The potential of rhizosphere and phyllosphere *Pseudomonas* sp. for potato late blight control

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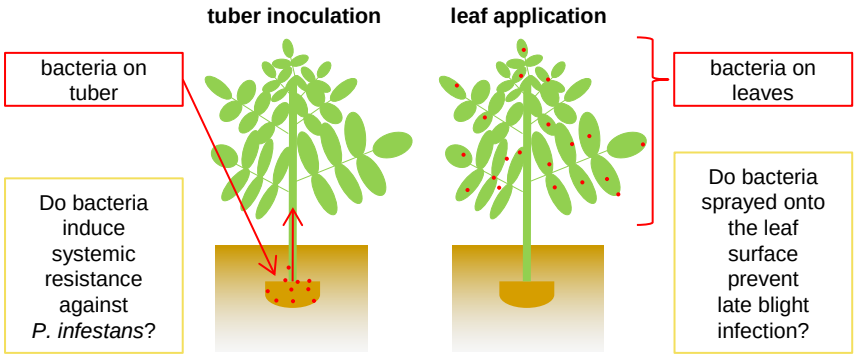
Background

The oomycete *Phytophthora infestans*, causing potato late blight, is a phytopathogen of major importance in potato production. In organic production, the oomycete is usually controlled by the application of copper products, which negatively impact the environment. In order to substitute or at least reduce the amount of applied copper, bacterial strains that are naturally associated with potato plants could potentially serve as biocontrol agents.

The aim of the study was the development of methods and the realization of experiments to…
- … assess the influence of rhizosphere (R) and phyllosphere (S) bacteria on potato plant development **(1)**
- … study the survival of bacteria applied onto the leaf surface **(2)**
- … investigate the protection potential of *Pseudomonas* strains on potato plants for late blight control **(3)**

Design of the study



Methods

Greenhouse experiment with two potato cultivars (Charlotte and Victoria) and six bacterial strains*

Microplot experiment with two potato cultivars (Agria and Nicola) and four bacterial strains*

The following measurements were conducted:
- Monitoring of the potato BBCH growth stages
- Recovery of bacterial colonies on the leaf surface
- Artificial inoculation of leaf material with *P. infestans* and monitoring of disease development

* Bacterial strains were selected based on promising results obtained in *in vitro* and detached leaf experiments.

Results

(1) No phytotoxic effect on potato plants
Plant growth and development were not significantly affected by the inoculation of the tubers with bacterial strains.

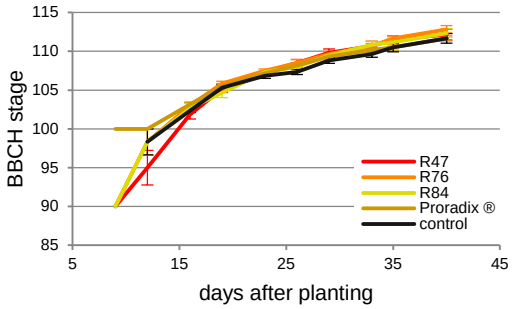


Figure 1 BBCH growth stages of Agria potato plants grown in the greenhouse. The tubers were treated with bacterial suspensions (OD=0.5) (s.e.m, n=6).

(2) Bacteria survive on leaf surface
The bacterial population density decreases within the first three days after spraying and then remains constant.

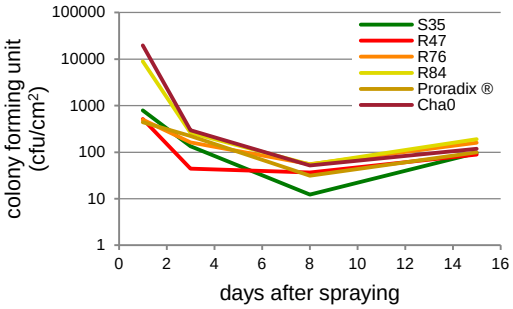
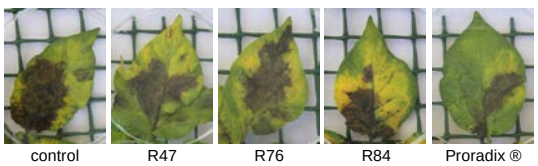


Figure 2 Bacterial population density on previously sprayed Victoria potato leaves (OD=1) (n=6).

(3) Potato leaves, collected from a microplot field experiment sprayed with four *Pseudomonas* strains, showed a tendency to decrease the infection area compared with the control plants treated with 0.9% NaCl.



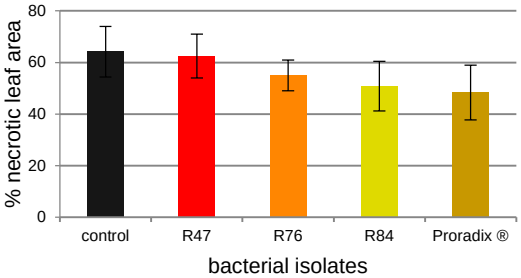


Figure 3 (top) Infection five days after infection with *P. infestans*.
Figure 4 (right) Bacterial effect on the infection of Agria leaves 7 days after artificial inoculation with *P. infestans*. Differences presented here are not statistically significant (s.e.m, n=6).

Development of a leaf disc method to monitor the infection:

Plant tissue necrosis and sporangiophore development can be monitored by automated image analysis.

Summary

The application of bacterial cultures on potato tubers did not lead to any phytotoxic effect. Bacteria, sprayed onto the leaves, could be recovered after two weeks.

Outlook

Further development of the leaf disc assay to evaluate the inhibitory effect of candidate strains on potato late blight.
Testing the four candidate strains for potato late blight inhibition on leaf discs.

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