Research shows potential for a new forecasting system for BYDV in autumn-sown crops

Key Points

- Barley yellow dwarf virus (BYDV) occurs as a result of aphids flying into cereal crops (primary infection) and aphids moving and reproducing within crops (secondary infection).
- In Canterbury, aphid flight data from 7.5m high suction traps has been used as a forecast for primary BYDV infection in autumn-sown cereal crops, but there has been no forecast of secondary BYDV infection.
- In recent years increased BYDV incidence (especially 2005) not explained by primary infection data has emphasised the need to include estimates of secondary aphid infestation in future BYDV forecasts.
- New analysis of both suction trap data (a measure of primary BYDV incidence) and heat unit accumulation (a measure of secondary BYDV incidence), especially in June, July and August, shows the potential of this combined data for predicting BYDV incidence in any given season.
- Forecast risk of BYDV will be reported in Crop Action and the Aphid Watch website from June to August.

Introduction

Crop & Food Research was asked by the Foundation for Arable Research to conduct a study into the environmental conditions surrounding the severe outbreak of Barley Yellow Dwarf Virus (BYDV) in autumn/winter-sown wheat in Canterbury in 2005.

In order to compare 2005 conditions with those of previous years, the researchers investigated records of winged cereal-inhabiting BYDV-transmitting aphids caught in the 7.5m Lincoln suction trap, and the heat unit (degree day) accumulations of ambient temperatures at Lincoln (from 1982 to 2006).

An analysis of both the heat unit (degree day) accumulations of ambient temperature and the aphid flight data provided a better indicator of BYDV incidence than previous analysis of flight data alone.

Background

The aphid-transmitted yellow dwarf viruses are major causes of cereal crop loss in New Zealand. At least six BYDV-transmitting aphid species are present in New Zealand, with the cereal aphid, *Rhopalosiphum padi*, known as the bird cherry oat aphid elsewhere in the world, being the the most prevalent in autumn crops.

Primary BYDV infection occurs as a result of aphids from insect and disease reservoirs such as grasses and forage cereals flying into cereal crops. Secondary infections occur when aphids move within crops; this includes virus transmission by the offspring of the initial invaders.

In Canterbury, aphid flight data has been used as a forecast of primary BYDV infection in autumn-sown crops but no measurement of secondary BYDV infection has taken place. As a result of the 2005 investigation, a clear association between historical data on aphid flights and heat unit accumulation was shown in relation to high BYDV incidence; especially for June, July and August.

Results

When the data was graphed (see overleaf), years with high records of BYDV incidence (circled) grouped well together in the upper right hand of the graphs. The data indicates that years of high BYDV incidence were associated with high autumn/winter aphid flights or moderate autumn/winter aphid flights and relatively warm autumn/winter months.

A special note needs to be made of the data for the years 2003 and 2004: 2004 is not circled because no survey of BYDV incidence was taken in this year; in 2003 severe BYDV was found in only some crops but overall BYDV incidence in that year was low. The researchers believe that changing insecticide use may account for the overall low BYDV incidence in 2003 because in that year about 60% of crops were treated with imidacloprid, which was a significant increase over previous years.

Attempts to forecast BYDV incidence in New Zealand have relied mostly on a measurement of aphid flight extent and timing. However a mild winter in 1998 may have accounted for greater than expected BYDV incidence in that year due to...
secondary infection and it was recommended that a measure of secondary aphid infestation and virus incidence may need to be included in future BYDV forecasts. The warm winter of 2000 was also implicated in localised severe incidence of BYDV in that year.

The current set of data gathered in order to better understand the 2005 outbreak of BYDV in autumn/winter-sown wheat shows how a useful assessment of BYDV incidence can be made by studying both the number of aphids trapped in the 7.5m suction trap at Lincoln (a forecast of primary BYDV incidence) and heat unit accumulation (a forecast of secondary BYDV incidence), especially in June, July and August. By positioning the current year’s aphid flight data and degree day accumulation on the graph(s) the risk of BYDV incidence for the season can be estimated with respect to historical data.

Additional (in-depth) analysis of the data set presented here and other factors contributing to BYDV incidence, such as sowing date, insecticide use and the proportion of aphids carrying the virus into the crop, are also likely to help in understanding the factors leading to BYDV incidence in Canterbury autumn/winter-sown wheat crops.

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FIGURE 1: Numbers of aphids caught in a 7.5m high suction trap at Lincoln with respect to degree day accumulation for the same time period for (a) May to August, (b) June to July, (c) June to August and (d) July to August. Circles denote years of significant BYDV incidence.