

The fungus forecast: protecting crops from attack



A field of Oilseed Rape, currently grown on around 6 % of the UK's arable land. Copyright iStockphoto / Zoran Simin

Scientists at Rothamsted Research, an Institute of BBSRC, have been working with support from DEFRA on developing forecasts for two serious diseases of oilseed rape since the early 1990s. The researchers have constructed models which can save tens of thousands of pounds for individual farmers and the UK economy millions each year.

Many countries pursue food security by specialising their agricultural production toward crops that fulfil domestic needs or have high export value. In the UK more than 600,000 hectares (around 6 % of the country's arable land) were devoted in 2010 to growing oilseed rape which is used in a variety of vegetable and industrial oils and as a constituent of biofuel.

Controlling pests and diseases on such a mass produced crop is crucial to individual farmers and the UK economy. Pest forecasts can make the difference between a wrecked harvest and a profitable one that uses the least amount of chemicals possible, saving time, money and reducing the crop's environmental footprint.

The researchers have constructed models to optimise control of the two main diseases of oilseed rape - the fungal pathogens light leaf spot (LLS) *Pyrenopeziza brassicae* and phoma stem canker (PSC) *Leptosphaeria maculans* - which can save tens of thousands of pounds for individual farmers and the UK economy millions each year.

“We have had a really good response from growers and their advisors over the years with many positive comments on the ease of use and usefulness of the forecasts.”

Dr Neal Evans,
Rothamsted Research

Key facts

6 % Of the UK's arable land is devoted to growing Oilseed Rape.

£75M

Has probably been saved by the industry because of this project

The models can save individual farmers tens of thousands of pounds each year.

The power of prediction

Light leaf spot is problematic because it causes an invisible symptomless infection in the autumn that can kill the plant over winter, or cause severe damage come spring. However, spraying a fungicide in autumn affords the best control of the disease, but how do farmers know if their plants are infected?

That's where the forecast comes in. It is based on the severity of infection the previous season (which gives a baseline of inoculum, or infection), summer temperature (hotter weather leads to decreased pathogen growth on crop debris), and winter rainfall (because spores are dispersed by rain-splash).

Farmers can then use the forecast to decide whether to spray or not, depending on risk. If they don't need to, they save money, time and resources by not using chemicals, which benefits the farmer's business and the environment.

Dr Neal Evans who worked on the models with Dr Sue Wellham says that the forecast, originally funded by the Home Grown Cereals Authority (HGCA), is freely available and that farmers love it. "We have had a really good response from growers and their advisors over the years with many positive comments on the ease of use and usefulness of the forecasts."

"In terms of benefit to the industry, we calculated that if just an additional 5% of farmers got good LLS control instead of poor or no control on 500,000 hectares, based on an average loss of 0.5 tonnes per hectare, an extra 12,500 tonnes of extra oilseed rape seed per year on average could be grown." ($0.5 \times 0.05 \times 500000 = 12500$)

"At the current price of £400 per tonne that is £5M per year. We've been running the forecast since 1996, so as a rough estimate our small research project has probably saved the industry more than £75M."

Fungal foes

Phoma stem canker (PSC) is a different adversary, but shares some aspects of its life-cycle. Unlike LLS, which is polycyclic and has continued spread of new spores and infections throughout a year, PSC is monocyclic so there is only one generation per season. Phoma spores are released from crop debris in the autumn, which, like LLS, is dependent on summer temperature and rainfall.

However, the PSC infections can be seen in autumn as phoma

leaf spots on leaves, and if more than 10% of plants in a crop are affected, the 'spray threshold' has been crossed and fungicides should be used to control the disease. If infection grows from the leaf spots into the stem before winter, damaging stem cankers begin to develop during spring, that if severe enough, can prevent water uptake and kill the plant before harvest.

As part of a Defra-LINK funded PASSWORD project, Evans and colleague Dr Andreas Baierl have developed a model to predict the onset of the PSC epidemic, the date of canker onset in spring, and canker severity at harvest. "We now have an online system to provide information to farmers and advisors as to when to expect 10% phoma leaf spotting in the autumn, since this is the key threshold with respect to when best to target the disease with a fungicide," says Evans. "Part of the remit was to reduce reliance on 'calendar spraying' so that farmers only treat in high risk years, as in the case of the LLS forecast, and treat at the most effective time, as in the case of PSC."

Media mashup

Evans is also using novel methods to communicate the forecasts, such as a Twitter account to disseminate updates, although he says that the website invites users to sign up and e-mail is his preferred method. Evans has also used Google Maps, which uses its user-friendly map interface to display which areas of the UK will be above the 10% threshold. "I just did it manually in Google Maps, but you can do something more elaborate which is database driven," says Evans. "We use a similar approach in my current project ENDURE."

The ENDURE Virtual Laboratory (VL), also based at Rothamsted, aims to aggregate information on all aspects of crop protection research across Europe and beyond to facilitate research across disciplines and borders.

About BBSRC:

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