Grower Summary

CP 099c

Evaluation of an integrated disease management system to ascribe risk of downy mildew disease on commercial salad and bulb onion crops in the UK

Annual report 2014

Disclaimer

The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of this report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

HDC is a division of the Agriculture and Horticulture Development Board.

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Project Title:	Evaluation of an integrated disease management system to ascribe risk of downy mildew disease on commercial salad and bulb onion crops in the UK
Project Leader:	Alison Wakeham National Pollen and Aerobiology Research Unit, University of Worcester, Henwick Grove, Worcester WR2 6AJ
Contractor:	University of Worcester
Industry Representative:	Andy Richardson Allium & Brassica Centre Wash Road, Kirton Boston, Lincs. PE20 1QQ
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GROWER SUMMARY

Headline

In this study, the timed application of onion downy mildew control regimes according to bio-aerosol concentration of *Peronospora destructor* reduced crop protection inputs by 50% and provided either the same or improved levels of disease control. An environmental model (MILIONCAST) was used to assess downy mildew infection conditions and the predicted latent period for disease development on infected onion plants to occur. These systems demonstrate an integrated disease management approach towards the reduction of crop inputs to control downy mildew on onion crops. According to the European Union sustainable pesticide use directive (2009/128/EC) professional producers will have to apply general principles of integrated pest and disease management from January 2014.

Background

Onion downy mildew (*Peronospora destructor*) is geographically widespread and is a serious disease in bulb onions, salad onion sets and in seed production. Downy mildew infects all of the main onion types grown in the U.K. including the common onion (*Allium cepa*), shallots (*A. cepa* var. a*scalonicum*) and Welsh onion (*A. fistulosum*). Welsh onion is particularly susceptible to downy mildew infection. Many commercial varieties of salad onion are crosses between *A. cepa* and A. *fistulosum* types. Yield losses in bulb onions of 60 to 75% have been recorded. These losses mainly result from severe infections causing early defoliation, reduced bulb sizes and poor storage quality of bulbs. In salad onions, yield losses can be as high as 100%, with whole crops being discarded as downy mildew symptoms on the plant make them unmarketable. Losses to seed production are frequently caused by the collapse of infected seed stalks and poor germination of seeds collected from infected stalks. Information from the work will provide data on the optimal use of the system and the potential cost savings.

The pathogen can over winter as mycelium in onion bulbs and sets and, as oospores in debris from diseased foliage. The onion downy mildew has also been shown to be seed borne. When either sets or seeds are planted the mycelium grows within the foliage of the plant. Under favourable conditions the downy mildew pathogen is capable of spore production. This is a diurnal process and both periods of light and darkness are required. Spore production is mainly during the night under high relative humidity of greater than 94 - 95% at temperatures of 6 - 22°C provided there is no rainfall. However high day temperatures exceeding 24°C have been found to inhibit sporulation during subsequent nights. Spore discharge is triggered when relative humidity falls below 59%. The spores can be transported by the wind over considerable distances and have been detected at heights of >450 metres. Once deposited on susceptible

host leaf surfaces, the spores can germinate and infect within hours. Under favourable conditions disease symptoms may be visible within 7 to 10 days.

The control of downy mildew on onions relies mainly on the prophylactic application of fungicides, as frequently as every seven to ten days. Fungicidal control of downy mildew is difficult as fungicides are only effective, if they are applied before or immediately after the disease first appears in the crop. To reduce the impact of fungicides on the environment, integrated disease management (IDM) approaches have been developed. Of these, MILIONCAST (an acronym for 'MILdew on onION foreCAST'), provides improved predictions of onion downy mildew sporulation than those based on DOWNCAST models. However forecasts based on environmental factors are unable to take in to account whether the disease is present or absent within the crop or locality. To overcome this, methods of detecting and quantifying downy mildew spores in crop aerosols have been developed (HDC FV356). Information of disease concentration within the cropping system can be used in conjunction with environmental based forecasting models to provide a precision approach to fungicide application and disease control. The purpose of this study is to validate the combined usage of these two approaches as an integrated disease management system to control downy mildew in commercial cropping systems of the UK onion industry.

Summary

In this study, the timed application of downy mildew control regimes according to bio-aerosol concentration reduced crop protection inputs by 50% and provided either the same or improved levels of disease control.

Field bio-aerosol testing was carried out using two air sampling systems:

- A Microtitre immunospore trap (MTIST), available from Burkard Manufacturing (http://www.burkard.co.uk) at a cost of approx. £2,300 + VAT, provides a weekly field air sample for risk of downy mildew disease. However, samples require laboratory processing by ELISA (enzyme-linked immunosorbent assay). By postal delivery the results can be available within several days however. Provisional results indicate that a downy mildew bio-aerosol disease risk warning is provided when ELISA results of ≥ 0.8 optical density is recorded.
- A weekly multivial air field sampler (daily air samples provided in seven tubes for testing on-site by lateral flows) can also be used to collect field bio-aerosols. This field-ready air sampler with a timer can be purchased from Burkard

Manufacturing for an approx. costing of £1650 + VAT. Daily air samples are assessed once weekly by an agronomist or grower using on-site field tests (lateral flows). A single tube lateral flow reading of OD ≥ $2.5x10^4$ is proposed as the disease threshold for onion downy mildew risk on onion crops. On-site lateral flows for other plant diseases currently retail at circa £7 per test. It is assumed that this costing would apply to a test for downy mildew disease. At present a digital lateral flow test reader would be required for measurement of downy mildew spore concentrations. A reader currently retails at circa £1000 however smart phone readers with downloadable applications are being developed for other diseases.

Information on the presence or absence of a critical downy mildew spore threshold in bio-aerosols provides growers capability to identify periods when crops are at risk from the disease. However, this information is best used in conjunction with an environmental forecast (MILIONCAST) to determine best times to apply control measures. Using this approach should lessen the reliance on mancozeb based fungicides for onion downy mildew control (these are being withdrawn). Also, as part of the sustainable use directive (SUD) http://ec.europa.eu/food/plant/pesticides/sustainable_use_pesticides/index_en.htm, this approach will enable producers to demonstrate that they have taken alternative integrated pest management (IPM) measures to prevent disease development before the use of spray applications of fungicides.

Financial Benefits

The main financial benefits will be in the use of these tests to reduce unnecessary crop protection inputs to onion cropping systems. Fungicide usage is costly and is one of the major inputs in crop production. Using the lateral flow device the grower/consultant will be able to check for the presence of onion downy mildew in the air and better time the first fungicide application. The cost of these tests must be compared with a typical spend of £260/ha for fungicide treatment. In high risk years it is common to spend in excess of £300/ha on fungicides in a bulb onion crop. However savings will be variable between years and depend on the overall reductions in sprays achieved.

Action Points

- air samplers can be used to trap onion downy mildew disease in field bio-aerosols;

- testing of these collected air samples for onion downy mildew disease can be made either by laboratory staff or using lateral flows on-site in the field;
- The use of these tests with environmental models provides an improved accuracy to identify onion downy mildew infection and sporulation periods. This integrated disease management approach provides information on airborne disease load and environmental data. This will assist growers to schedule fungicide applications to crops more effectively and reduce crop protection inputs whilst making cost savings.
- The European Union sustainable pesticide use directive (2009/128/EC) states that professional users will have to apply general principles of Integrated Pest and Disease Management from 1 January 2014.