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Endo Prime™

Goes where roots can't.

Technical Presentation

Mycorrhizae

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What is EndoPrime and what is Mycorrhizae?

- EndoPrime from Sumitomo is a plant and soil enhancement product that contains Arbuscular Mycorrhizal Fungi (AMF)
- Mycorrhizae are beneficial fungi that naturally exist in soils colonizing the root systems of plants.
- EndoPrime includes 4 high performing endo-mycorrhizae species that have been proven to increase crop productivity and overall plant and soil health.
- EndoPrime also includes humic acid.

Australian Organic Registered Farm Input
ALLOWED INPUT 10332AI

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Mycorrhizal Fungi

1. Mycorrhizal fungi form symbiosis with >90% of land plants.
2. 400 million years old relationship.
3. Fewer species of mycorrhizal fungi and many species of plants – low specificity.
4. Mycorrhizae provides better absorption of nutrients and increased water uptake to the plant in exchange for carbon supply.
5. Cannot function without host plant (obligate symbiont).
6. AMF plays an important role in soil biology (glomalin protein).
7. 7 different types of mycorrhizae

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Mycorrhizal Symbiosis

The mutually beneficial relationship, where carbon flows to the fungus and inorganic nutrients and water flow to the plant.

This symbiosis is described as the most important mutualism on earth

400 million years old relationship

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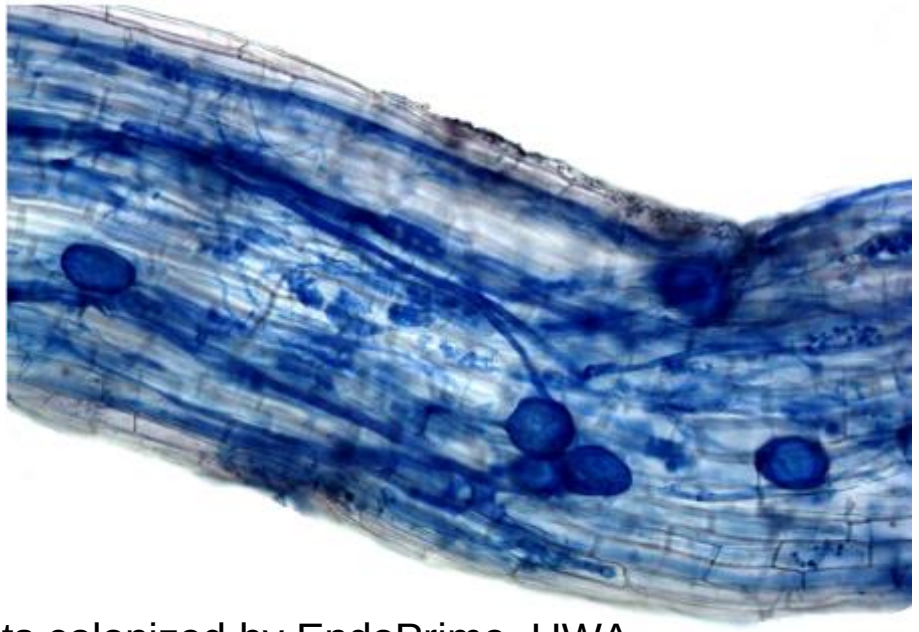
Endomycorrhizae (AMF)

(formally known as VAM)

- Provide increased absorption and availability of nutrients and water to the plant
- Cannot survive without a symbiosis with a plant
- Plant can form symbiosis with many mycorrhizae at once
- The plant is the driver in the symbiosis relationship with mycorrhizae, turning on and off the symbiosis as the plant needs it
- Plant needs different benefits from different mycorrhizae thus plant stage and needs can require different mycorrhizae
- Production of glycoprotein identified as glomalin is critical to soil structure, soil carbon and soil health long term.



Roots colonized by EndoPrime, UWA

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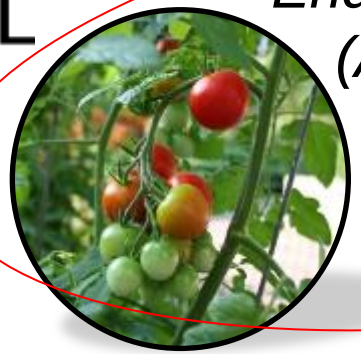
7 types of Mycorrhizae

Endomycorrhizae (Arbuscular Mycorrhizae, AMF)



Monotropoid Mycorrhizae

Ectomycorrhizae

Arbutoid Mycorrhizae

Ectendo-mycorrhizae

Ericoid Mycorrhizae

Orchid Mycorrhizae

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Agriculturally Important Mycorrhizal Fungi

Endomycorrhizae (Arbuscular Mycorrhizae)
80% of the world's plants

Other Mycorrhizae
5% of the world's plants

Non-Mycorrhizal
5% of the world's plants

Ectomycorrhizae
10% of the world's plants

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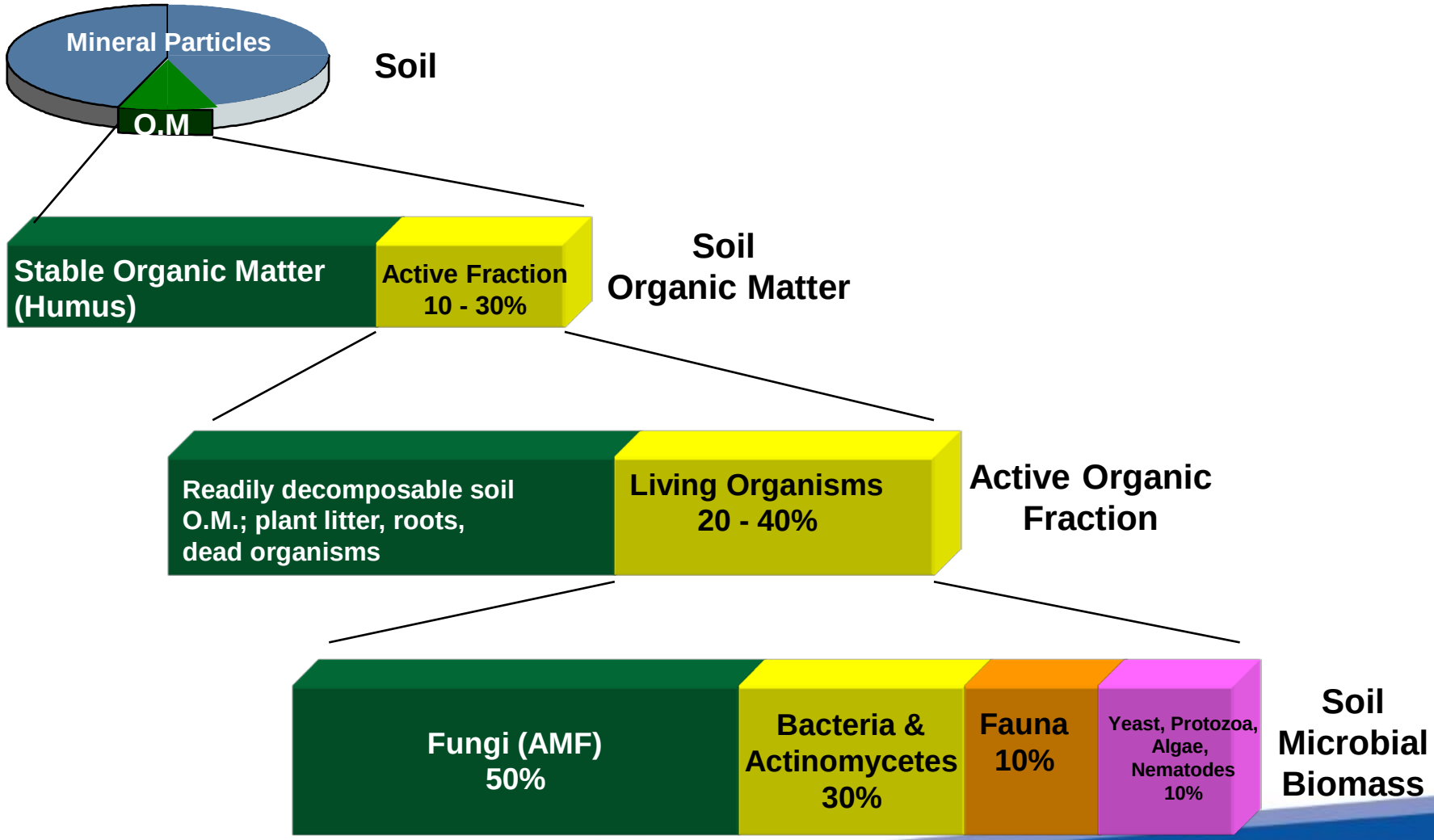
Composition of Soil O.M.



