Fight early blight with PLANT-Plus

(J E Smith University of Pretoria E-mail: jsmith@fabi.up.ac.za)

Early blight is a common disease of potatoes and tomatoes in most growing areas in South Africa and globally. The economic importance of this disease is often underestimated and overshadowed by that of late blight. Early blight can, however, cause serious yield losses if not adequately controlled.

In contrast to the name, early blight rarely occurs early in the season, but is primarily a disease of senescing or stressed plants. Affected leaves develop small dark brown or black spots. As the spots enlarge, concentric rings can be seen in the lesions, giving them a distinct "target spot" appearance. Severely infected leaves turn yellow and fall off.

Cause

Early blight is caused by *Alternaria solani* a fungus that survives in leaf and stem debris in or on the soil. Spore formation is favoured by alternating wet and dry conditions. Spores are easily dispersed by wind, water, insects or farm equipment. Disease development is favoured by mild to warm temperatures and wet weather.

The implementation of cultural practices, such as crop rotation, proper fertilisation, irrigation, sanitation and management of other pests can manage early blight. The best control method, however, remains the use of fungicides. Traditionally, spraying commences when symptoms appear and subsequent sprays are applied every 7-10 days. This provides adequate disease control, but sometimes results in application of fungicides even when the threat of disease outbreak is minimal. Public concern about pesticide contamination of produce and the environment is placing pressure on producers to reduce the amount of chemicals applied and to increase the use of alternative disease control strategies such as IPM, Fungicide use can be minimised with the correct implementation of reliable disease warning systems.

Disease warming systems

One such system is PLANT-Plus, original-

Figure 1

ly developed by DaCom Automatisering, Netherlands, for the prediction of late blight in potatoes. The late blight PLANT-Plus prediction model has been tested by ARC Roodeplaat and used with great success in various potato growing areas of South Africa. Another PLANT-Plus model was recently developed for early blight of potatoes. The model is being tested for epidemiological soundness and accuracy of predictions of early blight under South African conditions.

Field-specific advice

PLANT-Plus is an internet-based model, which means that growers are able to get real-time information on the disease status in the field. PLANT-Plus relies on inputs from a number of sources – weather data as well as crop details. Basic information about a field, such as location of the field, soil type, potato variety planted and its disease resistance rating, dates of planting and emergence is recorded. Executed crop measures, such as irrigation and pesticide application are also recorded throughout the season. Weekly information about crop growth rate, growth stage and density is gathered and entered into the model. Sources of infestation in the vicinity of the field increase the disease pressure and stress on potato plants. This is therefore also brought into consideration in the model. The recording of all this data serves to ensure that the advice generated by PLANT-Plus is "personal" to the field under scrutiny.

The system makes use of weather data generated by the grower's own weather station as well as a five-day regional forecast from the Dutch meteorological office, KNMI. The reason for using KNMI data is that KNMI has an agreement with the World Meteorological Organisation to provide weather forecasting information
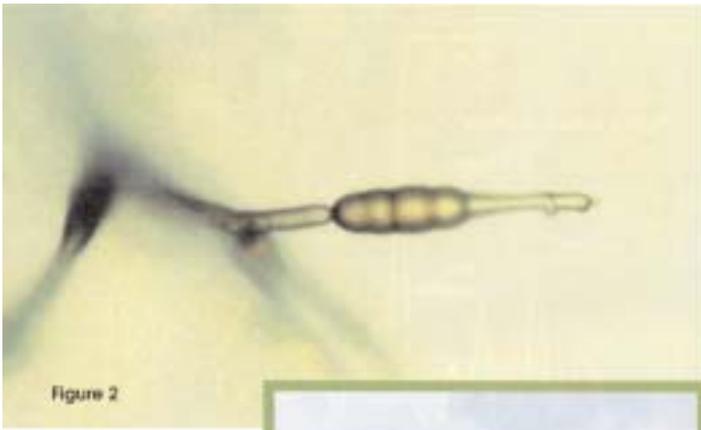
Figure 2

Figure 3
Spore concentrations

Jacquie Smith, writer of the article, at a weather station during her visit to the Netherlands.

all over the world. This service is provided at low cost. The data is available electronically and updated daily via the internet.

