



Grower Summary

HNS/PO 190

Evaluation of fungicides and novel treatments for the control of black root rot, *Thielaviopsis basicola*, in bedding and hardy nursery stock plants

Annual 2015

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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.

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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 the full 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.

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

Project title: Evaluation of fungicides and novel treatments for the control of black root rot, *Thielaviopsis basicola*, in bedding and hardy nursery stock plants

Project number: HNS-PO 190

Project leader: Dr Erika F. Wedgwood, ADAS

Report: Annual report, August 2015

Previous report: Annual report, August 2014

Key staff: Erika Wedgwood ,Robert Drummond (2014),Steve Richardson (2014),Jonny Kerley Sam Brown (2015),Chris Dyer

Location of project: 2014 Viola: ADAS Boxworth, Battlegate Rd., Boxworth, Cambridge, CB23 4NN.
2015 Choisy: Fletchers Lane site of New Place Nurseries Ltd, Pulborough.

Industry representative: Protected Ornamentals:
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Address: Ivan Ambrose Co. Ltd., Rosemount Nursery, Pygons Hill Lane, Lydiate, Merseyside, L31 4JD
Hardy Ornamental Nursery Stock:
Name: Mike Norris
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Date project commenced: 1st September 2013

Date project completed (or expected completion date): 31st August 2017

GROWER SUMMARY

Headline

Root growth reduction and damage by *Thielaviopsis basicola* can be reduced, not stopped, by certain preventative fungicide programmes. Nursery hygiene to remove inoculum should be the primary control measure. Roots of susceptible host plants should be inspected regularly, as foliar vigour decline may only occur when the black root rot disease is well advanced.

Background

Symptoms and prevalence

Black root rot (*Thielaviopsis basicola*, syn. *Chalara elegans*) causes root damage (Figure 1) leading to reduced nutrient and water uptake, consequent leaf yellowing and potentially plant loss. Losses in pansy and viola production can be substantial and black root rot is frequently implicated in losses of susceptible hardy nursery stock species such as *Choisya*, *Skimmia* and *Ilex*. A massive peak of plant loss can occur in summer as temperatures rise and plants are put under stress. Early crops can also succumb when it is cold. Losses are greatest in propagation and at the liner stage. Growers producing container ornamental crops under glass can give a single preventative drench of Cercobin WG (thiophanate-methyl), while for those grown under polythene, Scotts Octave (prochloraz) is permitted for use to achieve disease control chemically



Figure 1. *Viola* sp. roots infected by *T. basicola* (left hand plant) causing reduced root growth, tissue browning and root hair loss (Experiment 3, September 2014).

Overview of the current project

In the review PO 14 carried out prior to this project, it was determined that there were active ingredients currently in use on other crops, or being used pre-registration as a plant protection product that might give effective control of black root rot (Wedgwood, 2013), which given approval, might widen the number of products available to reduce the risk of fungicide resistance developing. Several products which reduced black root rot in earlier work in PC 143 (Jackson, 2000) are now unavailable to UK ornamentals growers. The current project seeks to identify novel treatments, including non-conventional elicitors and microbial products, and to test their efficacy as preventative and curative drenches against black root rot. Initially, the species *Viola* and *Choisya* were used as example crops in which to test products individually, and then evaluate them in a range of programmes giving consideration to fungicide resistance management. In 2015, products that were found in 2014 to be safe and effective on *Viola* species (sp.) at various timings were tested on *Choisya* sp.

Summary

Three inoculated glasshouse experiments were carried out on *Viola* sp. in 2014, testing the protectant and curative activity of plant protection products against *Thielaviopsis basicola*. In each case *Viola cornuta* cv. Sorbet XP White Jump Up were grown in 24-cell module trays in glasshouse compartments at ADAS Boxworth. Some plant protection products were applied at sowing, but the majority were applied either a week before or after inoculation, or at both times. Inoculation was carried out by drenching the peat-based growing medium with a spore suspension of *T. basicola* four weeks after sowing. Experiment 1 and 2 were reported on in 2014. This report details the work carried out on Experiment 3, which used information gained in the earlier two experiments to determine the products tested. Experiment 4 started in May 2015 with *Choisya ternata* plugs potted into 90 mm pots set out within a commercial crop on a nursery where black root rot has previously occurred. This trial will not be completed until November 2015 and so it will be reported in full in the next report.

Experiment 3 – Simple programmes on *Viola* spp.

