Grower Summary

FV 417

Use of plant defence elicitors to provide induced resistance protection in brassica and allium crops

Annual 2015

Disclaimer

While the Agriculture and Horticulture Development Board seeks to ensure that the information contained within this document is accurate at the time of printing, no warranty is given in respect thereof and, to the maximum extent permitted by law the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document.

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 AHDB Horticulture office (hort.info.@ahdb.org.uk), quoting your AHDB Horticulture number, alternatively contact AHDB Horticulture at the address below.

AHDB Horticulture,
AHDB
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

AHDB Horticulture is a Division of the Agriculture and Horticulture Development Board.

Project Number:	FV 417
Project Title:	Use of plant defence elicitors to provide induced resistance protection in brassica and allium crops
Project Leader:	Nicola Holden, James Hutton Institute
Contractor:	James Hutton Institute
Industry Representative:	<u>Disease system 1 (Brussels sprouts)</u> Name: Matt Rawson Address: MRR Vegetable Agronomy Ltd, Pasture Farm, West End, Kilham, Driffield, East Yorkshire, YO25 4RR <u>Disease system 2 (broccoli)</u> Name: Alistair Ewan Address: East of Scotland Growers, Prestonhall Industrial Estate, Cupar, Fife, KY15 4RD <u>Disease system 3 (cabbage)</u> Name: Euan Alexander Address: Kettle Produce, Balmalcolm, Cupar, Fife, KY15 7TJ <u>Disease system 4 (radish)</u> Name: Liz Johnson Address: L J Technical Consultancy Ltd, 35 West Fen Road, Ely, Cambridge, CB6 1AN <u>Disease system 5 (onion)</u> Name: Andy Richardson Address: Allium and Brassica Agronomy, Wash Road, Kirton, Boston, Lincs, PE20 1QQ
Report:	Annual report 2015
Publication Date:	09 July 2015

Previous report/(s):	Annual report 2014
Start Date:	01 April 2013
End Date:	31 March 2016
Project Cost:	£304,565

GROWER SUMMARY

Headline

Plant defence elicitors have the potential to aid in the treatment and control of bacterial and fungal diseases of Brassica and Allium species.

Harpin applied on its own is as effective as standard fungicides in controlling bacterial disease of cabbage *Xanthomonas campestris* pv. *campestris* and red onions *Burkholderia gladioli* pv. *alliicola*.

SiTKO-SA also provided a degree of protection against *Burkholderia gladioli* pv. *alliicola* on red onion bulb and Amistar was beneficial for yield on broccoli. However, increased yield in broccoli was coupled with presence of hollow-stem disorder, e.g. for Regalia.

Trials on the Brussels sprout varieties Cobus, Aurelius and Petrus at two sites show that elicitors reduce severity of Light Leaf Spot significantly and two elicitors in particular, Bion® and Regalia®, show the most promise.

Background

Brassica and Allium crops suffer from a number of important fungal and bacterial diseases. Bacterial pathogens are a serious concern because the choice of available control options is very limited. Their effectiveness is influenced by the timing of application, weather conditions and the rate of plant development. Trials were conducted to test whether plant defence elicitors could be used to provide protection against four bacterial and one fungal pathogen in five different horticultural crops for commercially important diseases:

Head rot in broccoli caused by a number of bacteria including *Pseudomonas fluorescens, Pseudomonas marginalis* and *Pectobacterium atrosepticum*

Black rot in cabbage caused by *Xanthomonas campestris* pathovar. *campestris* (Xcc)

Leaf blight on radish leaves caused by *Pseudomonas cannabina* pv. *alisalensis* (Pca)

Soft rot in red onion bulbs caused by *Burkholderia gladioli* pv. *alliicola* (Bga)

Light leaf spot on Brussels sprouts caused by the fungus *Pyrenopeziza brassicae*

The Brussels sprout area in the UK in 2011 was 3,045ha, with the 45,000 tonnes produced having a farmgate value of £41 million (Basic Horticultural Statistics 2012). The disease Light Leaf Spot (LLS) (*Pyrenopeziza brassicae*) is a particular problem in the wetter north of England and in Scotland, and has become established further south in Nottinghamshire and

Lincolnshire. It is estimated that annual losses due to light leaf spot are in the region of 10-15% or around £4-6 million.

Head rot is a major disease of broccoli (*Brassica oleracea* L. var. *italica* Plenck) that can cause 30-100% crop losses, estimated to cost the UK industry £10-15 million annually - up to 30% of the market value (Harling & Sutton, 2002). The disease is caused by the soft rotting bacteria, predominantly *Pseudomonas fluorescens, Pseudomonas marginalis* and *Pectobacterium carotovorum* (Cui & Harling, 2006). Previous work (FV 378) tested whether plant defence elicitors were able to reduce or prevent head-rot symptoms in a broccoli trial and indicated that application of some combinations, including those with Amistar could reduce the incidence of symptomatic disease.

