

Navigating the Interactions between Soil Properties, Pest and Diseases and the Benefits of Soil Fumigation and Biological Stimulants in the Murray Mallee

Bryan Robertson
R&D Agronomy Manager



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Topics

- Soils
- Topography
- Soil Characteristics
- Soil Fumigants
- Onion Case Studies
 - Pests and Diseases
- Biological Stimulants – ZADCO Products

Soils



- Coarse Sandy Soils represent 30% of Cropping soils in low rainfall regions.
- Associated with Dune-Swale Systems
- Crop Nutrition & Crop Rotations – key role in lifting root growth.
- Ensure deep rooting capacity & opportunity
- Increase Soil Organic Matter
 - Improves Chemical, Biological & Physical Fertility

Topography



Soil Characteristics

- Coarse Sandy Soils:
 - Alkaline pH (7 – 9)
 - Low Clay Content leading to increases rates of Organic Matter breakdown
 - Poor Water Holding Capacity
 - Poor Biological Activity
 - Soil water repellency
 - Poor capacity to protect soil organic matter
 - Low CEC 2.7 – 4.6 meq
 - Nutrient deficiencies in N, P, S, Zn, Mn, Cu, Co, B, Mo, Se, Fe, Ca
 - Added P fertilizer to soils is generally absorbed onto soil particles or precipitated as insoluble compounds.
 - Ions readily leached down profile out of reach of plant roots & soil microbes.

Soil Fumigants



Fumigation Broadacre Rigs



Soil Fumigants - PrePlant

- **Metham Sodium**
 - Nematicidal & Fungicidal effects
 - Widely used
 - Losing effectiveness over time due bacterial degradation of product
- **Telone**
 - Nematicidal effects
- **C-35** (35% Chloropicrin, 65% Telone)
 - Nematicidal and some Fungicidal effects
- **C-60** (60% Chloropicrin, 40% Telone)
 - Fungicidal & some Nematicidal effects
- **PicPlus** (85% Chloropicrin)
 - Fungicidal & some Nematicidal effects

Onion Case Studies



Onions



Pests and Diseases



- Pest and Diseases Identified using SARDI DNA Soil Test Technology
 - Predicta Pt Plate
 - HortVeg Plate
- Interactions between Pests & Diseases
 - Rhizoctonia & Root Knot Nematodes
 - Pythium & Sclerotinia
 - Pink Root, Rhizoctonia, Pythium & Nematodes
 - Macrophomina, Pythium, Rhizoctonia, Nematodes, Sclerotinia
- Need to Identify which nematode species are the problem
- Pests & Diseases are located in micro environments within the paddock with relationships between soil types, water, nutrition and background biology.

Pests and Diseases



- Rhizoctonia concentrations are lower on sand hill than swale clay soils.
- Rhizoctonia prunes plant roots and good nutrition can reduce severity.
- Summer weed control has been shown to decrease winter Rhizoctonia populations.

Onion Case Studies



Onions (Fumigated)

Myalup, Western Australia – 2018/19

Variety: Delgado Planted: 22/9/18 Harvested: 18/3/19

Costs - Biological \$1,000 / ha, Fumigation \$3,400 / ha, Chemicals \$475 / ha

BAY No.	TONNES/BAY	TONNES/HECTARE	APPLICATIONS
	1 BAY= .403Ha		
25	43	106	NO APPLICATIONS
26	62	153	FUMIGATION+ BIOLOGICALS
27	47	116	BIOLOGICALS
28	51	126	CHEMICAL + BIOLOGICALS

Onion Case Study - Pests and Diseases

Onions – (Before Fumigation) Murray Bridge, SA

Powdery Scab	Meloidogyne fallax	Colletotrichum coccodes	R. solani AG2.1	R. solani AG3	R. solani AG4	Verticillium dahliae	Common Scab	Pratylenchus crenatus	Pratylenchus neglectus	Pratylenchus penetrans	Meloidogyne hapla	M. javanica/incognita/ar enaria
pgDNA/g Sample*	pgDNA/g Sample*	pgDNA/g Sample*	pgDNA/g Sample*	pgDNA/g Sample*	pgDNA/g Sample*	pgDNA/g Sample*	pgDNA/g Sample*	nematodes/g soil	nematodes /g soil	nematodes /g soil	pgDNA/g Sample*	pgDNA/g Sample*
	0	223	0	0	0	16	0	0.0	0.0	0.0	0	0
	0	35	0	0	0	21	0	0.0	0.2	0.0	0	0
	0	145	0	0	0	32	0	0.0	0.5	0.0	0	0

