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Soil borne disease control: Current, new and emerging options

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What we will cover

- Current chemical options for priority diseases identified in the SARP
- Options to chemical use including biopesticides to manage resistance
- Emerging options for soil borne disease control
- Trial examples on selected diseases



Soil borne diseases



Priority diseases– chemical and biopesticide control options

Crop	Disease	Control options
Brassicas 2020 SARP	Bacterial soft rot (<i>Pseudomonas spp</i>)	Copper products Biological – <i>Bacillus amyloliquefaciens</i>
Carrots 2019 SARP	Cavity spot and forking (<i>Pythium sulcatum and P. violae</i>)	Fumigants - Chloropicrin (Grp 8A), Metham Sodium Metalaxyl (Grp 4) Biological- <i>Streptomyces lydicus</i>
Celery 2021 SARP	Sclerotinia Rot (<i>Sclerotinia sclerotiorum</i>)	Iprodione (Grp 2), Boscalid (Grp 7)
Cucumbers 2020 SARP	Fusarium wilt (<i>Fusarium oxysporum</i>)	Fludioxonil (Grp 12) Fumigants - Chloropicrin (Grp 8B), Dazomet (Group 8F)
	Damping- off (<i>Pythium spp., Phytophthora spp., Fusarium spp. & Rhizoctonia spp</i>)	Fumigants - Chloropicrin (Grp 8B), Chlorothalonil (Grp M5), Metalaxyl (Grp4), Thiophanate –methyl + Etridiazole (Grp 1+14) <i>Bacillus amyloliquefaciens</i> (Grp 44) <i>Streptomyces lydicus</i> (Grp BM02)

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Priority diseases and control options various vegetable crops

Crop	Disease	Control options
Lettuce 2021 SARP	<i>Sclerotinia Rot/ Lettuce Drop (S. minor, S. Sclerotiorum)</i>	Azoxystrobin (Grp 11), Boscalid (Grp 7), Cyprodinil + Fludioxonil (Grp 9 + 12), Dazomet (Grp 8F), Fludioxonil + Pydiflumetofen (Grp 12+7) , Fluopyram + Trifloxystrobin (Grp 7 + 11), Iprodione (Grp 2), Mandestrobin (Grp 11) , Penthiopyrad (Grp 7), Tebuconazole (Grp 3), Bacillus amyloliquefaciens (Grp BM 02), Aureobasidium pullulans (Gro BM 02), Fluopyram + Tebuconazole (Grp 7 + 3) Fumigants- Metham sodium
Leeks, celery 2020,2021 SARP	Fusarium foot rot (<i>Fusarium avenacium & F. oxysporum</i>) Sclerotinita Rot (<i>Sclerotinia sclerotiorum, Sclerotinia minor</i>)	Fumigants- metham sodium chlorpicrin (Grp 8), Dazomet (Group 8F), Mancozeb + sulphur, Thiabendazole (Grp 1) Boscalid (Grp 7), Iprodione (Grp 2) Fluopyram + Tebuconazole (Group 7+3) Bacillus amyloliquefaciens strain MBI 600 Cyrpodinil + Fludioxonil (Group 9 + 12)
French beans 2021 SARP	Sclerotinia Mould (<i>S. sclerotiorum</i>)	Fumigants- 1,3-Dichloropropene + Chloropicrin, Dazomet (Grp 8F) Azoxystrobin (Grp 11), Boscalid (Grp 7), Cyprodinil + Fludioxonil (Grp 9+12), Mandestrobin (Grp 11)

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Priority diseases and control options for onions

Crop	Disease	Control options
Onions 2020 SARP	<i>White rot (Sclerotium cepivorum)</i>	Axoxystrobin + Oxathiapiprolin (11+49), Procymidone (Grp 2) , Tebuconazole (Grp 3), Triadimenol (Grp 3), Bacillus amyloliquefaciens Strain QST 713
	<i>Pink root (Phoma terrestris)</i>	Bacillus amyloliquefaciens Strain QST 713 (Group 44)
	<i>Basal Rot (Fusarium oxysporum)</i>	Bacillus amyloliquefaciens Strain QST 713 (Group 44)