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What makes up the soil microbial biomass?

So what do we really know?

Component of Soil biota	Functions of benefit in grain production systems	Average number/g soil
Viruses	unknown	1,000,000,000
Bacteria	Decomposition, disease suppression, etc	5,000,000,000
Archaea	Nutrient production	1,000,000,000
Fungi	Decomposition, disease control, etc	5,000,000
Protazoa	Nutrient mobilisation, bacterial regulation, disease suppression	50,000
Nematodes	Nutrient moblisation, disease suppression	20,000
Collembola	Nutrient mobilisation, structure/porosity	5000

Ref: GRDC Groundcover Jan 2012

AMF typically make up around 50% of the total fungi in a healthy soil

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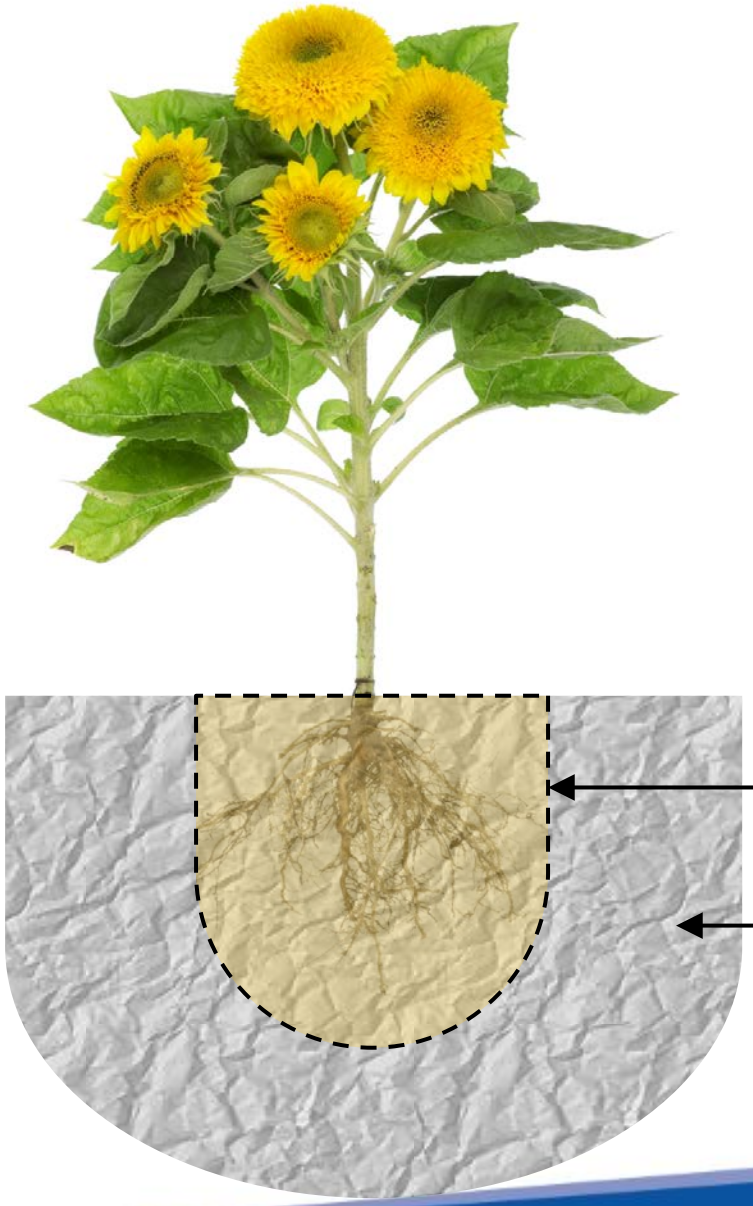
How does mycorrhizae work?

How Do Mycorrhizae Work?



- Within the soil, plant roots are limited in the area they can absorb nutrients (referred to as the depletion zone).
- Mycorrhizal hyphae grow out well beyond the depletion zone.
- Absorption area increases up to 50x.

