water negative control with or without rainfall and also than the positive control, Cueva, following simulated rain for both 7 and 24 hours after product application. These results show that LPI-6786 is a promising product for plant disease management.