# Grower Summary

## FV 352

Disease management in organic Brassica seed and transplants

Final 2011

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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.

## 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.

## Further information

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

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## Headlines

- Treating seed with hot water, thyme oil, Serenade ASO or an experimental product B0002 reduced *Phoma* and *Alternaria*.
- Minimising watering, incorporating composted green waste or Trianum prior to sowing reduced *Pythium* infection in transplants.

## Background and objectives

The use of healthy, clean seed and planting material is an important component of effective disease management for plant propagators and is essential for organic growers who have fewer options for disease control. This was highlighted at an HDC/HDRA stakeholder day (Managing Pests, Diseases and Weeds in Organic Vegetable Production, Ryton Organic Gardens 2007) where the importance of seed quality and good disease management was identified by stakeholder discussion groups as a priority area for future research.

Diseases caused by soil and seed-borne fungal pathogens such as *Pythium* spp., *Rhizoctonia solani* (damping-off, soil-borne), *Alternaria* spp. and *Phoma* (seed-borne) are a major problem for all plant propagators, especially for high volume / high value plants such as vegetable Brassicas which have a total production value of ca. £200 million in the UK (Defra statistics, 2007). Additional disease problems may also be created for organic plant raisers through the use of companion planting (e.g. bird's foot trefoil for management of cabbage root fly) as the species employed are often fodder crops of variable seed quality which could harbour pathogens and reduce the germination and emergence of both companion and crop.

A number of products which claim to have benefits for disease management in organic transplant production are now available in the EU and are marketed as growth promoters, plant strengtheners or crop protection agents. In particular, suppressive microbial inoculants and composts have shown promise for disease control and there is increasing interest in these products in conventional production systems because of the pressure to reduce pesticide use and the potential loss of many active ingredients with the revision of EC directive 91/414.

The aim of this project was to evaluate a range of organically acceptable compost and Brassica seed treatments for their efficacy and cost effectiveness in controlling damping-off diseases caused by *Pythium* and *Rhizoctonia* and seed-borne diseases caused by *Phoma* and *Alternaria*.

During the first year of the project, compost and seed treatments were tested independently for their effects on soil-borne and seed-borne fungi respectively. In the second year the

most promising treatments were tested in combination and in a more realistic simulated plant-raising set up.

## Summary of results and conclusions

### Compost treatments (year 1)

The microbial products Trianum, Prestop, Mycostop, Subtilex, Revive P and green waste compost inoculated with *Trichoderma* (*T. viride* S17A or *T. harzianum* from Trianum) were tested for their efficacy in controlling damping-off of cauliflower seedlings caused by *P. ultimum* and *R. solani* and compared with a fungicide treatment (thiram-treated seed) in multiple experiments. The pathogens were introduced into Bulrush Organic Modular Compost and the microbial treatments added as drenches or granules at the recommended rates. Green waste compost with or without *Trichoderma* was added at 20% v/v. The amended Bulrush compost was dispensed into modules and cauliflower seed (cv. Belot) sown. The number of healthy seedlings was assessed over time.

Damping-off disease pressure varied between experiments but overall there was no consistent or clear benefit from adding the microbial products tested for control of *P. ultimum* or *R. solani.* However, at low disease pressures there was some evidence that green waste with or without *Trichoderma* was beneficial. The thiram-treated seed consistently controlled *P. ultimum* but was less effective against *R. solani* at high disease pressures.