<u>S. sclerotiorum / minor</u>	<u>R. solani AG2.2</u>	<u>R. solani AG8</u>	<u>Pythium sulcatum</u>	<u>Pythium violae</u>	<u>Aphanomyces euteiches</u>	<u>Blackleg</u>	<u>Macrophomina phaseolina</u>	<u>Plasmodiophora brassicae</u>	<u>Pratylenchus thornei</u>	<u>Pratylenchus s zeae</u>	<u>Pythium clade f</u>	<u>Pythium clade l</u>	<u>Phoma terrestris</u>
<u>kDNA copies/g Sample*</u>	<u>pgDNA/g Sample*</u>	<u>pgDNA/g Sample*</u>	<u>kCopies / g sample</u>	<u>kCopies / g sample</u>	<u>pgDNA/g Sample*</u>	<u>pg DNA / g soil</u>	<u>kCopies / g soil</u>	<u>kCopies / g sample</u>	<u>nematodes/ g soil</u>	<u>kCopies / g sample</u>	<u>pgDNA/g Sample*</u>	<u>pgDNA/g Sample*</u>	<u>kDNA copies/g Sample*</u>
0	0	0	0	0	0	0	10	0	0	0	20	25	83
0	0	12	0	0	0	0	8	0	0	0	32	0	97
0	0	38	0	0	0	0	14	0	0	0	25	1	110

Onion Case Study - Pests and Diseases

Onions – (After Fumigation) Murray Bridge, SA

<u>Paddock</u>	Meloidogyne fallax pgDNA/g Sample*	Colletotrichum coccodes pgDNA/g Sample*	R. solani AG2.1 pgDNA/g Sample*	R. solani AG3 pgDNA/g Sample*	R. solani AG4 pgDNA/g Sample*	Verticillium dahliae pgDNA/g Sample*	Common Scab pgDNA/g Sample*	Pratylenchus crenatus nematodes/g soil	Pratylenchus neglectus nematodes/g soil	Pratylenchus penetrans nematodes/g soil	Meloidogyne hapla pgDNA/g Sample*	M. javanica/i ncognita/ arenaria pgDNA/g Sample*	<u>S. sclerotiorum / minor</u> kDNA copies/g Sample*
Control	0	0	0	79	0	0	0	0.0	0.1	0.0	0	0	0
200kg/ha C60	0	0	0	44	0	0	0	0.0	0.0	0.0	0	0	0
300kg/ha C60	0	0	0	5	0	0	0	0.0	0.0	0.0	0	0	0

<u>R. solani AG2.2</u> pgDNA/g Sample*	<u>R. solani AG8</u> pgDNA/g Sample*	<u>Pythium sulcatum</u> kCopies / g sample	<u>Pythium violae</u> kCopies / g sample	<u>Aphanomyces euteiches</u> pgDNA/g Sample*	<u>Blackleg</u> pg DNA / g soil	<u>Macrophomina phaseolina</u> kCopies / g soil	<u>Plasmodiophora brassicae</u> kCopies / g sample	<u>Pratylenchus thornei</u> nematodes/g soil	<u>Pratylenchus s zeae</u> kCopies / g sample	<u>Pythium clade f</u> pgDNA/g Sample*	<u>Pythium clade I</u> pgDNA/g Sample*	<u>Phoma terrestris</u> kDNA copies/g Sample*
0	0	0	0	0	0	6	1	0.0	0	91	8	158
0	0	0	0	0	0	2	0	0.0	0	47	5	31
0	0	0	0	0	0	1	0	0.0	0	20	1	3

Trial: Murray Bridge, SA

Left: 200kg/ha C-60 Right: 300kg/ha C-60



Biological Stimulants



- Trichoderma
 - Assists with root health, nutrient & water uptake
 - Counteracts effects of fungal pathogens and nematodes
 - Increases plant root area
- Bacillus
 - Assists with the suppression of Sclerotinia and related Pythium populations
- Mycorrhiza
 - Increases the surface area of roots and assists with the uptake of P & Zn
 - Increases water uptake efficiency
- Stimulating wax degrading microbes can reduce water repellency.
- Stimulate background predatory Nematodes & Fungi to reduce pest nematode numbers.
- Stabilises decomposition of Soil Organic Matter

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