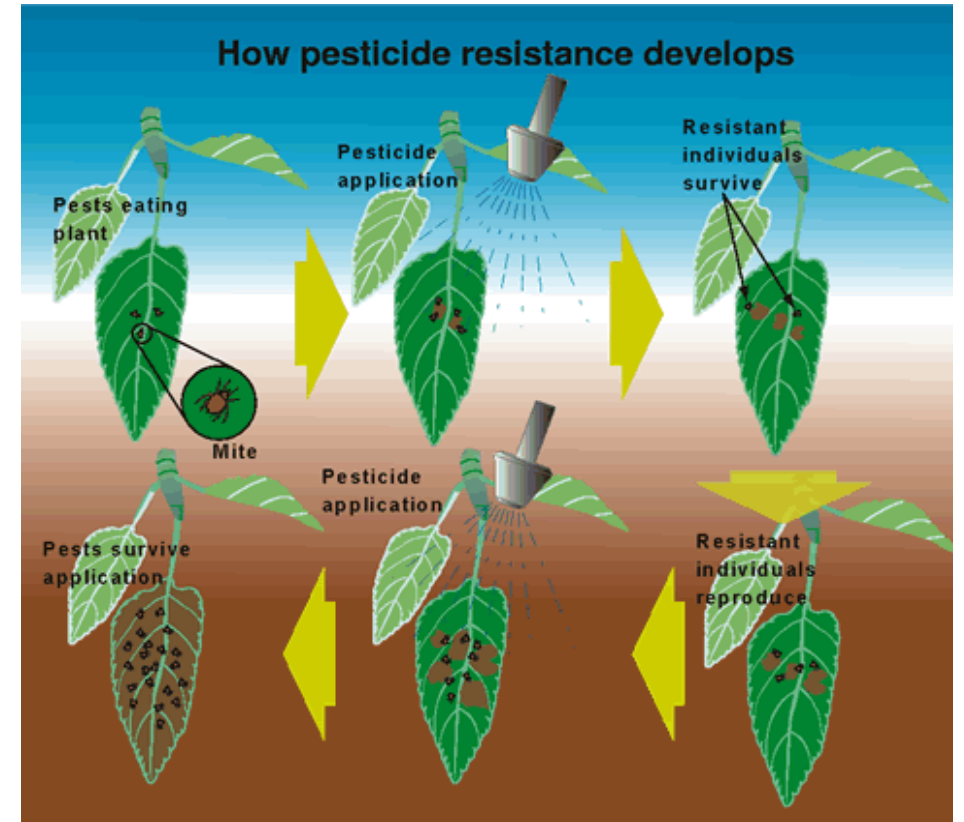
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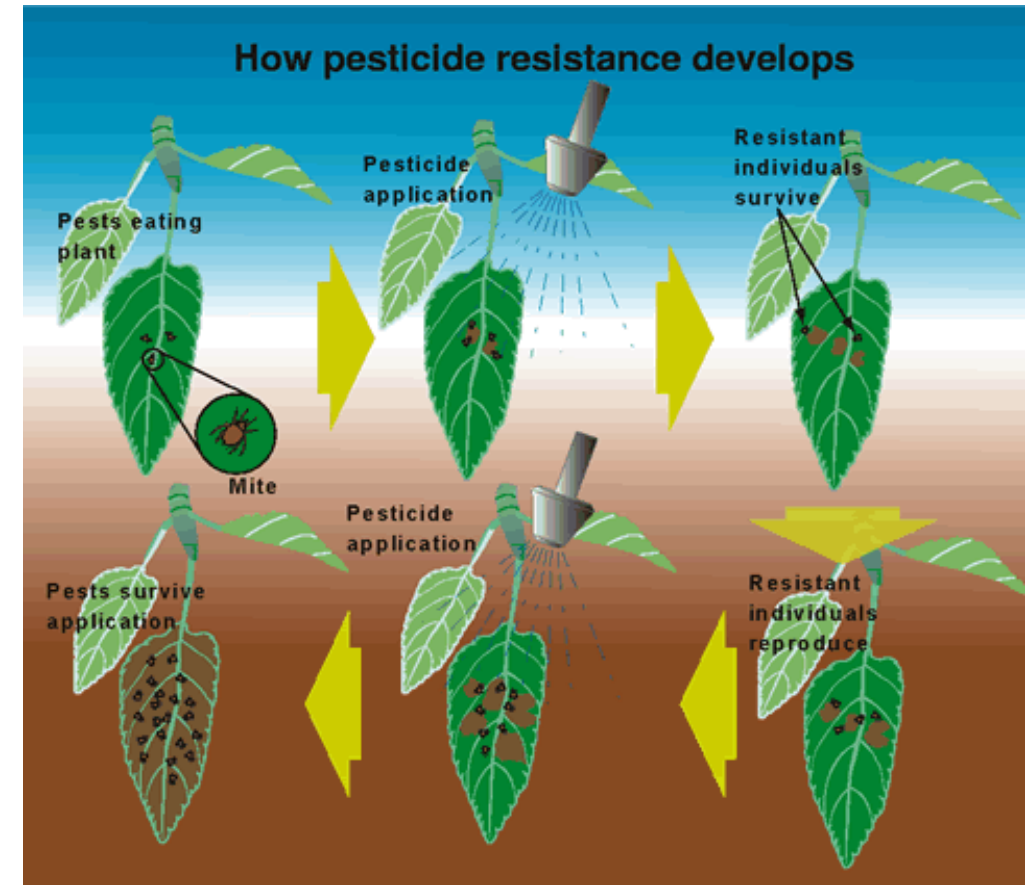
What is resistance and how does it occur ?