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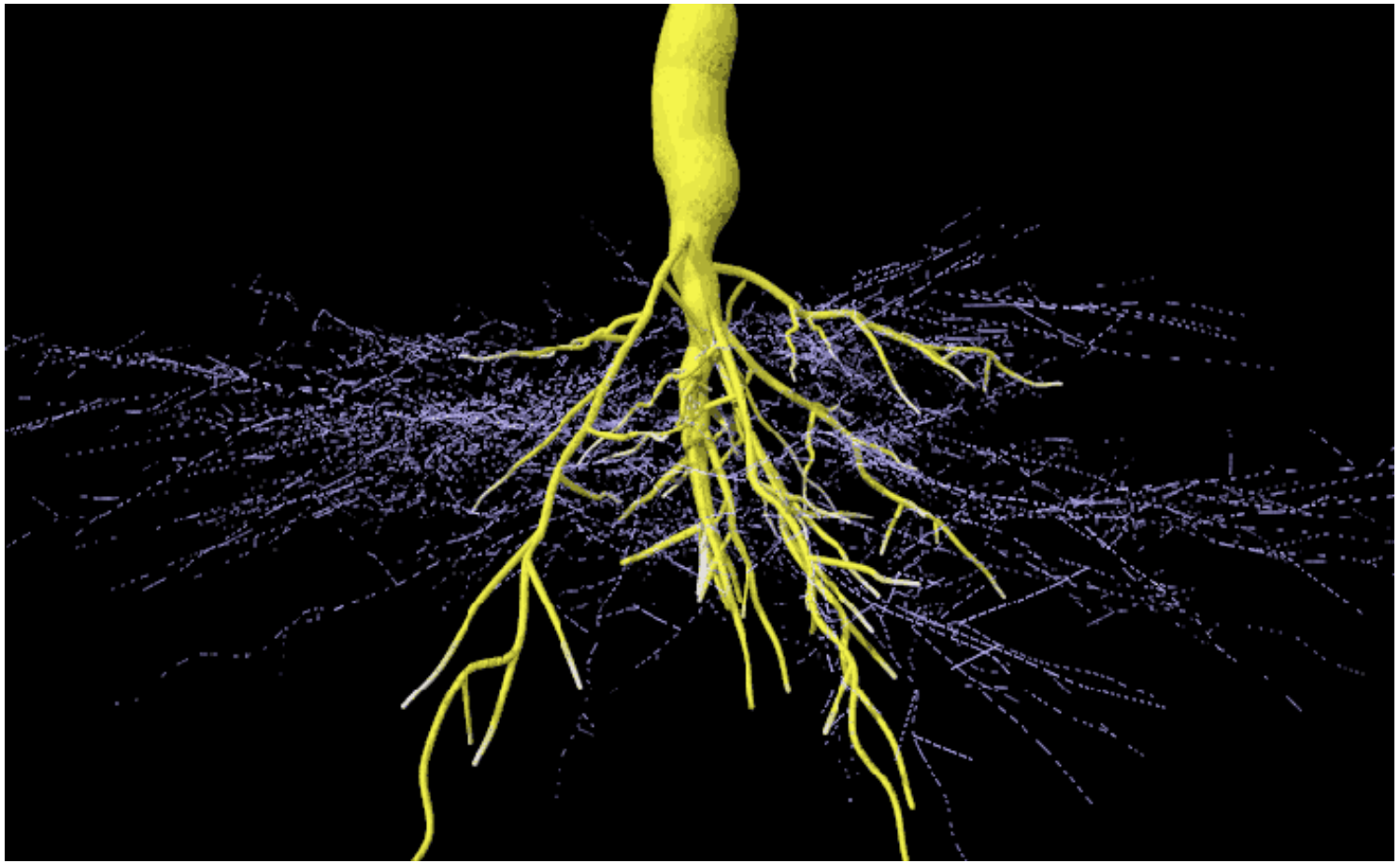
Vastly increased nutrient and moisture foraging ability



AMF hyphae extend the foraging zone well beyond where the plants roots alone can extend.

Goes where roots can't.

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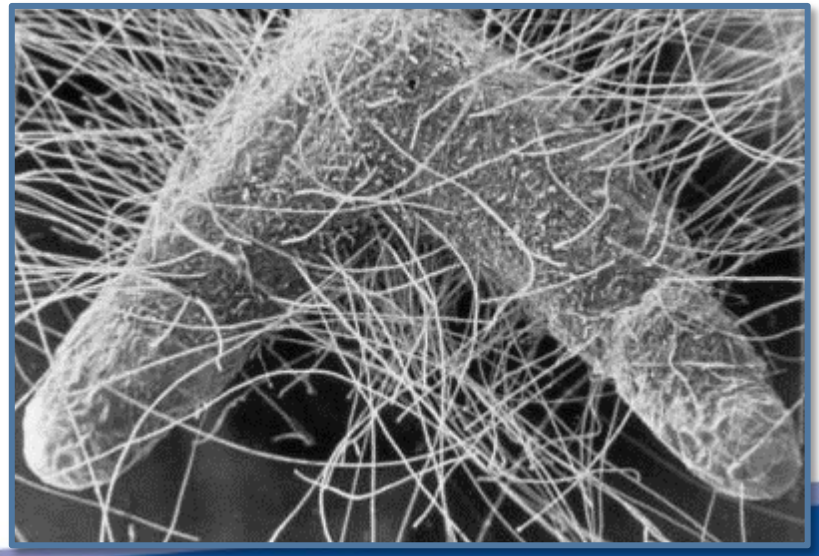
Root hair vs. Mycorrhizal fungal hyphae

Root Hair:

- Maximum length is several millimeter
- Nutrient absorption occurs only at the tips
- Nutrient uptake from available (soluble) pool only
- The rate of nutrient inflow is low

Mycorrhizal Fungal Hyphae:

- Maximum length 65 cm
- Nutrient and water absorption occurs along the entire length of the hyphae
- Mineral nutrient uptake from the soluble and insoluble pool
- More efficient nutrient uptake (greater nutrient inflow)



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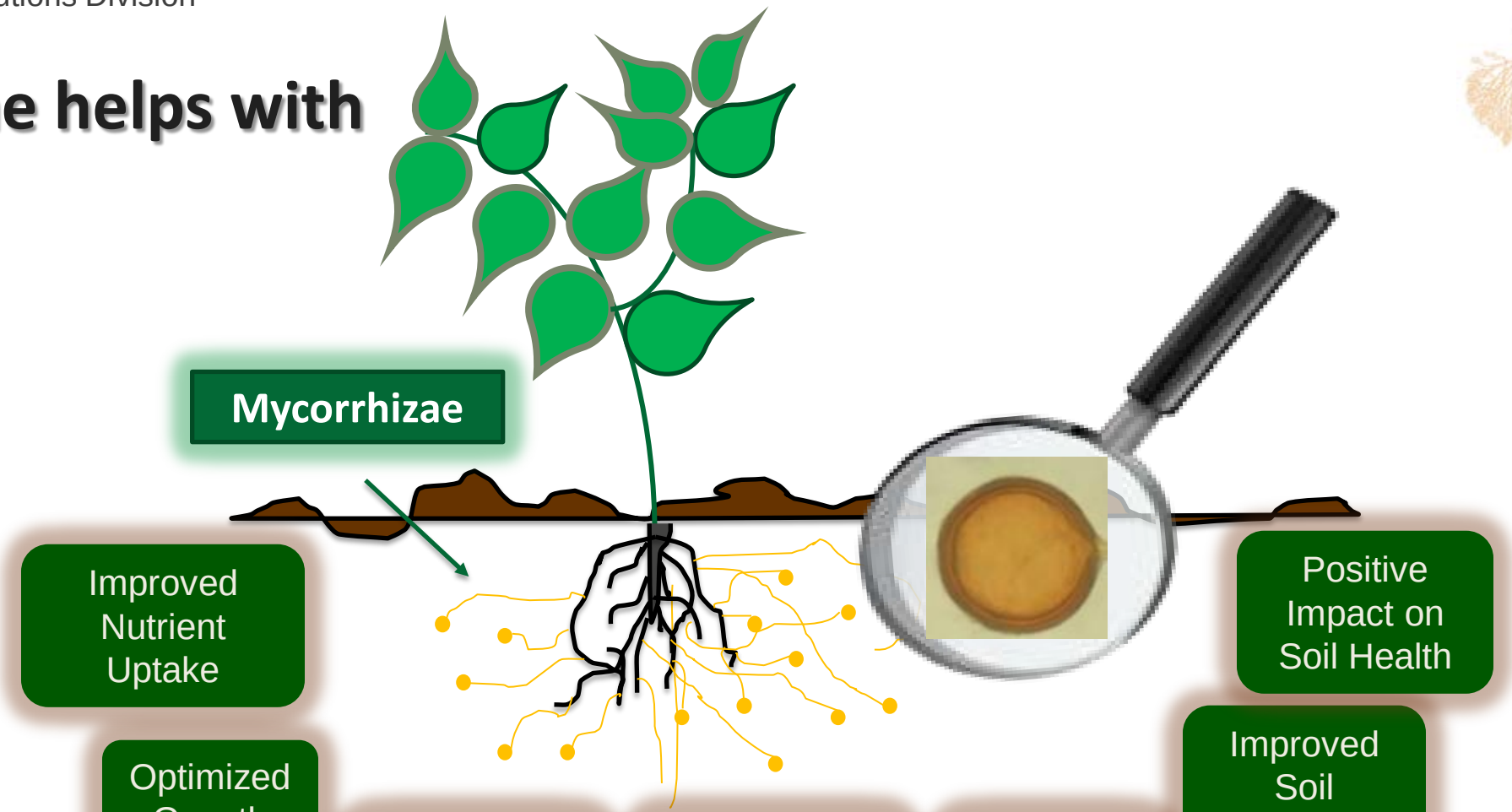
Mycorrhizae helps with



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What impacts Mycorrhizae levels in soils?