Black Rot (*Xanthomonas campestris* pv. *campestris)* is a major bacterial disease of cabbage throughout the world and can cause significant losses in UK winter cabbage, with Savoy and Savoy x White hybrids particularly susceptible. The disease is thought to be introduced by infected seed and is now endemic in production fields in these areas and although the preventative use of copper and strobilurin fungicides can minimise disease outbreaks there is little that can be done to control established disease. Winter cabbage area in the UK is around 2,900ha, producing around 147,000 tonnes with a farmgate value of £54 million (Basic Horticultural Statistics 2012). It is estimated that severe disease outbreaks in some years can lead to production losses amounting to 15-20% or £7-10 million.

The radish production in the UK is about 5,800 tonnes, with a market value of around £11 million. Approximately 15% of the production is sold as a bunched product, and although radish leaves are not intended for consumption, there has been an increase in demand for radish bulbs sold in bunches with the leaves attached. The presence of bacterial blight and development of scorched-leaf symptoms caused by *Pseudomonas* species renders the crop unmarketable, despite the absence of disease symptoms on the roots. The disease has been observed in crops over the past few seasons particularly during spells of wet weather. It has been estimated that during a high infection period there could be up to 6% losses.

Summary

Trials at two sites (Blackness, Falkirk and Tyninghame, East Lothian) using early, mid- and late-season Brussels sprout varieties Cobus, Aurelius and Petrus demonstrated that the elicitors Bion®, Regalia® and SiTKO-SA reduced light leaf spot severity substantially on leaves and sprouts. Reduction of visible symptoms was as much as 3-fold, although there was some variation depending on the tissue type, variety and geographical location. Of

particular interest was the elicitor Bion®, which used either on its own, or in combination with the elicitor Regalia®, gave significant reductions in light leaf spot severity when applied just 3 times during the growing season.

Reproducible positive effects were seen for the elicitors on bacterial diseases. The effects were compared to fungicides that are normally applied to the crops as a means to control fungal pathogens. Harpin applied on its own was as effective as, or more so, than standard fungicides in controlling bacterial disease of cabbage (*Xanthomonas campestris* pv. *campestris*) and red onions (*Burkholderia gladioli* pv. *alliicola*). Glasshouse trials on radish showed a significant reduction in the severity of *Pseudomonas cannabina* pv. *alisalensis* - associated leaf blight symptoms, following application of SiTKO-SA on var. Celesta, whereas Chitosan and Seaweed extract showed some control in polytunnel grown plants. Application of Regalia increased the yield of broccoli, although this was correlated with an increase in hollow-stem disorder.

Most elicitors interacted with fungicides, which means that due consideration needs to be given to the whole system of the crop species, varieties, disease causing agents and environment. For example, Harpin was generally only seen to be beneficial when applied on its own and not when mixed with standard fungicides on cabbage or red onion. The same was true for SiTKO-SA on radish (glasshouse-grown), whereas the opposite effect was seen for chitosan plus seaweed extract on cabbage and red onion. Although fungicides are designed to specifically target fungi and not bacteria, their application alters the microbial community associated with the plants, which may then affect the likelihood of bacterial disease. The effects could be positive, i.e. in some way help to also reduce the pathogenic bacteria, but they may be negative, by removing competition for nutrients from pathogenic fungi, thereby providing pathogenic bacteria the opportunity to grow and cause disease. Therefore, it is anticipated that elicitors will be most useful as part of an integrated disease management programme.

Financial Benefits

Potential financial benefits have not been estimated yet from this project since there is still one more year to run. However, for the bacterial diseases on red onion, cabbage and broccoli, application of some elicitors alone (Harpin, SiTKO-SA, Amistar) appear as beneficial, or more so, than application of standard fungicide regimes for cabbage (Amistar, Nativo, Rudis, Signum), red onion (Dithane NT, Invader, Olympus, Unicur, Valbon), or

copper oxychloride for broccoli. This is likely to increase saleable crop and therefore be financially beneficial.

Losses from light leaf spot on Brussels sprouts are thought to account for 10 – 15 % per annum. Under optimal conditions, the average yield of Brussels sprouts in the UK is 8 ton / acre, however, current yields are impacted by effects of disease and climatic events meaning that yields are closer to 6.5 ton / acre. Therefore, application of Bion®, either with or without Regalia®, may contribute to improving current yields resulting in increased profitability.

Action Points

Due consideration must be given to how the various fungicides applied as standard to horticultural crops interact with elicitors, especially for bacterial diseases. One of the major findings of the project so far is that interactions occur between different treatment types (fungicides, elicitors), which inevitably have consequences on the outcome of disease. Therefore an important action is to use our knowledge of the underlying ecology of crops to help improve plant health.

Environmental factors have an important impact on the development of bacterial disease, which was clearly demonstrated by comparing radish grown under glasshouse or poly-tunnel conditions. Furthermore, under the conditions used here, broccoli was not particularly susceptible to head-rot. For both disease-systems, multiple bacteria are involved. Therefore, it is necessary to determine which pathogens are responsible for causing the disease, and whether their complement changes under different environments. This will in turn, allow more targeted applications for control.