- Results from a change in the fungal population that makes the fungicide less effective or ineffective.
- Resistant strains of the fungus are selected by repeated use of a particular chemical or fungicides with the same mode of action
- Resistant strains can then reproduce and increase the fungal population
- Resistance can result from a genetic mutation or if a fungal strain can use an alternative biochemical pathway.
- Resistant strains probably always exist at low frequencies in a fungal population



Managing resistance

1. Know your crop
2. Rotate the fungicide mode of action groups/ classes
3. Identify the disease correctly
4. Follow the label – use right time, right place and right rate
5. Keep good records
6. Test for resistance
7. Careful monitoring
8. Adopt integrated crop protection strategies



Options for soil borne disease control

- Most soil borne diseases have a wide host range including clubroot
- Chemical options
 - fumigants and fungicides are a common approach to managing soil- borne diseases
 - Seed treatments
- Non-chemical options (cultural, biological)
 - Biofumigants
 - Cover crops
 - Soil amendments and general good soil health management
 - Biological products – including biopesticides

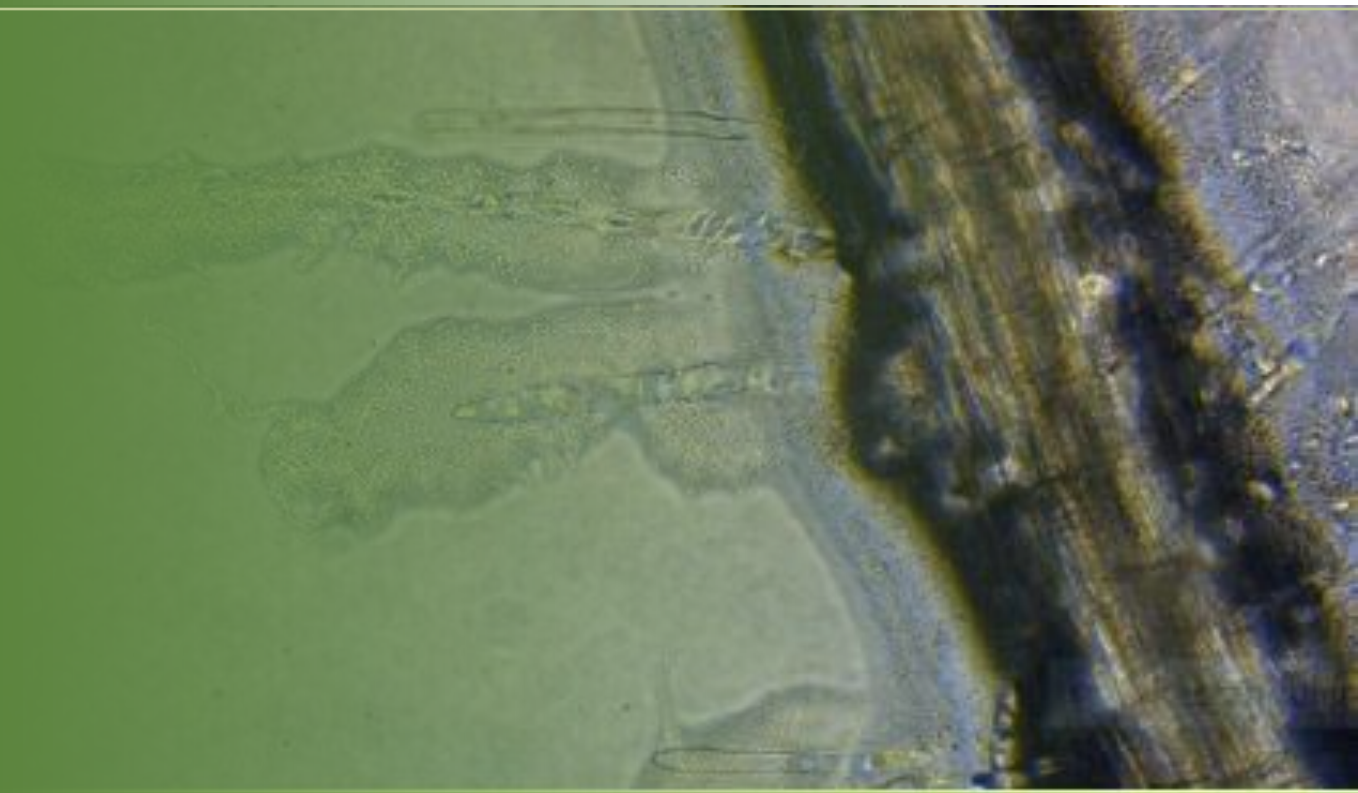




Bacteria amyloliquefaciens