1. Previous crop or rotations with non-mycorrhizal plants (Brassica, Mustards, Lupins etc.)
2. Frequent, repeated or extended fallow periods (6 months or longer)
3. Continual wetting/drying cycles
4. Tillage
5. Fumigation (chemical treatments)
6. Once depleted, mycorrhizal populations are slow to recolonize naturally as propagules have to migrate from nearby reservoirs (plant hosts).

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Cultivation destroys the Propagule Bank

Colonization of roots arises from three sources of inoculum:

1. Spores
2. Colonized root fragments
3. Hyphae

Propagules in the soil are often called the ‘propagule bank’

Tillage reduces the propagule bank by:

(i) Breaking up of the hyphal network
(ii) Dilution of the propagule-rich topsoil
(iii) Accelerated root decomposition.

Tillage has one of the biggest impacts on reducing soil mycorrhizal infectivity

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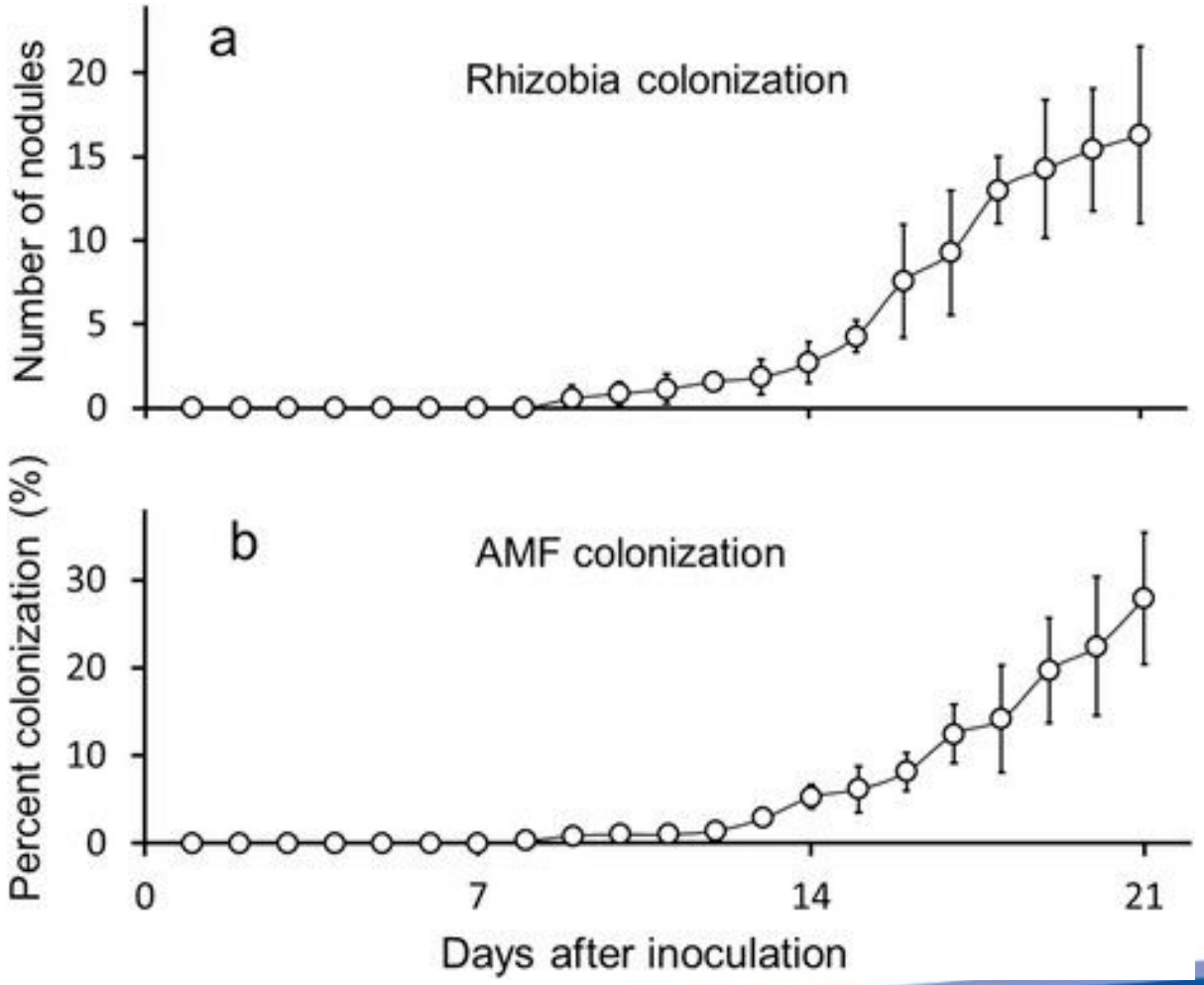
How Quickly does Mycorrhizae colonise the roots



Rhizobia and arbuscular mycorrhizal fungi colonization in *Green Beans*

Significant colonization in first 14-21 days

Daniel J Ballhorn, Brett S Younginger & Stefanie Kautz
BMC Plant Biology **volume 14**, Article number: 321 (2014)

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Life Cycle of Arbuscular Mycorrhizal Fungi (AMF)

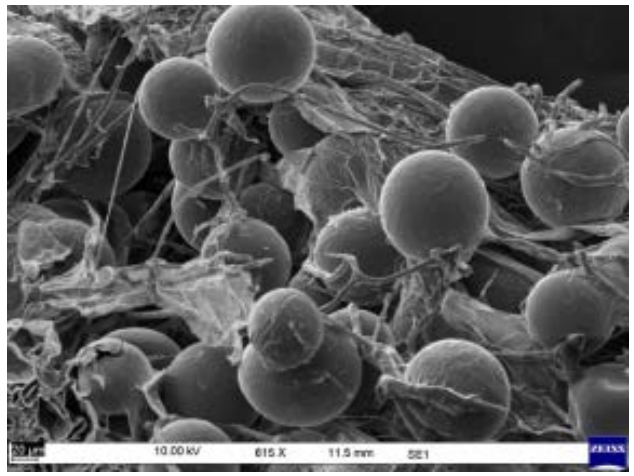
• **Chlamydospores;** form at the end of fungal hyphae either within the plant root or outside in the soil from hyphae that have stored energy reserves.

