SoilWealth | ICP
nurturing crops · protecting crops

THE ONION PROJECT

5th Soilborne Disease Masterclass

Biological control of vegetable soilborne diseases

Len Tesoriero

Adelaide 8th and 9th May 2024

Hort Innovation ONION FUND

This project has been funded by Hort Innovation using the onion research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Hort Innovation MELON FUND

This project has been funded by Hort Innovation using the melon research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Hort Innovation VEGETABLE FUND

This project has been funded by Hort Innovation using the vegetable research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

AUSVEG

Hort Innovation

ahr applied horticultural research

RMCG

Definitions of disease suppression by microbes

(Cook & Baker, 1974)

General suppression results from competition between pathogens and various microbes in soils (or composts)

Specific suppression is direct biocontrol by specific microbes such as hyperparasites, enzyme, detergent or antibiotic producers

Microbial biocontrol modes of action

- parasites of plant pathogens (hyperparasites)
- produce antibiotics, enzymes, & surfactants
- competitors for space and food
- produce plant growth promoting chemicals
- induce plant resistance response (ISR)

Some examples of common microbial biocontrols

Bacillus spp.

Pseudomonas spp.

Streptomyces spp. & *Actinomyces* spp.

Trichoderma spp.

Arbuscular mycorrhizae (e.g. *Glomus* spp.)

Various fungal & bacterial epiphytes & endophytes – *cross protection*

Bacteriophages & Mycoviruses

Others – Amoebae, worms etc.

Other properties required for biocontrol efficacy & registration

- Rhizosphere competence (ability to colonise & compete; effect of root substrates; interspecies signalling that can down-regulate genes coding for antibiotics)
- Inoculant delivery system (formulation; shelf-life & use-pattern)
- Environmental Impact (non-target organisms)

Some limitations of biocontrols

- Some are very specific to certain pathogens (some strains of pathogens but not others)
- Some work with certain plant cultivars & not others (rhizosphere competence)
- Some have efficacy that depends on plant age
- Some have temperature-dependent efficacy
- Some are affected by common fungicides
- Coevolution of other microbes – e.g. enhanced chemical or antibiotic breakdown; bacteriophages

Overcoming limitations of biocontrols

- Using combinations of biocontrols with different specificity &/or modes of action
- Screen plant cultivars to validate efficacy
- Develop ‘use-pattern’ for product (treatment type/frequency x dose x plant age)
- Check for environmental variables that might influence efficacy
- Determine compatibility

Points where biocontrols can be applied

- Seed dressing
- Seedling production
- As a preventative during production via trickle irrigation or in nutrient channels (hydroponics)

Chemical controls

- Protectant & systemic fungicides ('biorationals')
- Oils and bicarbonates ('soft fungicides')
- Growth promoting organic acids & plant hormones
- Induced Systemic Resistance inducers (Silicates, Salicylic acid derivatives, chitosan)
- Fungicides derived from microbial secretions
  - Synthetic strobilurins (ex. Fungus)
  - synthetic analogues of pyrrolnitrin (eg fludioxonil - ex. *Pseudomonas* sp.)