Agricultural pest and disease forecasting under future climate conditions

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Background

Climate change will directly affect agricultural cropping systems by increased temperature and altered precipitation, and indirectly by increased pest and disease outbreaks. Knowledge of the future plant and pest situation in Switzerland is important for sustainable plant protection strategies and effective adaptations.

Fig. 2: Codling moth larvae (left), fire blight symptoms (right)

Project plan

Presently, pest and disease models are used to predict the infestation depending on actual weather conditions. Assessing the future risk of pest-related damages requires downscaling of climate predictions to produce weather data at high temporal and spatial resolution and knowledge on pest and disease biology (Fig. 1).

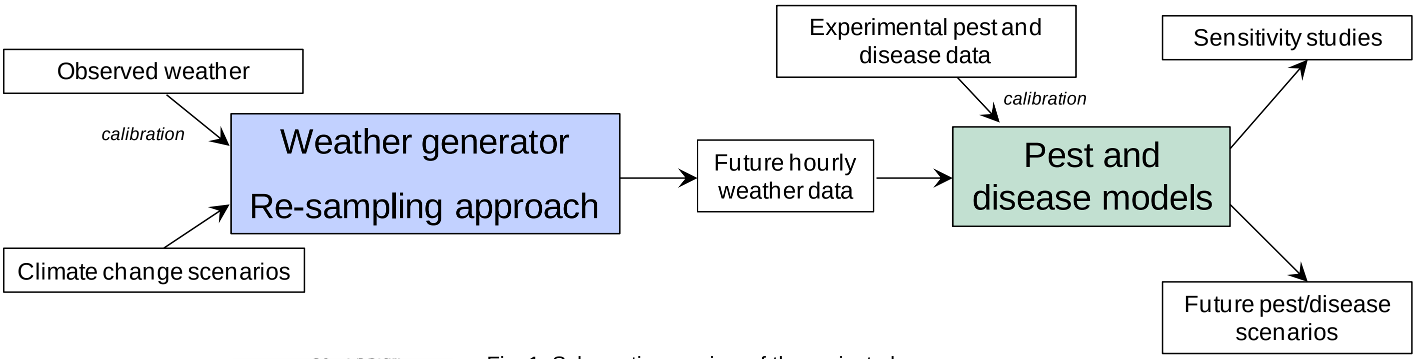
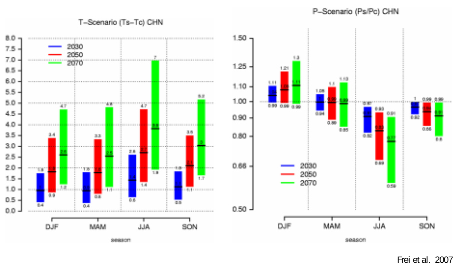


Fig. 1: Schematic overview of the project plan.



Downscaling

• Stochastic weather generators (WG) simulate synthetic weather series compatible with a given climate, using observed weather for calibration.

• An existing WG (M&Rfi, Dubrovsky *et al.* 2006) will be adapted to the needs of the pest and disease forecasting model, requiring the introduction of new variables (e.g. air humidity, soil temperature).

• From the regional climate scenarios for 2050 in Switzerland, the WG produces future daily temperature, precipitation and radiation data. Then realistic diurnal cycles are created using a nearest neighbor re-sampling approach.

Pest and disease modelling

• The codling moth, *Cydia pomonella* (L.), is the major insect fruit pest in apple orchards worldwide (Fig. 2). The flexible life cycle (1-5 generations per year) underlines the sensitivity of this species to expected climate change. Fire blight, caused by the pathogen *Erwinia amylovora*, is the most serious apple disease in Europe (Fig. 2). Abiotic conditions during the flowering period determines fire blight infection risk.

• The stability of codling moth life history components and sensitivity of parameters for fire blight infection under climate change will be evaluated. A special focus will be given to the number of generations per year (voltinism) & photoperiodic diapause induction by the day length (codling moth), and humidity data & time of full bloom (fire blight), respectively.

Future pest and disease scenarios

Pest (SOPRA, Samietz *et al.* 2007) and disease (Maryblyt, Billing 2000) forecasting models will be extended regarding future weather data, critical life history components and sensitive weather parameters. The models will be validated based on field and laboratory data and used to develop future pest (e.g. additional codling moth generation) and disease (e.g. infection risk) scenarios.

Outlook

The results will contribute to answer the question what adaptations to plant protection strategies are necessary considering the probable pest and disease situation in Switzerland 2050 under conditions of changed climate

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