Grower Summary

FV 449a

Integrated control of Allium white rot

Annual report 2020

Project title:	Integrated control of Allium white rot
Project number:	FV 449a
Project leader:	John Clarkson, University of Warwick
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Location of project:	University of Warwick, Wellesbourne Campus, Warwick.
Industry Representative:	Phil Langley, G's Growers
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The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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GROWER SUMMARY

Headline

Three field trials in 2019 did not identify effective treatments against *Allium* white rot disease due to low disease levels at two sites, while a third trial showed good disease pressure but no reduction in disease for any of the treatments. Lab experiments showed that *Allium* products stimulated germination of *Sclerotium cepivorum* sclerotia *in vitro*.

Background

Sclerotium cepivorum is the causal agent of *Allium* white rot (AWR) an economically important disease of onion (*A. cepa*), garlic (*A. sativum*) and other *Allium* spp. worldwide (Entwistle, 1990). The soilborne fungal pathogen causes estimated losses of 2-15% in UK onion equating to approximately £7M per annum. In addition to this, the heavy infestation of some sites has led growers to abandon onion growing in areas of the East and South East of England with production moved to less infested, but lower yielding areas.

The pathogen infects the root systems of plants from soil-borne sclerotia (resting structures), causing roots to collapse and decay, leading to reduced crop vigour, chlorosis and often plant death. This can result in high levels of physical and marketable yield loss, with the production of further sclerotia allowing the pathogen to proliferate and persist in soil between crops. Relatively small quantities of sclerotia are required for disease to develop with densities as low as 0.1 sclerotia L^{-1} soil leading to economic loss, whilst higher levels such as 10 sclerotia L^{-1} soil can lead to total crop loss (Crowe *et al*., 1980; Davis *et al*., 2007). In addition, sclerotia are able to survive for periods of up to 20 years (Coley-Smith *et al*., 1990).

Currently management options for AWR are limited. Cultural control approaches aim to prevent infestation through practicing good equipment/field hygiene measures (although due to the small and persistent nature of sclerotia, this is challenging), whilst the use of wide rotations aims to prevent inoculum build up. Chemical control is limited in the UK to off label approvals under the HSE Extension of Authorisation for Minor Use (EAMU) scheme. At the time of writing only Signum® (boscalid and pyraclostrobin) and tebuconazole were registered for use against AWR in the outdoor production of bulb/salad onion, onion sets, garlic and shallots. However other products/active ingredients (a.i) have shown promise elsewhere (Villata *et al*., 2004; 2005; Ferry-Abee, 2014) and were reviewed by Clarkson *et al*., 2016 in AHDB project FV 449.

Other alternative methods of AWR disease management have also been explored, such as biopesticides (Clarkson *et al*., 2002; 2004), biofumigation (Smolinska, 2000), solarisation (McLean *et al*., 2001) and sclerotial germinants (Coventry et al., 2006; Coley-smith *et al*., 1969) but few of these are currently practiced commercially.

Consequently, the aim of this project was to identify and test a range of treatments for the integrated control of AWR in bulb and salad onions, and generate preliminary data for the effect of selected treatments on Fusarium basal rot caused by *F. oxysporum* f.sp *cepae*. Three objectives were carried out in the current year;

1) Test fungicides and biological control agents for their effect on *Allium* white rot disease.
   1b) Generate preliminary data on effect of selected products on Fusarium basal rot.
2) Test *Allium* products for their effect on the germination of *S. cepivorum* sclerotia *in vitro*.
3) Test biofumigants for their ability to reduce viability of *S. cepivorum* sclerotia and reduce *Fusarium* inoculum.

Summary

Objective 1: Test fungicides and biological control agents for their effect on *Allium* white rot disease.

- No significant control of AWR disease was observed for fungicide or biological treatments in a field trial carried out at an inoculated site at Wellesbourne (Warwickshire) and two commercial field sites in Cambridgeshire and Lincolnshire. This was due to low disease levels at the first two sites (<1%), and whilst the third site attained moderate disease, there were no differences between treatments. This could be due to the high organic matter content of the soil at this site which may have compromised fungicide efficacy. These results are in contrast to those from 2018 where some fungicide products resulted in significant reduction of AWR disease at the Wellesbourne site.

Objective 1b: Test fungicides and biological control agents for their effect on *Fusarium* basal rot

- No significant level of FOC disease control was observed for fungicide or biological treatments in an inoculated field trial carried out at Wellesbourne (Warwickshire).

Objective 2: Test *Allium* products for their effect on the germination of *S. cepivorum* sclerotia *in vitro*.

- An *in vitro* (laboratory based) assay was developed and used to examine commercially developed and unformulated *Allium* extracts for their ability to stimulate germination of *S. cepivorum* sclerotia.
- Commercially formulated *Allium* products generally resulted in high levels of sclerotial germination for products HDC F264, HDC F265 and HDC F261.
- Unformulated food grade garlic granule products resulted in moderate sclerotial germination.
- When examined in a soil-based system, HDC F264 resulted in the lowest rate of sclerotia survival (<1%) due to stimulation of sclerotial germination, along with an unformulated garlic granules (<2%). Other products were also stimulatory but were more variable in their efficacy.

Objective 3: Test biofumigants for their ability to reduce viability of *S. cepivorum* sclerotia and reduce *Fusarium* inoculum.

- Two batches of plant biofumigant material was produced in the glasshouse for experimental work. However, analysis suggested that the levels of key glucosinolates were low. This material will be used in future experiments, but further biofumigant plants are being produced.
- A seedling based assay for FOC established that 1 x10^6 cfu/g of compost would result in consistent high levels of onion seedling mortality, providing a suitable system to examine the effect of plant biofumigants on the pathogen in future experiments.

Financial Benefits

None to report at this time.

Action Points

None to report at this time.