Four of the products which reduced black root rot in *Viola* spp. in the earlier experiments were selected for use in this experiment investigating two-product programmes. Ten programmes were tested. Treatment timings were at sowing, and three and five weeks later: treatments consisted of either one or two applications of test products (Table 1). The products selected for use on *Viola* sp. in comparison with Cercobin WG as a standard were:

- T34 Biocontrol (microbial, EAMU 1118 of 2012 as drench on ornamentals)
- F174 (conventional, registered for spray application on sugar beet)
- F175 (conventional, for spray application but not yet registered on any crop)
- F178 (non-conventional, a stimulant now registered for use on chrysanthemums)

Table 1. Experiment 3 – Programme of one or two products applied at different timings for control of black root rot. All except T1 were inoculated with *T. basicola* four weeks after sowing

| | Treatment programme | | | | | | | | | | | |
|--------|---------------------|----|-------------|------|------|------|------|------|----------------|------|------|------|
| Timing | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 | T10 | T11 | T12 |
| Wk 0 | | | | | | | | | T34 Biocontrol | | | |
| Wk 3 | | | Cercobin WG | | | F174 | F175 | F178 | | F174 | F175 | F178 |
| Wk 5 | | | | F174 | F175 | | | | | | | |

There were two untreated controls: one left uninoculated (T1), the other (T2) inoculated with *T. basicola* at the same time as all the treated plots, four weeks after sowing. The number of spores used was double that of the earlier experiments to seek to obtain a greater severity of black root rot that might then cause some foliar symptoms (not seen previously).

Cercobin WG alone (T3) was applied preventatively three weeks after sowing, and in two other programmes (T4 and T5) this was followed by a curative application of coded products a week after inoculation. All three coded products were tested preventatively, either as the only treatments (in T6, T7 and T8) or preceded by T34 as a drench to the trays straight after sowing (in T10, 11 and T12). T34 Biocontrol was also used only at sowing (in T9) (Table 1).

No difference in foliar vigour was seen between any of the plots (Figure 2), nor any phytotoxicity. Roots were assessed 10 weeks after sowing. In the uninoculated untreated plots (T1) the roots covered a mean 74% of the plug surface; in the inoculated untreated plants (T2) this was reduced to 42%. T10 (T34 Biocontrol followed by F174) was the only treatment with increased percentage root cover compared with untreated inoculated plants. It was noted that, although not significantly lower than the untreated inoculated, plants which received F174 application a week before inoculation (T6) had the smallest root area – only 39% (Figure 2). T10 also resulted in the least area of rotted root, reducing it from 67% to 39%.

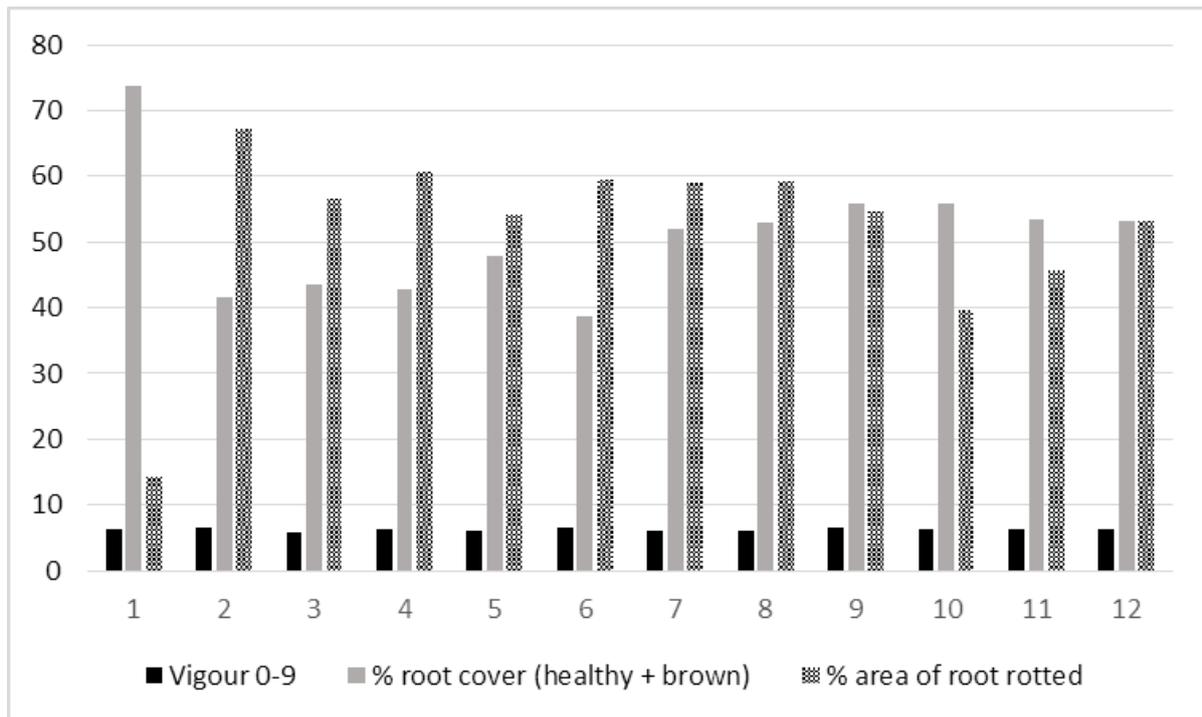


Figure 2. Effect of plant protection product programmes on plant vigour, root extent and root rot of *Viola* sp. in Experiment 3. Treatments assessed on 25 September 2014, 10 weeks after sowing, for above-ground vigour (0 = dead to 9 = very good – no significant differences), the coverage of the surface of the plug by roots ($P=0.034$, LSD 17.717), and the proportion of these roots that were browned ($P<0.001$, LSD 16.549).