MOA: Facilitates the plant's uptake of nutrients from the soil by stimulating the plant to increase root volume as well as producing organic acids resulting in more productive and vigorous plants.

- **Location: Plant rhizosphere**
- Application: Active root growth stage



Bacillus subtilis cells colonising around root hairs.

Seaweed extract- Ascophyllum nodosum

- **Seaweed extract– Ascophyllum nodosum**
- **MOA:** Improves root and plant growth to withstand abiotic and biotic stress
- **Contains:** N,P,K and trace elements, vitamins, amino acids and betaines.



Evaluation of *Ascophyllum nodosum*

- **Trial:** Iceberg lettuce to help root development to reduce transplant stress **Application:** Drench followed by a foliar application during the plant growth cycle or 24 hours prior to a heat event.
- **Evaluation:** NDVI, Sap tests and EC levels, plant vigour.



Untreated



Treated



Damping off (Pythium, phytophthora, fusarium, rhizoctonia)

- **What?** A disease complex
- **Symptoms** -Poor growth, stunted, yellowing plants, death of seedlings, wilting of older plants, poor germination and brown or black, rotted roots and crowns. Symptoms can depend on which pathogens are present.

Options

- Chemical seed dressing
- Fumigation
- calcium amendments
- microbial bio-controls
- plant defence activators.



