Biological control of *Allium* white rot by sclerotial degrading fungi


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Introduction


White rot on onion bulbs

Onion white rot caused by the fungus *Sclerotium cepivorum* is a serious disease of onions world-wide and a good target for biological control because:

- there are no resistant onion varieties
- soil fumigation is unreliable or being phased out
- chemicals are not registered, ineffective or unreliable
- white rot – free land is decreasing

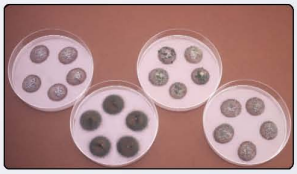

White rot symptoms in the field

A screening programme involving an agar test, sclerotial degradation assay and onion seedling bioassay was developed to identify fungal biological control agents (BCAs) of *S. cepivorum*. Effective isolates were tested in the field.

Methods

Screening program for BCAs of *S. cepivorum*

1. Agar test: drops precolonised with *S. sclerotiorum* were confronted with test fungi and sclerotial degradation assessed.


Agar test

2. Sclerotial degradation assay: BCA bran cultures or spore suspensions were tested for their ability to degrade *S. sclerotiorum* sclerotia in soil.


Sclerotial degradation test

3. Onion seedling bioassay: BCA bran cultures or spore suspensions were used to amend soil infested with *S. cepivorum* sclerotia. Onions were sown and plants assessed for white rot.


Seedling bioassay

Field trials


BCAs suspended in guar gum were applied in furrow using a modified drill

Bran cultures of BCAs were fluid drilled in guar gum with onion seed and / or applied to the stembase mid-season.

A tebuconazole seed treatment and untreated plants were included as controls and white rot was assessed weekly.

Results

Screening programme

- 65 (45%) of 154 fungal isolates tested degraded more than 80% of *S. cepivorum* sclerotia on agar.
- 15 (88%) of 17 most effective BCAs from the agar test caused significant degradation of sclerotia in soil when applied as wheat bran cultures compared to only 4 when applied as spore suspensions. Up to 60% of sclerotia were degraded.
- 16 (47%) of 34 BCAs tested controlled white rot in seedling bioassays when applied as wheat bran cultures compared to 12 when applied as spore suspensions. Up to 66% disease control was achieved.

Field trials

- Two isolates of *Trichoderma viride* (S17A & L4) controlled white rot in the field in two years of trials.
- The best disease control was achieved if BCAs were applied at drilling.
- At harvest, the proportion of diseased bulbs in BCA treatments was significantly reduced compared to the untreated control (Table 1).
- The tebuconazole seed treatment suppressed white rot symptoms during the season but did not control disease at harvest (Table1).

Treatment	Proportion bulbs infected
Untreated control	0.75
Tebuconazole treated seed	0.72 NS
S17A drill	0.64 *
S17A stembase	0.64 *
S17A drill/stembase	0.51 ***
L4 drill	0.54 ***
L4 stembase	0.74 NS
L4 drill/stembase	0.47 ***

Table 1. Effect of biological control agents on percentage of onion bulbs infected with white rot at harvest in 2001. Significance from untreated control at *** $P \leq 0.001$, ** $P \leq 0.01$, *$P \leq 0.05$. NS = not significant.

Future

The level of field control by BCAs could be improved by increasing the biomass applied to the seedbed and/or by integrating with other control methods such as use of soil amendments, semi-resistant onion varieties and fungicides.

More information

Clarkson JP, Payne T, Mead A, Whipps JM (2002) Selection of fungal biological control agents of *Sclerotium cepivorum* for control of white rot by sclerotial degradation in a UK soil. *Plant Pathology* **51**, 735-745