Grower Summary

SF 123

Raspberry: Efficacy of novel products for the control of *Phytophthora rubi* root rot

Final 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.

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

Project Number:	SF 123
Project Title:	Raspberry: Efficacy of novel products for the control of *Phytophthora rubi* root rot
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Further information

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

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GROWER SUMMARY

Headline

- A novel plant Protection product has been identified which offers equivalent control of raspberry root rot to Paraat.

Background and expected deliverables

Soil-borne *Phytophthora rubi* (previously known as *Phytophthora fragariae* var. *rubi*) can infect raspberry roots causing root rot, leading to the visible wilting of stem, petiole and leaf tissues and over time, the death of whole plants. Other species of Phytophthora can also cause root rot, but *P. rubi* is the most common and serious form (Kennedy and Duncan, 1991). Sections of the crop row and their resulting fruit yields are lost for the remainder of the crop's life. Once the soil is contaminated by the pathogen, any replacement plants are also likely to succumb to infection.

Another Phytophthora species (*P. idaei*) has also been found causing root rotting in Rubus species, but unlike *P. rubi*, it does not cause the crop to wilt. It is likely that resting spores of other Phytophthora species survive in land re-used for raspberries, even after a gap of five years or more. The resting spores will be stimulated to germinate when roots grow out into the soil. The motile zoospores produced are mobile in irrigation water. Once a plant becomes infected, the pathogen multiplies and neighbouring plants become infected as zoospores spread. Although some crops are grown in soilless substrates, contamination of the substrate can still occur resulting in root infection. Contamination can occur by irrigating with spore-contaminated water which has been drawn from open reservoirs. It can also occur where growing containers are stood directly on woven ground-cover and roots are allowed to develop through the woven material into contaminated soils below. The introduction of symptomless plants which are initially thought to be healthy is another common way of contaminating soilless substrates.

In soil grown crops, growers can fumigate the soil before planting using products such as Basamid (97% w/w dazomet) or chloropicrin, although the future availability of chloropicrin is uncertain. Experience suggests that soil fumigation does not totally eliminate the presence of *P. rubi* spores however and there is still a risk that infection will occur. At present, there is no commercial soil test available for detecting the presence of *P. rubi* in soils or soilless substrates, although research in HDC Project SF 130 aims to develop one. Until a commercial test is widely available, growers are unable to determine the risk of infection occurring in soils or fields destined for cane fruit production.

As a control measure against *P. rubi*, growers usually apply fungicide drenches both in autumn and spring, applied to the root zone. The EAMU for SL567A (44.7% w/w metalaxyl-M) has been relied upon for some years, but resistance to metalaxyl has been reported in other crops such as potato (when used to control *Phytophthora infestans*). Other products used by raspberry growers include Shirlan (fluazinam) and Paraat (500 g/kg dimethomorph), but there is always a greater chance of resistance developing in pathogens where products have only a single mode of action. In commercial practice, none of the currently approved products provide complete control, so alternative products would be beneficial to the industry.

The aim of this project was to identify new drench treatments that protect raspberries from root infection by *P. rubi.*

Specific objectives were:

- To identify suitable products for the control or suppression of Phytophthora root rot in raspberry.
- To test products using inoculated growing media to determine their efficacy in the prevention of *P. rubi* infection in raspberry.
- To provide information to growers and the relevant chemical companies on any products that have efficacy and to collaborate with the industry to secure new EAMU approvals to control *P. rubi* in raspberry.

