Horticultural Development Company

Grower summary

FV 358

Onion: Pot experiment to examine the suppression of Fusarium basal rot using compost colonised with Trichoderma viride

Final Report 2009

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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 HDC office (hdc@hdc.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Headline

Under high disease pressure, compost colonised with *Trichoderma viride* S17A and incorporated in soil at 25% reduced Fusarium in onion plants by 48% compared with the soil control

Background

In onion growing, Fusarium basal rot is becoming a greater problem in the UK and other parts of Northern Europe and is likely to increase with global warming. US-bred short-day varieties of onion that show resistance to Fusarium basal rot may not be resistant to European strains of the pathogen *Fusarium oxysporum* f.sp. *cepae*, and do not have the same attributes of susceptible long-day varieties. The only approved (off-label) fungicide for Fusarium of onion is a seed treatment with thiabendazole + thiram; however this treatment is aimed at preventing damping-off of seedlings and not basal rot. A HortLINK project (HL0176) has shown that that *Trichoderma viride* S17A can colonise a wide range of composts. Control of Allium white rot in the field has been achieved by broadcasting and incorporating Trichoderma colonised compost into soil artificially infested with sclerotia of the pathogen, *Sclerotium cepivorum*. The Trichoderma can persist in the soil and control white rot from one year to the next, potentially avoiding the need for repeated applications. Broadening the efficacy of Trichoderma colonised compost to also control Fusarium basal rot would enhance the economics of a single treatment.

There are increasing amounts of compost available (currently around 3 million tonnes/year in the UK). Commercial trials in the above LINK project showed that screened compost could be applied within the onion planting row at rates of 3–5 tonnes/ha using a modified set planting machine. At such rates, the *Trichoderma* colonised and degraded compost can provide useful amounts of plant nutrients, particularly P and K.

A Defra funded project at Warwick HRI has developed a PCR-based method for distinguishing formae speciales of *Fusarium oxysporum*. Cultures obtained from diseased onions in the UK have been identified as *F. oxysporum* f.sp. *cepae* and *Fusarium proliferatum,* when compared with resulting onion disease symptoms and molecular taxonomy of isolates deposited in fungal culture collections elsewhere. This has enabled isolates confirmed as *F. oxysporum* f.sp *cepae* to be available for the pathogenicity bioassay used for this pot experiment.

Objectives and expected deliverables

- Obtain isolates of the pathogen *Fusarium oxysporum* f.sp. *cepae* from onion crops.
- Produce composts colonised with *Trichoderma viride*.
- Determine the suppressive effects of composts inoculated with *Trichoderma viride* on basal rot of onion in pot bioassays.
- Monitor the populations of Trichoderma and Fusarium propagules in the compost amended soil and non-amended soil.
- Disseminate results to the onion industry and make recommendations for future pot and field-scale experiments.

Summary of the project

A pot bioassay experiment was set up to examine the effect of incorporating green waste compost, with and without colonised Trichoderma, into soil on Fusarium in onion plants. The soil and soil/compost mixtures were infested with a chlamydospore inoculum of *Fusarium oxysporum* f.sp. *cepae*. Soil and soil/compost mixtures without the Fusarium chlamydospore inoculum were also prepared. The following treatments were compared:

- Control, no compost amendment added to soil
- Compost incorporated in soil at 25% and 40% by volume
- Compost, colonised with *Trichoderma viride* S17A, incorporated at 25% and 40%
- Compost, colonised with *Trichoderma hamatum* L4, incorporated at 40%.

Plant deaths due to Fusarium were recorded during a 19-week growing period, and as basal rot symptoms at harvest. The weight of symptomless onions at harvest was also recorded.

Main conclusions

1. Under high disease pressure, compost colonised with *Trichoderma viride* S17A and incorporated in soil at 25% reduced Fusarium in onion plants by 48% compared with the soil control. This compares with a 26% reduction in white rot previously found in a pot experiment with the same treatment, although white rot control in the field with the same treatment was 59-100%.
2. After growing in Fusarium infested soil, average weight of onions without disease symptoms was higher following incorporation of 25% *T. viride* S17A-colonised compost than in the soil control.
3. Compost without added Trichoderma and incorporated in soil at 25% had no effect on Fusarium disease symptoms or plant weight compared with the soil control.

4. Compost without added Trichoderma and incorporated in soil at 40% increased Fusarium; this effect of was offset by the presence of *T. viride* S17A in the compost.
5. Results for *T. viride* S17A were slightly better than for *T. hamatum* L4 although the differences were not significant.
6. There were no Fusarium disease symptoms in any of the treatments without the Fusarium chlamydospore inoculum.
7. There were no differences in average plant weight at harvest between treatments without the Fusarium chlamydospore inoculum.
8. Following application of Trichoderma-colonised compost to soil, the Trichoderma propagule count in the soil remained at a high level throughout the glasshouse pot experiment, although the decline was greater than that observed in the field, possibly due to the warmer and less favourable conditions for Trichoderma survival in the glasshouse.

Financial and environmental benefits

- Potential for control of both Fusarium and white rot using a single treatment of *Trichoderma virdie* S17A colonised compost.
- The pot bioassay developed is an effective method for preliminary testing the efficacy of treatments against Fusarium of onion, before testing in the field.
- Substitution of inorganic fertilisers, particularly P and K, by application of compost.
- Suitable for conventional and organic production.

Action points for growers

- Further development work on a range of Trichoderma isolates in pot experiments and in the field is needed to establish which isolates are the best. Work is currently being conducted on semi-commercial scale production of Trichoderma colonised compost, and within planting row compost application.
- High rates of compost or organic matter application immediately before an onion crop, in the absence of Trichoderma, should be avoided since this appears to encourage Fusarium, possibly by increasing soil moisture availability or by volatiles released from the compost stimulating Fusarium chlamydospore germination. This mechanism requires further investigation since it may also provide an opportunity for longer term Fusarium disease control, and has implications for the application of high rates of onion waste compost at short or long intervals before onion cropping.
- Where compost is applied to onions, inorganic fertiliser rates, particularly P and K, should be reduced.