Grower Summary

CP 124

Managing ornamental plants sustainably (MOPS):

The efficacy of soil setting for the control of Fusarium in soil

Annual 2014

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Work package leader:	Erika Wedgwood
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GROWER SUMMARY

Headline

Anaerobic soil disinfestation of soil using three high-protein plant based products from Dutch manufacturer Thatchtec showed one treatment (Herbie 14.3 + Herbie 67P starter) to significantly reduce the proportion of infested plant stems with *Fusarium* in debris buried for two weeks.

Background and expected deliverables

Soil-borne pathogens invariably build up in the soil with intensive mono-cropping as is generally practiced for high-value speciality crops such as cut flowers. After the loss of methyl bromide and the restriction of Basamid (dazomet) use to once in every three years, soil disinfestation for cut flowers grown under protection now largely relies on steam sterilisation. This method, whilst effective, is not without risk and is costly, labour-intensive and not environmentally sustainable in the long-term. Alternative methods of soil disinfestation that are effective, sustainable and practical to apply are urgently required. The major soil-borne pathogen of ornamental crops in the UK is *Fusarium* (e.g. affecting lisianthus, column stocks), but results are likely to be relevant to other soil-borne diseases, such as *Verticillium* spp. and *Sclerotinia* spp.

Anaerobic soil disinfestation (ASD), is a potential non-chemical alternative for glasshouse and field crops. It involves incorporation of specified organic matter (e.g. with a known C/N ratio and protein content) into soil at a high moisture content and covering with oxygen-impermeable film for 4-6 weeks. Efficacy is believed to arise from production of low molecular weight fungitoxic acids and other chemicals. There is strategic work on the technique, known as soil setting, by Wageningen University. Applied research by a commercial company in the Netherlands (Thatchtec BV) is seeking to understand the mechanisms of activity with a view to optimising effect and reducing treatment time to 2 weeks. The technique has been used in commercial organic tomato production in the UK and initial results look promising. Scientific assessment of the level of control of *Fusarium* by the use of organic fermentation products of high protein content of specific composition from Thatchtec (Herbie products) is required, as these could be utilised by soil-growing cut flower growers to reduce pathogen levels in the soil between crops.

The specific objectives of this work (2014 and 2015) are:

- To determine the efficacy of Herbie organic material products against *Fusarium oxysporum* in soil
- To determine the effect of temperature on the efficacy of Herbie treatment

Summary of the work and main conclusions

Experiments followed guidance provided by Thatchtec, the manufacturer of the Herbie soil setting products used in the trial, and aimed to simulate soil glasshouse anaerobic soil disinfestation (ASD).

9.5 L polypropylene pots were filled with 8 L of un-sterilised loamy sand collected from inside a recently cropped glasshouse at a column stocks nursery. This soil was treated with one of three Herbie products with or without the pre-addition of a Herbie starter product prior to filling. Treatments were incorporated by hand mixing the product with soil. Two net bags (on strings to allow retrieval) containing plant material from *Fusarium oxysporum* infested stocks plants were buried at a cultivation depth of about 100 mm per container. These pots were watered with 600 ml tap water and each container was covered tightly with a black polythene cover and left in a polytunnel aiming to achieve temperatures up to the optimum for Herbie anaerobic soil disinfestation of 25°C for 8 weeks. The six Herbie treatments were compared with two untreated controls which comprised of inoculated buckets without any Herbie products, replicated four times.

Temperature inside each container was recorded throughout the experiment. Inoculum bags were retrieved after two and eight weeks of treatment, and plant material was isolated onto agar and the percent *F. oxysporum* re-isolation was assessed after three and seven day's incubation. Soil was sent for nutrient analysis at the end of the trial from each treatment and the control to assess for changes to soil mineral content and percent organic matter. Data was analysed by analysis of variance.

After two weeks of ASD treatment, Herbie 14.3 with the addition of the starter product showed significantly less *Fusarium oxysporum* on the plant material extracted when compared with the untreated control (Figure 1). Other Herbie treatments did not show an effect.