Some pale brown roots were seen in all treatments, (including uninoculated), however microscope examination and isolation onto agar of uninoculated damaged roots showed no evidence of any root rot pathogens and it was likely that the 14% of the root ball surface affected was probably from desiccation; plants were checked for *Pythium* root rot and none was found. Evidence of *T. basicola* was confirmed in samples of rotted roots from inoculated plants by high-power microscope examination of root squashes, with mycelium and both endospore and chlamyospore production being visible inside roots.

On average, approximately half of the root area was discoloured for most of the inoculated treatments including those with Cercobin WG (T3, T4 and T5), significantly more than the 14% in the uninoculated. This was largely due to black root rot. Only two of the ten treatments reduced black root rot compared with the 67% incidence of it in the untreated inoculated treatments (Figure 2). These were the preventative treatments F174 (T10) with 40% rot, and F175 (T11) with 46% rot; both received T34 Biocontrol at sowing. Use of any of these three product alone (in T6, T7 and T9, respectively) did not reduce root rotting.

Experiment 4 – Simple programmes on a *Choisya* sp.

The experiment was set up in a commercial glasshouse with 640 *Choisya ternata* plug plants potted up on 29 April 2015. Four biofungicides available for use on ornamentals and a non-conventional coded product were applied the next day as five treatments. Six weeks later, when new roots had established, these and eight other products, all conventional chemicals, were applied over the foliage and peat surface. After a further week, plants were inoculated on 11 June 2015 using an isolate of *T. basicola* from *C. ternata*. Three chemicals with potential curative activity were applied to some plots a week after inoculation. The plants are under observation to record phytotoxicity, vigour and disease, with root assessment due in November 2015. Results will be presented in the next Annual report.

Experiment 5 - Alternating programmes on *Choisya* spp.

This experiment will commence in spring 2016 using a fresh batch of *Choisya* spp. liners that will be potted into their final pot size. Products will be selected from the current experiment and six programmes developed with product alternation to reduce the risk of the pathogen developing resistance.

Financial Benefits

Effective treatments will improve crop quality by maintaining a healthy root system, improving crop establishment and reducing crop losses. Providing a range of products that can be applied at intervals during production to maintain a healthy root system will be particularly important for hardy nursery stock where plants are sold in a range of pot sizes.

Grower utilisation of the limited number of products already available for use in these crops has been shown to be effective against black root rot, and any that can be made available through the EAMU approval system will ensure different modes of action are employed, therefore reducing the chance of fungicide resistance developing. Products with activity already known against other root pathogens such as *Pythium* spp. will provide wider protection at no additional cost.

The use of biological products to suppress black root rot will help the industry meet the requirement to be using integrated crop management in order to comply with the EU Sustainable Use Directive for reduced pesticide use. This will ensure that suppliers can secure the business of clients anxious to source plants grown with minimal adverse environmental impact.

ADAS crop consultants have estimated that up to a quarter of some crops on UK nurseries can be affected and that a fifth of crops may not be sold either as the quality loss is too great or the infection has been severe enough to cause plant death.

Action Points

- The range of effective conventional plant protection products permitted as drench treatments to ornamentals is very limited. Consequently there is increased need for close attention to be paid to nursery hygiene (disinfection) and crop husbandry (avoiding plant stress) to avoid introducing and encouraging black root rot in crops.
- Examine sickly plants for black root rot infestation early, do not wait to see reduced vigour. Treat or destroy promptly, if necessary, otherwise endoconidia (dispersal spores of black root rot) can infect other plants and produce further sporulation within weeks.
- Prestop and Triatum G are permitted as drench treatments to ornamentals and significantly reduced black root rot in the inoculated treatment in the original trial; there was also evidence of some effect from T34 Biocontrol applied at sowing. Consider preventative use of these microbial products as they can produce a root-zone environment which has increased resistance to infection from a number of pathogens and potentially a systemic, protective benefit for the whole plant.
- AHDB Horticulture is seeking EAMUS for the use of some of the products within this project. As and when new products become available, select a range of chemical plant protection products with different modes of action to avoid the build-up of resistance to active ingredients. Be prepared to test the crop safety and efficacy of products with EAMUs before inclusion in nursery-wide programmes.