### Seed treatments (year 1)

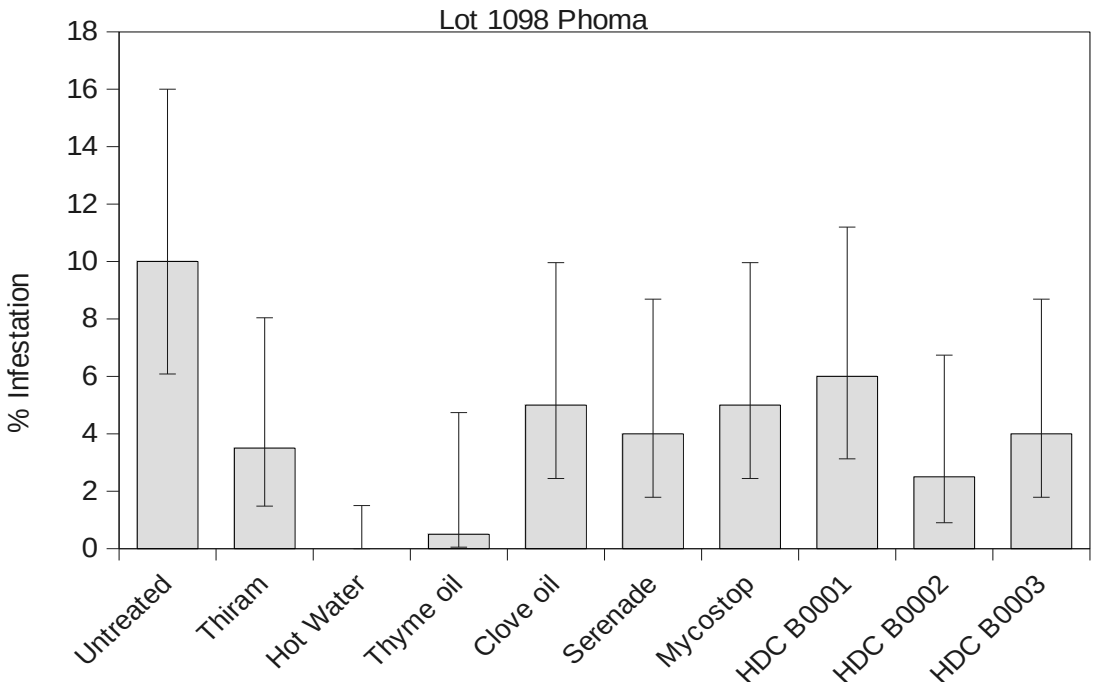
Hot water, two plant oils (thyme and clove), and five microbial products (Serenade, Mycostop and three experimental biocontrol agents) were assessed for their efficacy in the control of two seed-borne fungal pathogens of Brassicas, and improving emergence of the companion plant bird's foot trefoil. Seed was treated at recommended rates and pathogen infestation levels assessed in a standard 2,4-D blotter seed test (Brassicas) or freeze-blotter test (bird's foot trefoil). Effects on emergence and disease transmission were assessed by sowing seeds in trays of Bulrush Organic Modular Compost.

Hot water, Thyme oil, and the experimental product B0002 gave statistically significant reductions in *Phoma* seed infestation levels (shown in the Figure below), and a greater reduction than the chemical standard Thiram. Hot water in particular reduced infestation to undetectable levels (i.e. <1.5%). In transmission/emergence tests the proportion of seedlings affected by *Phoma* was significantly reduced by treatment with hot water, thiram, thyme oil and Serenade with hot water having the greatest effect.

All treatments gave a statistically significant reduction in the level of *Alternaria* infestation compared to the untreated control. The greatest reductions were achieved with hot water, Thyme oil, clove oil, the microbials Serenade and HDC B0002, and the fungicide Thiram. Again hot water reduced infestation to undetectable levels (i.e. <1.5%).

Emergence was relatively poor for the bird's foot trefoil and was not improved by any of the treatments.

Treatment with hot water led to a small but significant increase in damping off. None of the treatments gave a significant reduction in damping-off compared to the untreated controls.




**Effect of seed treatments on levels of Brassica seed infestation by *Phoma lingam* in a 2,4-D blotter seed test. Error bars represent the 95% confidence limits.**