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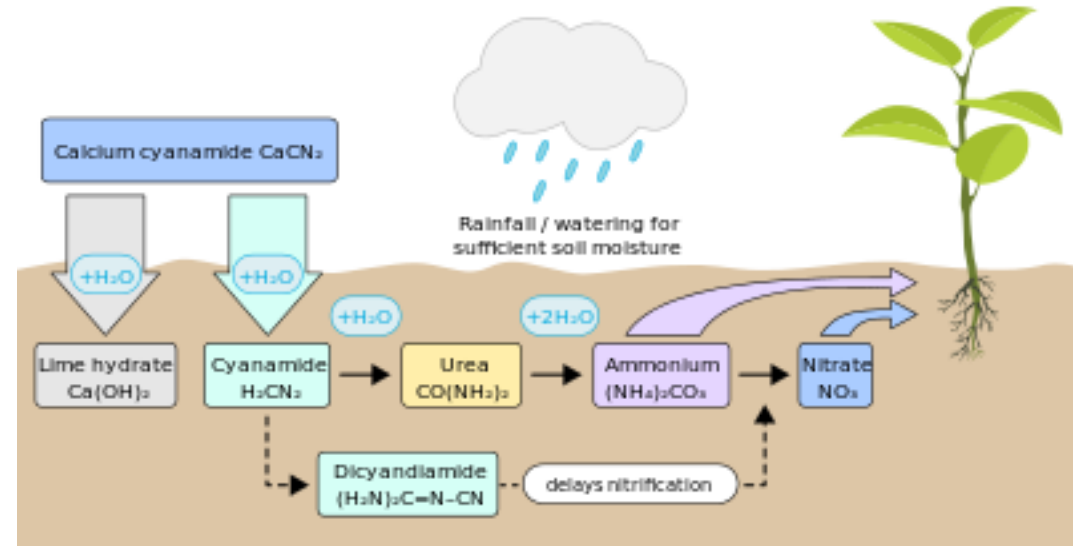
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Calcium Cyanamide

- Contains 19.8% N
- Calcium cyanamide (CaCN_2) is transformed into hydrated lime and cyanamide in the soil

Benefits:

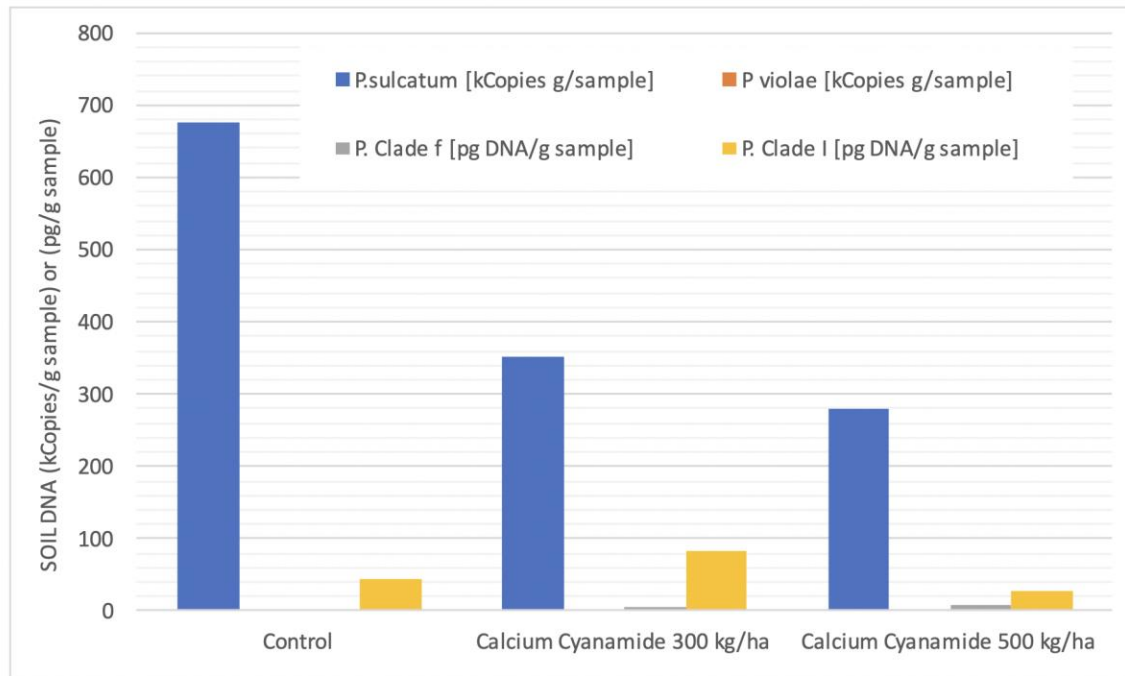
- Slow release nitrogen source
- Ready source of calcium – 50% CaO
- Improves soil structure
- Provides a fumigant effect
- Stabilises soil pH