Local weather data required from the grower's weather station are wind speed and direction, relative humidity, temperature, rainfall and leaf wetness (optional). This data is transmitted to a receiver and from there sent through manually or automatically to the Dacom databank for processing.

Advisory model

The advisory module of PLANT-Plus can be split into two main parts; namely the unprotected part of the crop and the disease cycle of the fungus. The former is determined by new growth of leaves and deterioration of the sprayed product. The latter is split into sporulation, spore dispersal, germination, penetration and incubation. Development of the disease is calculated based on weather parameters.

The crop details, local weather station data and five-day forecast from KNMI all determine the advice provided by the model. PLANT-Plus produces tables and graphs to show the threat of infection and recommend an appropriate fungicide
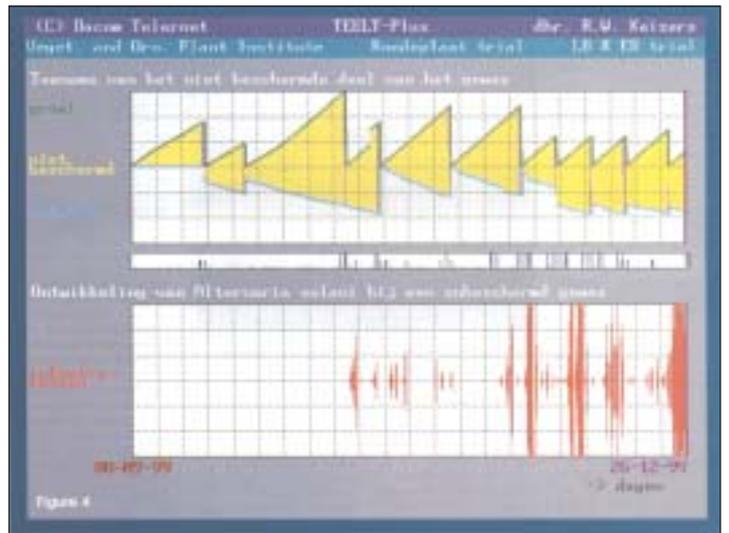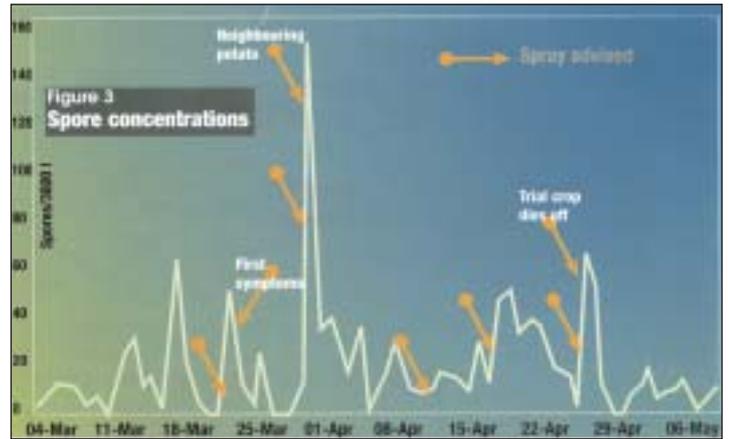
type. The aim of the model, says Dacom Automatisering product manager Peter Raatjes, is "to warn against the approach of the fungal spores and, later, to predict the severity of possible infection".

Assumptions

As with all prediction models, PLANT-Plus makes some assumptions. These include that the grower sprays when and what is advised and that good coverage is achieved. The five-day weather forecast facility of PLANT-Plus forewarns growers when wet weather is ahead, so that they can spray before the field becomes inaccessible.

Field trials

Field trials have been and are currently being run at ARC Roodeplaat to test the

accuracy and efficiency of the PLANT-Plus early blight-forecasting model. A trial using spore trap data was conducted to check that the spore production and dispersal information given by the model is correct. Preliminary results from these trials show that the model looks promising. The spore production and dispersal forecast given by the model correlated well with the spore trap data.

Future prospects

More research is required and is underway – before the model can be commercialised. The ultimate aim is to incorporate the late and early blight models into one, to provide growers with an integrated control programme for these two devastating diseases.

Potatoes South Africa is now also involved with and provides the funding for PLANT-Plus projects on early and late blight.