Proposal title:

Integrated models to control potato early blight caused by *Alternaria solani*

Target level: MSc students

Student name: Jala Hama

Introduction

Potato early blight (PEB) a common disease on potato caused by *Alternaria solani* Sorauer, is found throughout the world. It is one of the major foliar diseases of potatoes that causes losses ranging from 5 to 50 %. Like other plant leaf diseases, it typically targets less productive and older foliage first, followed by steady movement upwards in the plant canopy causing leave senescence. Visible symptoms of this disease include small 1–2 mm black or brown lesions, at early stages, turning into dark pigmented concentric rings under conducive environmental conditions, at mature stages of the disease. Application of fungicides is considered to be the most suitable method to manage early blight as reported by several workers. However, the fungicides cannot be considered as a long-term solution, due to concerns of expense, exposure risks and the hazards of its residues. Moreover, the development of resistance of pathogenic fungi towards synthetic pesticides is a great problem that can significantly affect the efficacy of chemical fungicides. A successful disease control program could involve just a single practice, but the long term reduction of disease losses generally requires the application of several control measures. The best way to ensure success of a disease management program is to use integrated disease management measures

Aims

1. Explore disease incidence, severity, and distribution
2. Evaluation the importance of early detection of the disease with PCR, pre-symptomatic detection.
3. In vitro evaluation of components of integrated control

4. In planta evaluation of integrated models that incorporate potato cultivar susceptibility, fungicide schedules, disease threshold, fertilizer inputs and date of sowing.

Methods

- Sampling-disease and distribution

  Samples will be collected from different potato growing areas. The samples are taken to know disease incidence and severity and the distribution of the disease in different growing regions.

- Isolation and identification of pathogens

  Suspected samples will take to the lab to isolate the pathogen and identify them depending on cultural and microscopic characteristics and conclude with the aid of PCR to eliminate the species of the pathogen.

- Pathogenicity tests

  This to screen the cultivated potato in the region and to know the susceptibility of the cultivars. This also helps to choose the resistant cultivars and incorporate it into integrated models.

- In vitro control tests

  o Fungicide evaluations

  The selected fungicides will be evaluated in culture and then, depending on the results, will be incorporated in the integrated programs.

  o Bioagent evaluations

  Fungal and/or bacterial bioagets will be evaluated in culture against the pathogen and then, depending on the results, will be incorporated in the integrated programs.

- In planta control tests-IDM models

  The models proposed will combine TWO or more of the following factors:

1. Cultivar resistance
2. Disease threshold
3. Plant age-plant maturity
4. Fungicide schedule
5. Fertilizer input
6. Mycorrhiza input
7. Bioagent

o **Model 1:** Integration cultivar resistance with fungicide schedule

The five fungicide treatments include: a 7-day schedule initiated after 50% flowering; a nonsprayed control; and three FAST (Forecaster of *Alternaria solani* on Tomatoes) application schedules based on combinations of critical levels of cumulative severity (CS, the disease severity values as a function of leaf wetness and temperature) and cumulative rating (CR, the disease rating values as a function of average temperature and hours of relative humidity greater than 90%) values.

o **Model 2:** (disease-threshold-based model): Model 1 combined with disease-threshold

This will be based on disease progress. It is the integration of cultivar resistance with PEB thresholds. One selected cultivar with different disease thresholds based on an evaluation scales.

o Integrating date of sowing with other methods

o Integrating disease threshold with fungicide schedules

o **Model 3** (fungicide-free model):

Incorporation of fertilizer, mycorrhiza, and resistant cultivar

- o **Model 4** (time of disease detection model):

  Integrating disease detection time (early detection using PCR, and at visibility of symptoms) with other methods

References

1- Stevenson, W., Loria, R., Franc, G.D. and Weingartner, D.P., 2001. Compendium of potato diseases, 2nd editio edn. *American Phytopathological Society Press, St Paul, USA*.

2- Dahmen, H. and Staub, T., 1992. Protective, curative, and eradicant activity of difenoconazole against Venturia inaequalis, Cercospora arachidicola, and Alternaria solani. *Plant disease (USA)*.

3- Hammerschmidt R, Douches DS (2005). Evaluation of potato late blight management utilizing host plant resistance and reduced rates and frequencies of fungicides applications. Crop Protection, 24:961-970.