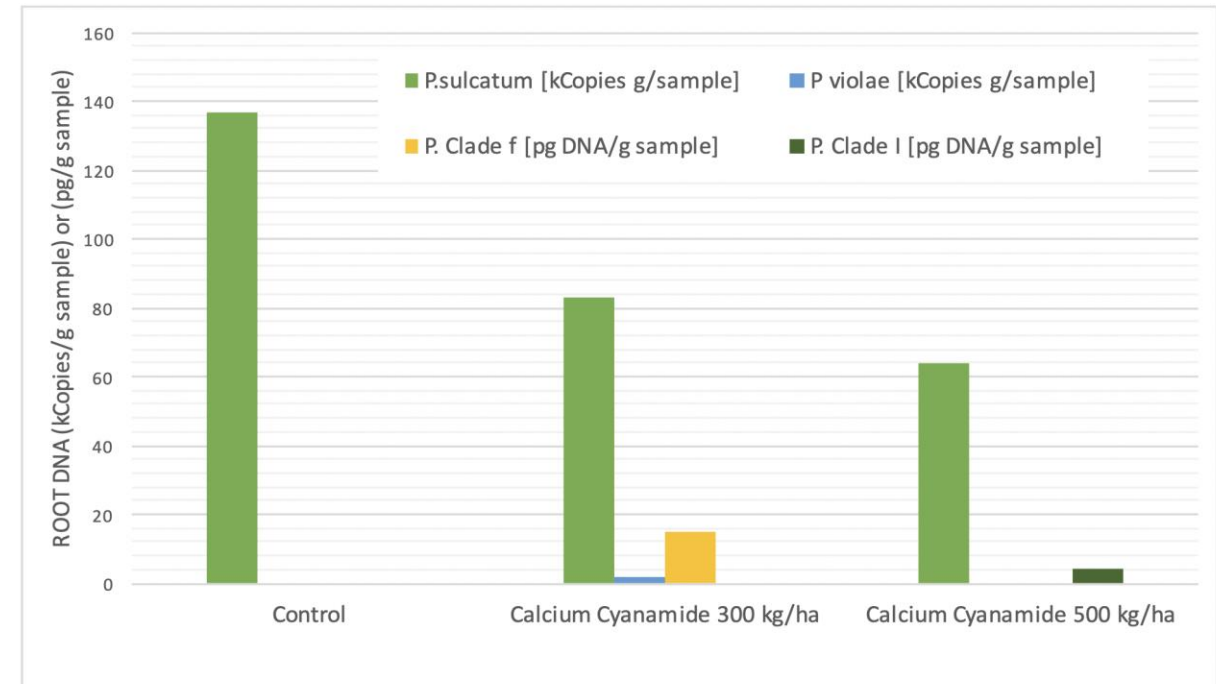
Calcium Cyanamide for treating *Pythium sulcatum* and *P. violae* in carrots

Calcium cyanamide applied at 300kg/ha and 500/kg/ha 2-3 weeks before sowing.

Soil DNA Test Results



Peel DNA Test Results



Potential IPM tools for Management of onion white rot in onions

Sclerotium cepivorum

- Trichoderma species – used to parasitize sclerotia
- Biofumigant brassica crops containing glucosinolates
- Synthetic sulphite compounds, diallyl disulphide (DADS) - pre- plant soil treatment



For more information visit:

- SWICP Biological Products Database: <https://soilwealth.com.au/2023/04/biological-productsdatabase/#:~:text=About%20this%20database%20and%20how,from%20growers%20about%20available%20products.>
- Managing Fungicide Resistance Factsheet
- Calcium cyanamide Factsheet <https://soilwealth.com.au/2019/06/can-calcium-cyanamide-cacn2-fertiliser-affect-pythium-spp-and-other-soilborne-diseases-in-carrots-findings-of-an-on-farm-demonstration/>



Thank you



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