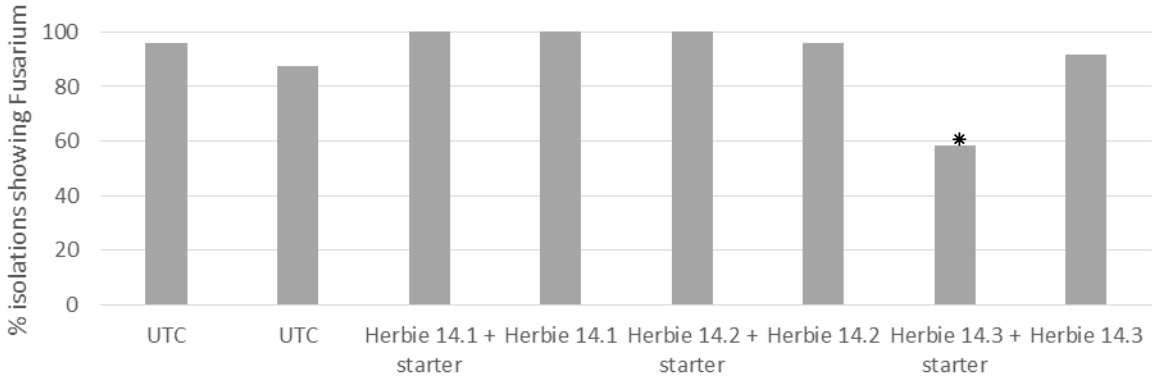

Figure 1. Assessment of plant material isolations retrieved after two weeks ASD. Percentage of infested stocks stems showing *Fusarium oxysporum* after 7 days incubation on agar**.** * denotes statistical significance at the 95% confidence level.

After eight weeks of ASD treatment, Herbie 14.3 with the addition of the starter product continued to show lower levels of Fusarium however this result was no longer statistically significant.

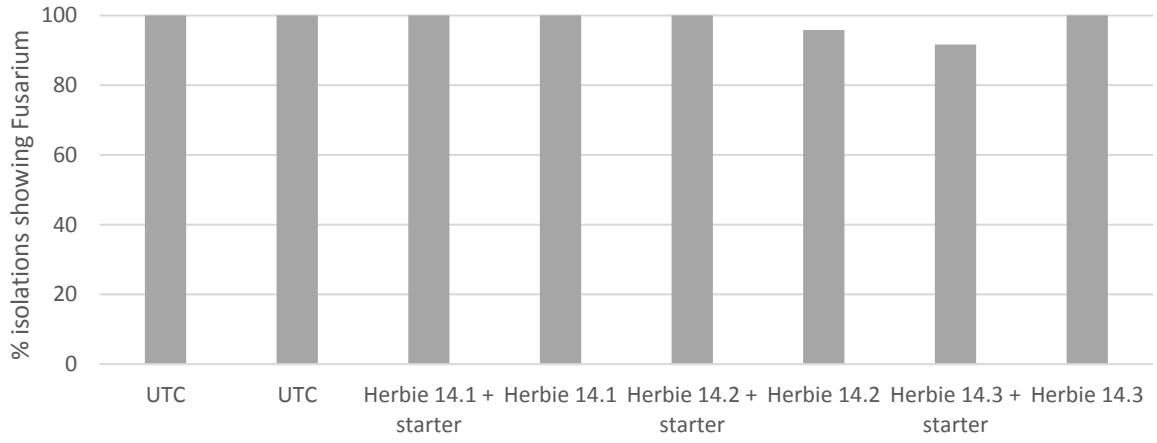

Figure 2. Results of the seven day assessment of plant material isolations made after eight weeks ASD, graph shows % plant material showing *Fusarium oxysporum*

Soil temperatures on average ranged between 15 and 30 °C through the eight weeks of the trial. During the first week of the trial, temperatures in the untreated control were on average 1 °C cooler than the six Herbie treatments suggesting the microbial action in these treatments may be raising the soil temperature slightly. This trend did not continue through August and September however. There was some concern that completely anaerobic conditions were not achieved throughout the trial because of the loss of tightness of the seal around the logger cables where they exited the pots.

Analysis of the soil after eight weeks showed that the three treatments which used the Herbie starter had on average 2 % greater soil moisture, and this was probably because the starter mix was produced by incubation of the Herbie 67P starter product in saturated soil. Interesting trends in other components were noted. The percentage of organic matter was higher in all six Herbie treatments compared with the control. Sulphates were higher in all six Herbie treatments and greatest in treatment seven (14.3 + starter) which appeared to be the most effective treatment. This treatment (14.3 + starter) also showed the greatest amount of available nitrogen, phosphorus and potassium.

Action Points

The most effective Herbie treatment (14.3 + starter) will be used in a further pot trial in 2015 to investigate soil treatment under cooler temperatures i.e. winter when sterilisation is normally carried out post-Christmas in the between-crop gap.