• **Spores germinate**; germ tube grows to encounter plant roots, penetrates & colonizes plants; in addition to hyphae the following structures can be seen.

• **Hyphae** - Each of the branching filaments (fungal roots) that make up the mycelium of a fungus.

• **Arbuscules** - Hyphal structures with many branches within the plant roots that serve as the site of nutrient exchange.

• **Vesicles** - Mycorrhizal storage structures within the roots.



Magnified Arbuscular Mycorrhizal Fungi (AMF) spores & hyphae emerging from root fragment.
Image by: Dr. Mike Amaranthus

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Mycorrhizal Fungi Commercial Success

- It is well established that mycorrhizal fungi are effective in what they do, 80,000+ literature references to mycorrhizal fungi research.
- The challenge has always been about getting the mycorrhizal fungi in contact with the roots in a viable way.
- Formulations and species are the pivotal point of commercial success with visual and results effectiveness.
- EndoPrime has proven consistency and ROI

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Why Multiple Mycorrhizal Species in EndoPrime?

- Mycorrhizae is well-researched with documented benefits
- One mycorrhizae species does not fit all conditions
  - Soil microclimate (e.g., changes in soil moisture, phosphate availability)
  - Plant phenology
- Different species dominate in different ecological conditions (e.g., soil type, cropping system, nutrient content).
- Plant utilises different species by growth needs, environmental conditions, soil conditions and species available.
- Plant can turn on multiple species at once

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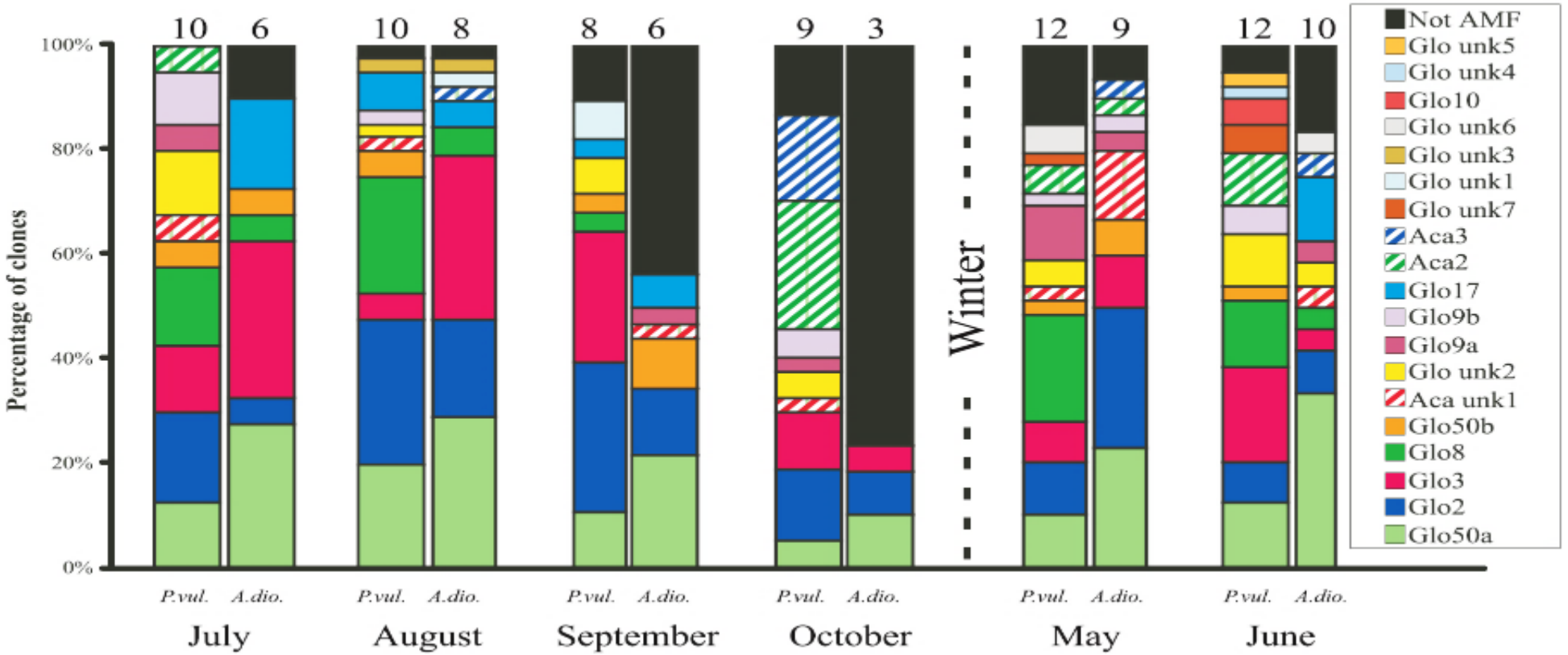
Seasonality in Mycorrhizal fungi communities



Proportional distribution of AMF sequence types in the roots of *Prunella vulgaris* and *Antennaria dioica* at different times during the growing season.

***(Source:* Santos-Gonzalez *et al.*, 2007. *Appl. Environ. Microbiol.* 73: 5613-5623.)**

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Sumitomo has an optimized species consortium

Groups	Benefits	Glomus mosseae	Glomus aggregatum	Glomus intraradices	Glomus etunicatum
Yield Increase	Increases crop yield			X	
Nutrient Uptake	Increases Nitrogen (N) and phosphorus (P) uptake	X		X	X
	Enzyme activity increases access micro nutrient uptake	X			X
	Tolerant of high fertility levels		X		
Root Improvement	Increases root and soil enyzme activity				X
	Promotes root health	X			X
	Improves drought tolerance			X	X
Plant Physiology	Improves plant establishment				X
	Increases flowering and fruiting	X			X
	Improves performance of palms and fruit trees		X		
	Improves performance in woody perennials	X			
Plant Tolerance	Improves plant performance in sandy soils		X		
	Improves plant salinity tolerance			X	
	Improves plant tolerance to a wide array of soil toxicities			X	

Efficacy comparison of single *spp.* vs 4 *spp.* consortium

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Endomycorrhizal plants

(commercially important)