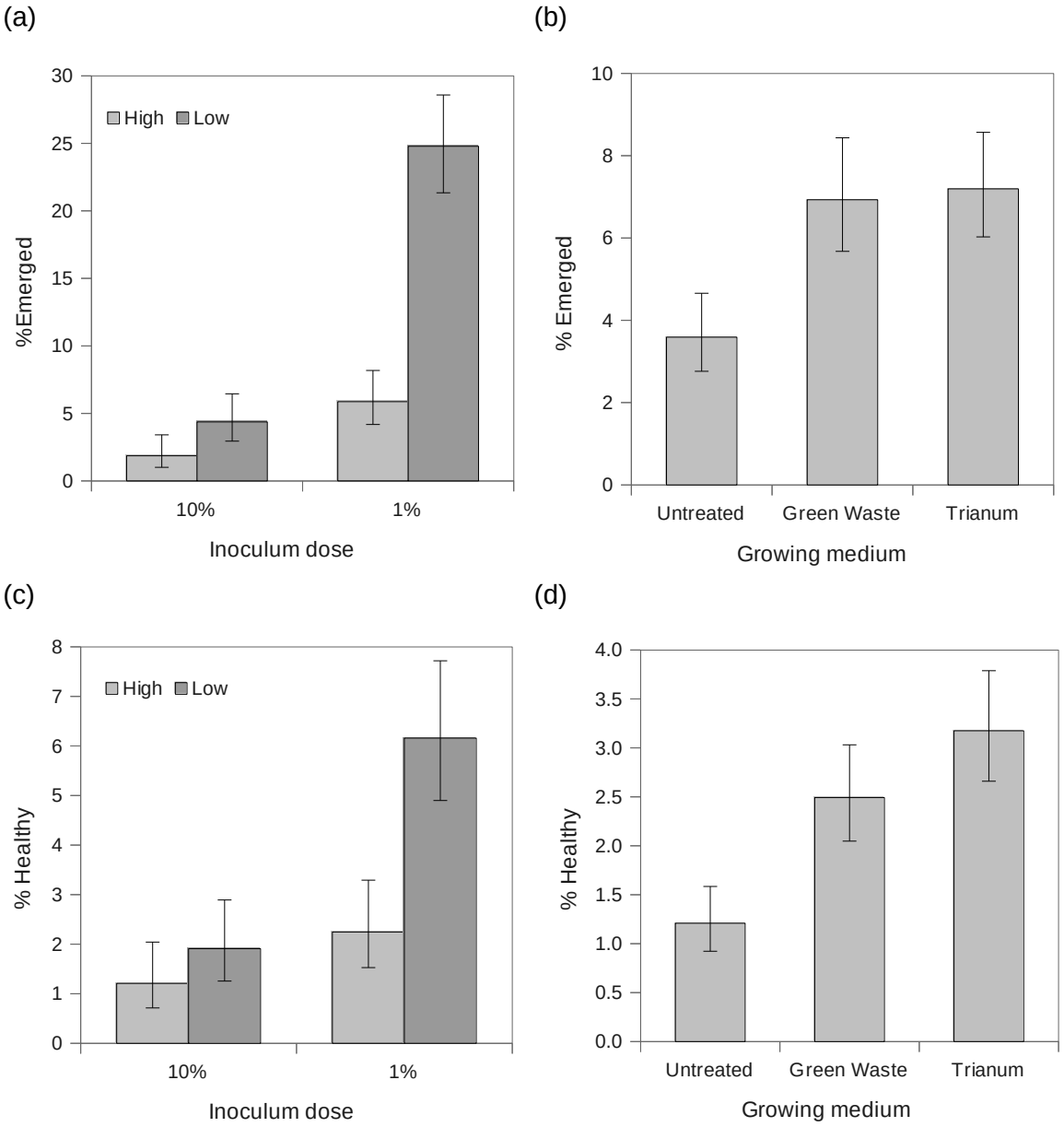
## Compost and seed treatments (year 2)

A factorial combination of four seed treatments (untreated, thyme oil, Serenade ASO and HDC B0002) and three growing medium treatments (untreated, 20% green waste, Trianum) was examined, to give a total of 12 treatment combinations. Each treatment was applied to a whole '345' module tray, with two trays for each treatment. The growing medium was Bulrush modular organic compost and all of the growing medium was inoculated with *P. ultimum*. The trays of each treatment were set out randomly on two separate benches in a glasshouse. Watering was via an overhead sprinkler system controlled by a timer and the two glasshouse benches were subject to different watering regimes (high and low), with the

high regime receiving double the amount/duration of irrigation as the low regime. Trays were initially given 20/10 minutes watering, then subsequently 8/4 min daily at 08:15 (with occasional manual cancelling, depending on weather conditions). Emergence and the presence of disease symptoms was recorded approx. 14 d after sowing. The entire experiment was repeated twice, with a reduced inoculum level in the second experiment.

Results can be summarised as follows:

- Emergence and the number of healthy Brassica seedlings was greater with the lower inoculum dose (shown below in a and c).
- Emergence and the number of healthy Brassica seedlings was greater with the low watering regime (a and c).
- Both of the growing medium treatments, green waste (20%, at sowing) and Trianum (pre-incorporated 2 weeks before sowing) increased emergence and the number of healthy Brassica seedlings (b and d).
- The high level of *Pythium* infection prevented the evaluation of the effect of treatments on seed-borne *Phoma* infection.
- None of the seed treatments had a significant positive effect on emergence or the number of healthy Brassica seedlings; Serenade ASO and thyme oil appeared to have an adverse effect.