Summary of the project and main conclusions

Objective 1 – Identification of candidate products for root rot control

Five products with potential to control Phytophthora root rot in raspberry were identified in Year 1 of the project. The newly identified products were HDC F181, HDC F182, HDC F183 and Prestop (*Gliocladium catenulatum*). HDC F182 has recently been registered in the UK for use on outdoor strawberries against red core and crown rot, with its efficacy against *Phytophthora cactorum* demonstrated in HDC project SF 99. HDC F183 is approved for use against the closely related potato blight pathogen, *Phytophthora infestans*. Prestop is a biopesticide with full label recommendation for use against root pathogens on cane fruit and an EAMU for outdoor crops. Ranman Twinpack (cyazofamid) was initially selected for assessment, but was removed from the final selection as it was considered highly unlikely to gain an extension of use from potato. After consultation with the HDC Soft Fruit Panel and the product's suppliers (then BASF, now Bayer), a second biological product, Serenade ASO (*Bacillus subtilis* strain QST 713) was chosen as an alternative candidate. This was chosen as it is known to have activity in soil against Phytophthora species. It already has an EAMU approval for use on raspberries and also for trees in amenity situations and forest nurseries, against Phytophthora root rot. The fifth candidate, HDC F181 was a chemical product shown in HDC Project SF 99 to give control of the Phytophthora species causing crown rot in strawberries.

Objective 2 – Evaluation of products for control of P. rubi in raspberry

The evaluation of plant protection products in an inoculated trial commenced in 2012 with Paraat (dimethomorph) used as the industry standard. Drenches of Paraat, HDC F181, HDC F182, HDC F183, Serenade ASO, and Prestop were carried out on 3 October 2012 on cv. Polka modules which were planted into 5 L pots of ericaceous growing medium in May 2012. Plants were grown in a Spanish tunnel with individual irrigation/feed drippers with the timing and volume adjusted to keep the growing media continuously wet. There were ten pots per plot and four replicate blocks of treatments. Each plant pot was placed in a saucer.

Drench treatments were applied twice by pouring 500 ml onto the pots. Artificial inoculation was done either a week later in 2012, or a month after drenching in 2013. Inoculation using mycelial plugs of *P. rubi* buried in the growing media was carried out on the two occasions in October 2012 and again in April 2013, using the isolate SCRP3333, FVR11, IMI355974.

In the first cropping year, no wilting or stem staining developed in the fruiting canes before their removal in January 2013. The re-grown crop was monitored throughout 2013 for wilting of the new shoots. There were no significant treatment differences in wilting. However, the inoculated untreated control had 48% of pots per plot with some symptoms of wilting. Product HDC F182 had the lowest incidence and severity of wilt, when assessed in September 2013. By October, in all the treatments except HDC F183, wilt severity was lower than in the inoculated untreated control.

Destructive assessments were made in January 2014. Most of the roots were found around the face of the rootball. In both the Paraat and HDC F182 treated plants, a smaller proportion of root area was dark brown compared to those in the inoculated untreated control plots (Figure 1). However 33% of the root ball surface was still affected. Other treatments did not differ significantly from the inoculated untreated control plots (which had dark brown roots over 47% of the root ball surface). Lighter brown roots nearer the pot surface (Figure 2) were also present and were probably naturally tanned. Both these and the darker roots lower down were confirmed to contain Phytophthora in inoculated pots. Pythium was also present in these roots and was also present in the roots in the upper and lower root-zone of the uninoculated control pots. No external stem browning was seen and although some internal stem base staining was recorded, this was seen throughout the plots, without treatment differences and no Phytophthora was detected in samples. There was no phytotoxicity.