- Acacia
- Agapanthus
- Alder (Endo/Ecto)
- Alfalfa
- Almond
- Apple
- Apricot
- Artichoke
- Ash
- Asparagus
- Aspen(Endo/Ecto)
- Avocado
- Bamboo
- Banana
- Barley
- Basil
- Bayberry
- Beans
- Beech
- Begonia
- Black Cherry
- Blackberry
- Black Locust
- Blue Gramma
- Box Elder
- Boxwood
- Buckeye
- Bulbs
- Cacao
- Cactus
- Camellia
- Carrisa
- Carrot
- Cassava
- Ceanothus
- Cedar
- Celery
- Cherry
- Chrysanthemum
- Citrus
- Clover
- Coconut
- Coffee
- Coral
- Tree Corn
- Cotton
- Cottonwood (Endo/Ecto)
- Cowpea
- Crab Tree
- Creosote
- Cryptomeria
- Cucumber
- Currant
- Cypress
- Dogwood
- Eggplant
- Elm
- Eucalyptus
- Euonymus
- Fern
- Fescue
- Fig
- Flax
- Flowers
- Forsythia
- Fuchsia
- Gardenia
- Garlic
- Geranium
- Grapes
- Grasses
- Green Ash
- Guayule
- Gum
- Hackberry
- Hawthorn
- Hemp
- Herbs, all
- Hibiscus
- Holly
- Hostas
- Impatiens
- Jatropha
- Jojoba
- Juniper
- Kiwi
- Leek
- Lettuce
- Ligustrum
- Lily
- Locust
- Lychee
- Mahogany
- Magnolia
- Mahonia
- Mango
- Maples
- Mesquite
- Millet
- Mimosa
- Morning Glory
- Mulberry
- Myrtle
- Nasturtium
- Okra
- Olive
- Onion
- Pacific Yew
- Palms
- Pampas Grass
- Passion Fruit
- Papaya
- Paw Paw
- Peas
- Peach
- Peanut
- Pear
- Peppers, all
- Pistachio
- Persimmon
- Pittosporum
- Plum
- Podocarpus
- Poinsettia
- Poplar
- Potato
- Pumpkin
- Raspberry
- Redwood
- Rice
- Rose
- Rubber
- Ryegrass
- Sagebrush
- Saltbrush
- Serviceberry
- Sequoia
- Shallot
- Snapdragon
- Sorghum
- Sourwood
- Soybean
- Squash
- Star Fruit
- Strawberry
- Succulents
- Sudan Grass
- Sugar Cane
- Sumac
- Sunflower
- Sweet Gum
- Sweet Potato
- Sycamore
- Taxus
- Tea Tobacco
- Tomato
- Violets
- Wheat
- Yam
- Yucca
- Willow (Endo/Ecto)

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Mycorrhizal fungi – likes and dis-likes

Highly preferred plant species :

1. Solanaceous crops (tomato/capsicum)
2. Legume vegetables
3. Tuber and root crops (carrot/potato)
4. Onion & garlic
5. Citrus & Pome
6. Hemp
7. Melons
8. Corn/Sorghum
9. Mungbeans
10. Cotton
11. Pigeon Peas
12. Faba Beans
13. Chickpeas
14. Lab Lab
15. Linseed

Known to benefit from Mycorrhiza:

1. Rice
2. Wheat
3. Barley
4. Banana
5. Sugarcane

Plants that DO NOT form a bond with Mycorrhiza:

1. Beet
2. Carnation
3. Spinach
4. Canola & Mustard
5. Cabbage
6. Canola
7. Lupins

Over 80% of the world plant species form a bond with Mycorrhizae

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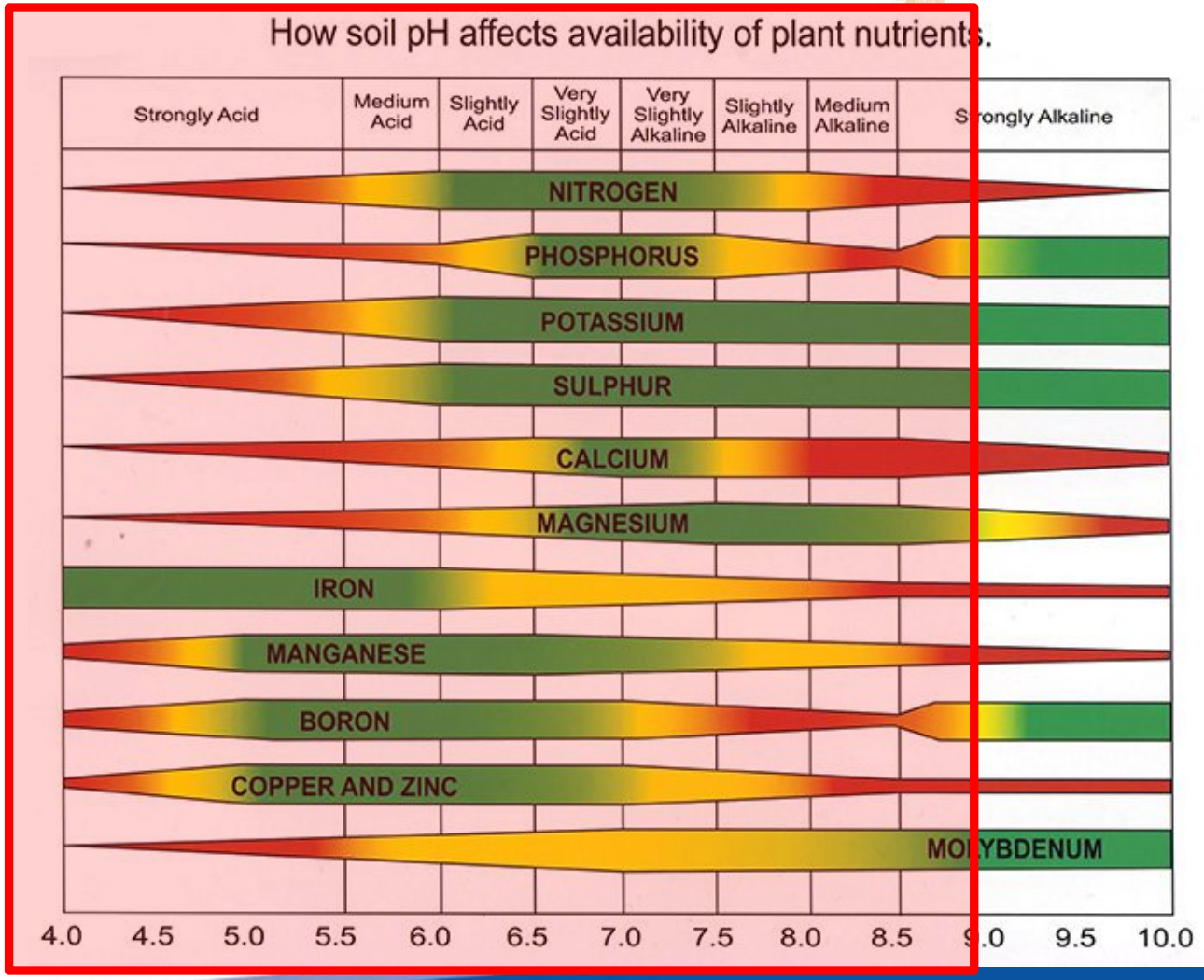
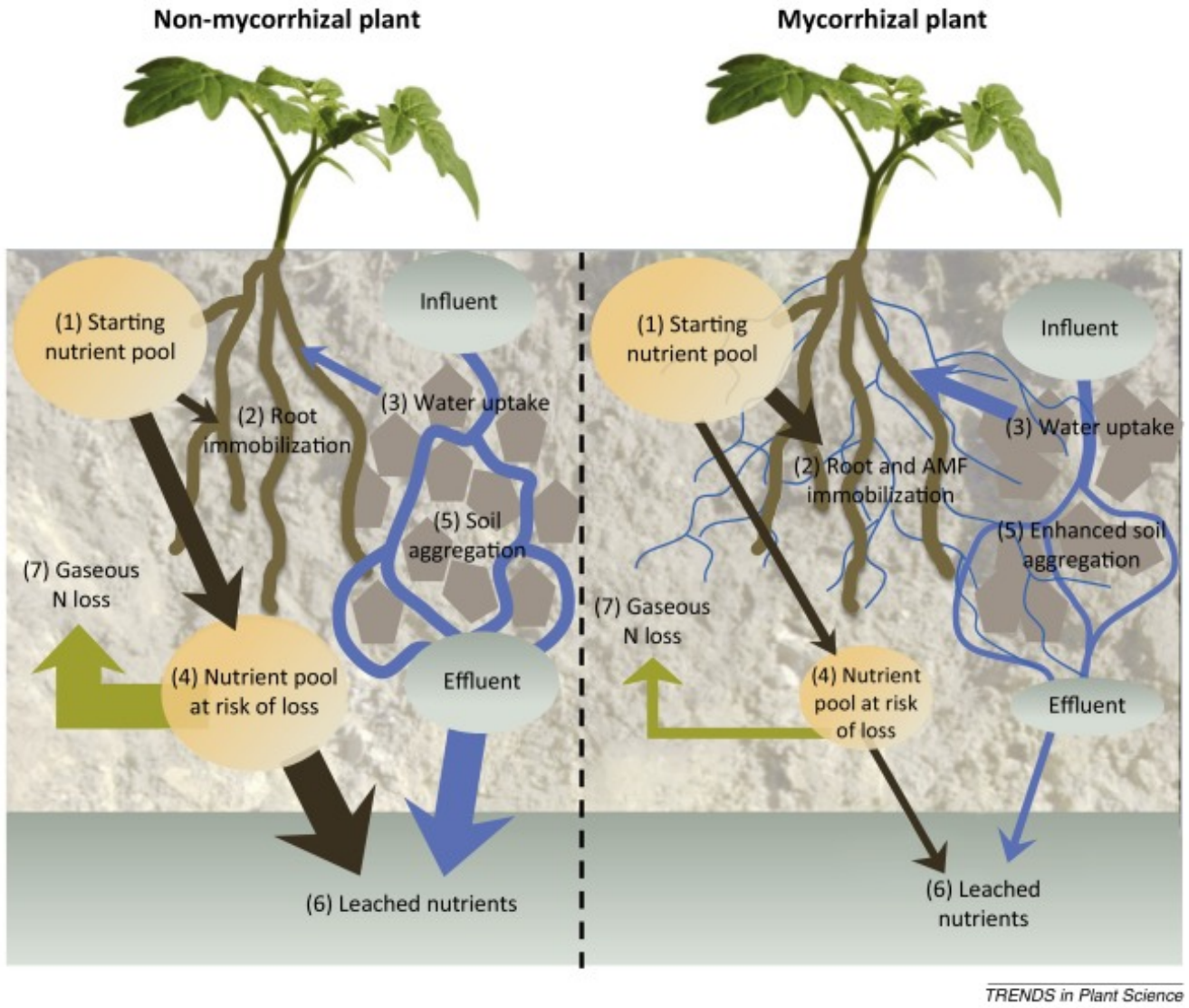
Soil pH interactions with Mycorrhizae