**Effects of treatments on Brassica emergence and % healthy seedlings: (a, c) watering regime (high, low) and inoculum dose; (b, d) growing medium treatment. Error bars represent the 95% confidence limits. Results based on combined data from two experiments.**

## Conclusions

- Keeping water applications to the minimum necessary is likely to have the biggest impact on *Pythium* infection in Brassica transplants.

- Incorporating green waste (just before sowing) or Trianum (two weeks before sowing) into the growing medium is likely to give a beneficial reduction in the levels of *Pythium* infection.
- Pre-incorporation should now be examined for other microbial products.
- Seed treatment with hot water (50°C, 30 min) gave the greatest control of *Phoma* and reduced *Alternaria* Brassica seed infestation to undetectable levels, but is not without problems and precise temperature-time conditions should be determined on a per seed lot basis.
- Seed treatment with thyme oil (1%) reduced both *Phoma* and *Alternaria* in Brassica seed, but its use is not currently approved.
- Two microbial seed treatments (Serenade ASO and an experimental product B0002) gave promising results against both *Phoma* and *Alternaria.* Their use as seed treatments is not currently approved.
- Conflicting results were obtained for the impact the Serenade ASO and thyme oil seed treatments on emergence.
- Emergence in the bird's foot trefoil was relatively poor, but this could not be attributed to any specific fungal pathogens and none of the seed treatments gave any improvement in emergence compared to the untreated control.
- Bird's-foot trefoil appears to be less susceptible to *Pythium* infection than Brassicas.

The Table below lists the approval status of products used in this project:

**Pesticide approval status of the various treatment products used in this study**

| Treatment/Product | A.I. | Status |
|---|---|---|
| *Compost treatments* | | |
| Trianum | *Trichoderma harzianum* | Listed on Annexe 1 of 91/414. Currently undergoing registration. |
| Prestop | *Gliocladium catenulatum* | Full approval for all edible (protected) and non-edible crops (protected) |
| Mycostop | *Streptomyces griseoviridis* | Not approved in the UK. Approved in several EU countries. |
| Subtilex | *Bacillus subtilis* | Not approved. |
| Revive P | *Bacillus subtilis* | Not approved, but marketed as a 'Microbial Soil Treatment' |
| Green Waste | | Approval not required. |
| *Seed treatments* | | |
| Hot water | | Approval not required. |
| Thiram | Thiram | Approved as a seed treatment for Brassicas. |
| Thyme oil | | Not approved, Annexe 1 listing in progress? |
| Clove oil | | Not approved, listed on Annexe 1 of 91/414 |
| Serenade ASO | *Bacillus subtilis* | Not approved for application to seeds. Approved for foliar application to all crops (SOLA ). |
| Mycostop | *Streptomyces griseoviridis* | Not approved in the UK. Approved in several EU countries. |
| HDC B0001 | | Experimental product. Not approved. |
| HDC B0002 | | Experimental product. Not approved. |
| HDC B0003 | | Experimental product. Not approved. |

## Financial benefits

Severe *Pythium* infection has the potential to cause complete crop loss for transplant producers. Minimisation of watering requires more attention to monitoring of the crop (and hence more staff time or equipment) but is likely to be worthwhile where *Pythium* infection has been a problem. Using growing media containing a proportion of green waste (produced according to PAS 100) should cost no more than media without, but there may be other risks and cost implications to the business, such as increased insurance costs. Incorporating Trianum may add around £0.05 per module tray, but is probably only worthwhile after efforts have been made to accurately monitor/apply water.

## Action points for growers

- Minimisation of watering should be the first consideration for the management of *Pythium* disease levels.
- Consider using growing media containing up to 20% composted green waste, but not without also considering the business, health and safety risks and insurance implications.
- Consider using growing media with Trianum pre-incorporated.
- Do not routinely use hot-water treatments without optimisation on a per-seed lot basis to avoid the potential for detrimental effects on emergence.
- Consider supporting an HDC-funded 'commodity approval' for thyme oil.
- Contact the manufacturers of the potential microbial seed treatments (Agraquest and Becker Underwood) or their distributors to demonstrate interest in the products.