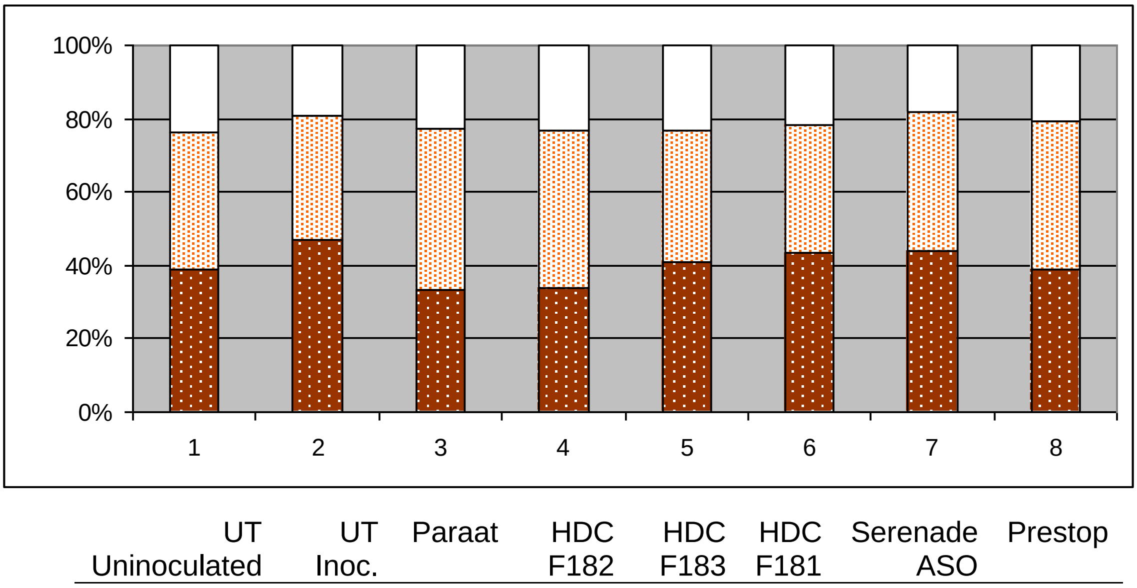

Figure 1: The mean proportion of root ball surfaces taken by dark rotted, lighter and white coloured roots (base to top of bar chart) in January 2014 showing a smaller area of dark brown roots where Paraat or HDC F182 had been drenched twice (P<0.05, Lsd 9.0%)

Figure 2:
Inoculated untreated two year old pot prior to destructive assessment in January 2014 Cane bases were examined for internal infection but the brown colour seen was not confirmed as Phytophthora.
Paler brown roots towards the top of the pot tested positive for both Phytophthora and Pythium. New white roots were growing.
Darker brown, rotted roots visible towards the pot base tested positive for both Phytophthora and naturally present Pythium.

Financial benefits

Effective treatments will reduce crop loss and extend the life of the plantation. Increasing the range of products available to growers for control of Phytophthora root rot via potential EAMUs, would increase the types of active ingredients used and reduce the chance of fungicide resistance developing. This will be particularly important if all soil fumigation products are withdrawn from the industry. Products effective on raspberry are likely to have an effect on other Phytophthora species such as those affecting strawberry and many ornamental species. Growers will be advised initially to drench small areas of their varieties in case of phytotoxicity not seen in the cv. Polka tested in the current work.

There has been interest in the two biological plant protection products to help the industry comply with the EU Sustainable Use Directive for reduced pesticide use. Neither gave significant root rot reduction and so growers should not expend money using them widely without first getting a better understanding of the conditions they might perform well under.

Action points for growers

- Determine the source and aim to stop the initial introduction of *P. rubi* into the crop.
- Utilise lateral flow devices to test roots to confirm symptoms are Phytophthora and thus ensure that the appropriate cultural or chemical control measures are used.
- Fungicide drenching against Phytophthora species needs to continue, but complete control is unlikely.
- Be aware that a molecular diagnostic test for *P. rubi* in soil is under development to facilitate decision making on soil versus container growing and tolerant variety selection based on inoculum thresholds.
- An EAMU should be sought for HDC F182 as it was found efficacious in the current work. This will widen the modes of action available to growers for *P. rubi* control.
- HDC F182 requires testing at different rates and application intervals in soil grown crops that have tested positive for *P. rubi* to seek to obtain the best efficacy.
- Do not discount the use of biological plant protection products; more understanding is needed of the host-pathogen-biological control agent relationship and how to utilise beneficial micro-organisms.