- Mycorrhizae spore germination and colonization can occur between pH 4 and pH 9.
- Ideal pH Range is between 5 – 8
- Mycorrhizae can often survive in more hostile soil pH ranges and other toxicities than the host plants can
- Mycorrhizae can often help plants withstand hostile soil conditions due to their wide ranging tolerance.
- Watch outs are high sodicity (high pH) levels leading to collapsed structure with anerobic conditions



Mycorrhizae reduce nutrient & moisture loss



- Reduced nutrient leaching below the root zone
- Improved fertilizer efficiency
- Reduces the amount of de-nitrification and Nitrous Oxide lost to the atmosphere
- Improved water retention and utilization

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Improved nutrient scavenging

- **Improved absorption and transfer of 15 major, macro and micro nutrients enhancing plant establishment and growth**, particular benefit with less mobile nutrients like Phosphorus.

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Mycorrhizae and soil health?

The future of every civilization is ultimately determined by how it cares for its soil.

Franklin Roosevelt

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Soil Quality Indicators

Physical	Chemical	Biological
Structure	pH	Respiration rate
Bulk density	CEC	Earthworms
Drainage	Plant-available nutrients	Microbial numbers
Water infiltration rate	Organic matter / C	Microbial biomass
Water-holding capacity	Soluble salts	Species diversity
Soil strength	Contaminants	Pathogens

AMF provide benefits across the majority of these key soil health indicators

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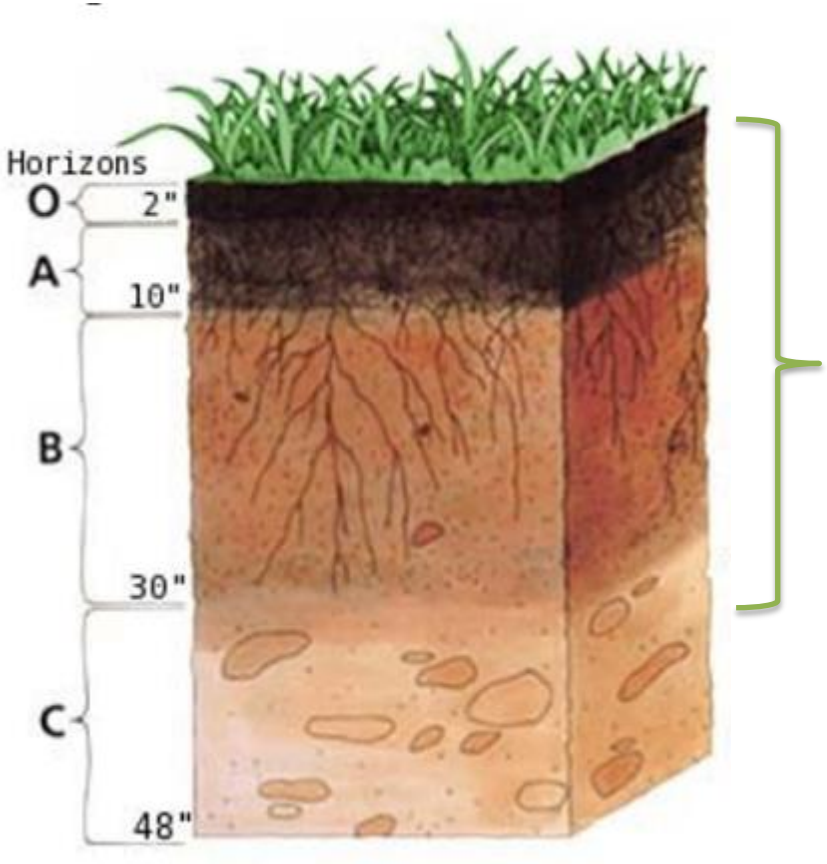
Improving soil structure



Mycorrhizae improve soil structure by secreting Glomalin to form soil aggregates & pores, which are fundamental to Soil Health and optimum plant production

Glomalin improve the soil structure across all soil horizons where roots and AMF have colonized.

Glomalin is a carbon rich secretion which can increase soil carbon levels over time.

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Glomalin & “soil aggregation/structure”

What is Glomalin?

Glomalin is a glycoprotein, which is a sugar based protein compound that binds soil particles together to form aggregates.

Soil aggregates are the structures that protect organic matter, hold moisture and improve soil tilth.

