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Predicting Severe Light Leaf Spot (*Pyrenopeziza brassicae*) on Winter Oilseed Rape in the U.K.

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INTRODUCTION

Light leaf spot (*Pyrenopeziza brassicae*) is a serious disease of winter oilseed rape in the UK, causing losses estimated to cost >£30M per annum by calculation from severity/yield loss relationships (Sansford *et al.*, 1996; Fitt *et al.*, 1997) with ADAS/CSL and SAC oilseed rape disease survey data, despite expenditure of >£5M per annum on fungicides to control the disease. Survey data indicates that the severity of light leaf spot epidemics, as indicated by the incidences (%) of plants with infected leaves in March or with infected pods in July, differs between seasons and that patterns in use of fungicides against the disease do not relate well to this seasonal variation in disease severity. To optimize use of fungicides for control of light leaf spot, avoiding unnecessary applications to crops which do not need them and improving the accuracy of timing when crops warrant treatment, it is necessary to develop a scheme for forecasting the severity of light leaf spot epidemics (Fitt *et al.*, 1994; Gladders *et al.*, 1995; Fitt *et al.*, 1996). The objective of a new project, funded by the UK Home-Grown Cereals Authority and involving collaboration between Rothamsted, ADAS, CSL and SAC, has been to construct a provisional forecasting scheme. This has three components:-

1. A seasonal risk index to identify high risk seasons.
2. An initial crop risk index to identify high risk crops at the start of the season.
3. An improved crop risk index, based on disease assessments at monthly intervals.

MATERIALS AND METHODS

<u>Seasonal risk index</u>. Winter oilseed rape disease survey samples were taken from commercial crops in eastern England at early stem extension (GS 2.1-2.5) in March and at maturity (GS 6.4) in July in 1977-1995. Step-wise regression techniques were used to analyse the relationships between incidences (% crops affected) of light leaf spot on leaves in March or on pods in July and factors such as previous disease incidence on pods, stems or leaves, monthly rainfall and temperature, alone or in combination. These analyses were used to predict incidence of light leaf spot (% crops with disease) in eastern England, and to develop a seasonal index for risk of light leaf spot infection in each ADAS region using survey data for England and Wales for harvest years 1987-1995.

<u>Initial crop risk index</u>. Data from the winter oilseed rape disease survey for England and Wales for the harvest years 1987-1995 (e.g. Hardwick & Turner, 1995) were used to estimate the influence of proximity to a previous season's crop, sowing date, cultivar resistance and regional climate on incidences (% plants affected) of light leaf spot on leaves in March or on pods in July. These analyses were used to estimate initial crop risk indices (0-100% scale) for assessing in October the risks that light leaf spot will develop on leaves

by March.

Improved crop risk index. Experiments were done to develop a protocol for sampling crops and assessing light leaf spot incidence to produce monthly improved crop risk indices. To investigate the spatial variability of the disease (% leaves with light leaf spot on each plant), on 14 February 1996 a structured sample of 360 plants in total was taken from different areas in eight unsprayed plots of a field experiment on winter oilseed rape (cv. Envol). To determine the optimum temperatures at which to incubate samples from crops for enhancing symptom development, four experiments were done. In experiments 1 and 2 (starting on 4 and 11 March 1996) five groups of 10 plants each, sampled from the field experiment, were incubated in polyethylene bags at 2, 5, 10 15 or 20°C and the % of leaves with light leaf spot was recorded on each plant 1, 2, 3, 4 and 6 days after sampling. In experiments 3 and 4 (starting on 22 March and 7 April 1996) five groups of 10 plants each, were grown in the glasshouse, exposed in the infected crop for 2 weeks, incubated in the glasshouse for 1 week, and then incubated at 2, 5, 10, 15 or 20°C before disease assessment.

RESULTS

Seasonal risk index. Regression analyses on eastern England winter oilseed rape survey data indicated that the prediction of the % crops with light leaf spot on pods in July can be done in two stages: prediction of % crops with light leaf spot on leaves in March from survey data for the previous July (% crops with light leaf spot on pods); prediction of % crops with light leaf spot on pods from disease incidence in March and rainfall in May. In autumn or spring, respectively, the best predictors of risk for subsequent spring or summer disease incidence (% crops affected) were the % crops affected the previous July or % crops affected in March. 1987-1995 survey data for England and Wales were then used to show the long-term risk of a slight, moderate or severe epidemic.

Initial crop risk index. The survey data suggested that early sowing and cultivar susceptibility both increased incidence of light leaf spot, which was greatest in the northern and south-western regions and smallest in the south-east, but proximity to previous oilseed rape crops did not. The greatest predicted disease incidences were for August sowing dates (e.g. 66% plants for cultivars with resistance ratings <5 in the northern region). Sowing dates between 1-14 September or after 14 September decreased predicted incidence by 8 or 12 %, respectively. These predictions give an autumn risk factor used to produce an initial crop risk index for predicting light leaf spot incidence (% plants affected) on leaves in March.

Improved crop risk index. Analyses of data on the spatial distribution of light leaf spot suggested that the disease occurred initially in small patches; visual inspection of crops confirmed this suggestion, with patches of diameter <1m frequently observed. In all four experiments on incubation temperature, the incidence of light leaf spot (% leaves infected) increased with incubation time at all temperatures, whilst maximum disease incidence differed between experiments. The rate of development of symptoms and the maximum disease incidence were generally greatest at 15°C but initial differences between temperatures were less in experiments 2 and 4 than in experiments 1 and 3. These data, together with existing information, were used to develop a provisional protocol for disease assessment to confirm the presence of disease in crops considered to be at risk.To assess the incidence of light leaf spot in a crop accurately, a combination of crop walking and incubation of samples before disease assessment is recommended. The procedure that farmers/consultants should consider provisionally is:

1. Inspect crops at monthly intervals from October to March, looking for patches of plants with light leaf spot.
2. Collect 100 in a diagonal across the crop.
3. Incubate plants (which should be reasonably dry) in polyethylene bags at 10-15°C (for example in a closed barn) for 4-5 days and assess incidence of light leaf spot to confirm the presence of disease.

DISCUSSION

This work provides preliminary risk indices for assessing seasons with risk and crops at risk of developing a high incidence of light leaf spot. However, considerable further work is required to develop risk indices for predicting light leaf spot severity and potential yield loss, as well as incidence. Furthermore, the initial crop risk indices might be improved by including other factors (e.g. previous cropping). Methods for producing the adjusted crop risk indices at monthly intervals from October to March need to be developed further and to include factors such as the occurrence of infection periods (Fitt *et al.*, 1994) and the use of fungicides on crops, besides incorporating data on the occurrence of the disease from the winter oilseed rape disease surveys in autumn and from inspection and sampling of individual crops.

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