Glomalin is formed by arbuscular mycorrhizal fungi (AMF), which produce the sticky compound in their vast webs of root-like hyphae.

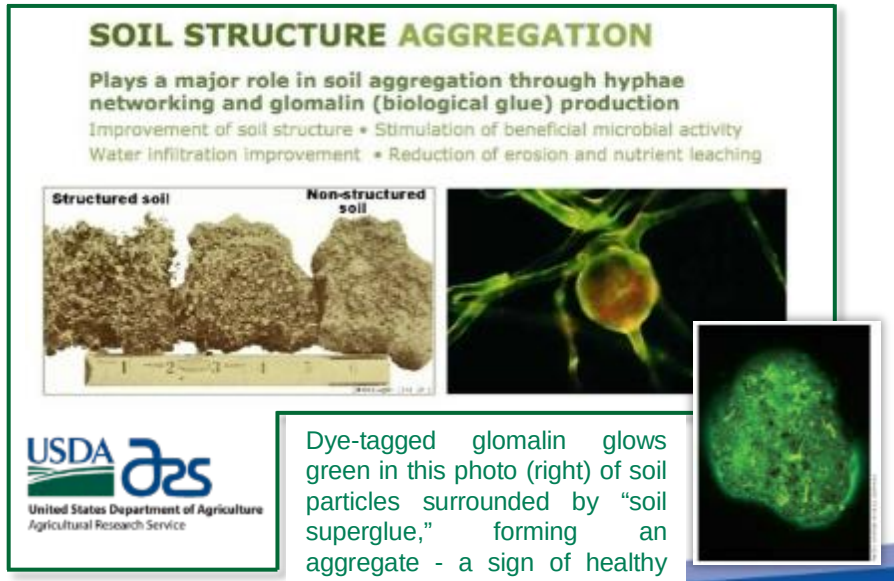
Source: Steve Werblow, Dr. Mike Amaranthus, Kristine Nichols
“Sticky Business, Glomalin provides the ties that bind”

1. Glomalin itself is a tremendous storehouse of carbon. As much as 30% to 40% of the glomalin molecule is carbon.
2. **Glomalin lasts 7 to 42 years** depending upon conditions (estimate using carbon dating).
3. Glomalin may account for as much as one-third of the world’s soil carbon.

How does Glomalin benefit Growers?

When growers convert to Low-Till practices, it generally takes about (5) years for disturbed soil structure to improve.

However, adding Mycorrhizal fungi each crop year serves to fully re-establish agronomic soil structure within as little as three (3) years,



Dye-tagged glomalin glows green in this photo (right) of soil particles surrounded by “soil superglue,” forming an aggregate - a sign of healthy soil. (Dr. Amaranthus)

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Mycorrhizae can help plants overcome disease

CSIRO study in 2012 showed AMF colonization induces expression of potato PR genes in response to infection by *Fusarium sambucinum*

Found that the AMF treatment upregulated the expression of all defense genes except one in potato roots at 72 and 120 h post inoculation with AMF

AMF significantly suppressed disease severity of *Fusarium* on potato plants compared with those infected and non-mycorrhizal plants. Furthermore, the AMF treatment decreased the negative effects of *Fusarium* on biomass and potato tuber production.

Fusarium dry rot

Early blight

Functional Plant Biology 39(3) 236-245 https://doi.org/10.1071/FP11218
Submitted: 28 September 2011 Accepted: 13 January 2012 Published: 21 February 2012

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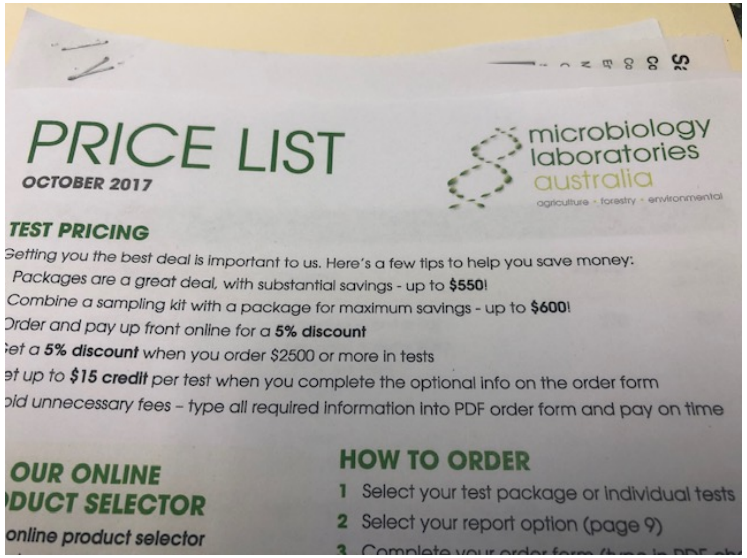
Can I test for Mycorrhizae in my soil?

1. Yes
2. Various methods exist
   i. Many non specific tests indicate overall microbial life
   ii. Some very specific like DNA methods (predicta B)
3. Commercial tests are available and are not too expensive


PRICE LIST
OCTOBER 2017
microbiology laboratories australia
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TEST PRICING
Getting you the best deal is important to us. Here's a few tips to help you save money:
Packages are a great deal, with substantial savings - up to $550!
Combine a sampling kit with a package for maximum savings - up to $600!
Order and pay up front online for a 5% discount
Get a 5% discount when you order $2500 or more in tests
Get up to $15 credit per test when you complete the optional info on the order form
Avoid unnecessary fees – type all required information into PDF order form and pay on time
OUR ONLINE DUCT SELECTOR
online product selector
HOW TO ORDER
1 Select your test package or individual tests
2 Select your report option (page 9)


AgVita Analytical Pty Ltd
Prices effective from July 1, 2016
AGVITA ANALYTICAL
NU-test nutrient uptake
Plant Sap Analy
CODE	Product	Elements	Price
NU1	3 elements	NO_3, P, K,	$58.00
NU2	7 elements	NO_3, P, K, Ca, Mg, Zn, B	$76.00
NU7	15 elements	NO_3, NH_4, P, K, Ca, Mg, Na, S, B, Cu, Zn, Mn, Fe, Mo, Cl	$92.00
NU7F	Fruit/Fruitlet Analysis	NO_3 (by ISE) NH_4, P, K, Ca, Mg, Na, S, B, Cu, Zn, Mn, Fe, Mo, Cl, Weight (av.)	$82.00
NU9	Additional to above tests	per analysis (eg. Al, Co, Se, Si, Brix) – per element or additional sample preparation. Please specify additional analyte required. Loss on Drying (LOD) also available	$8.00

PLANT RESPONSE
Plant Tissue (digestion) An
CODE	Product	Elements	Price
PR70	Total N	N (as total N) only (Dumas method)	$27.00

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EndoPrime Application and Rates

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Application methods:


Seed Treatment


Seedling dip


In furrow


Drip irrigation


Fertilizers mixing


Growing Media

EndoPrime formulation benefits relating to application:

- Fine sprayable powder
- No non-soluble substrates (suitable for drip systems)
- Quality consistency (Propagule count)
- Longer shelf life (2 years)
- Easy to use (can be used by various application methods)

The Main Goal: To get the Mycorrhizal fungi in contact with plant roots at an early stage of development in order to optimize the resulting symbiosis benefits

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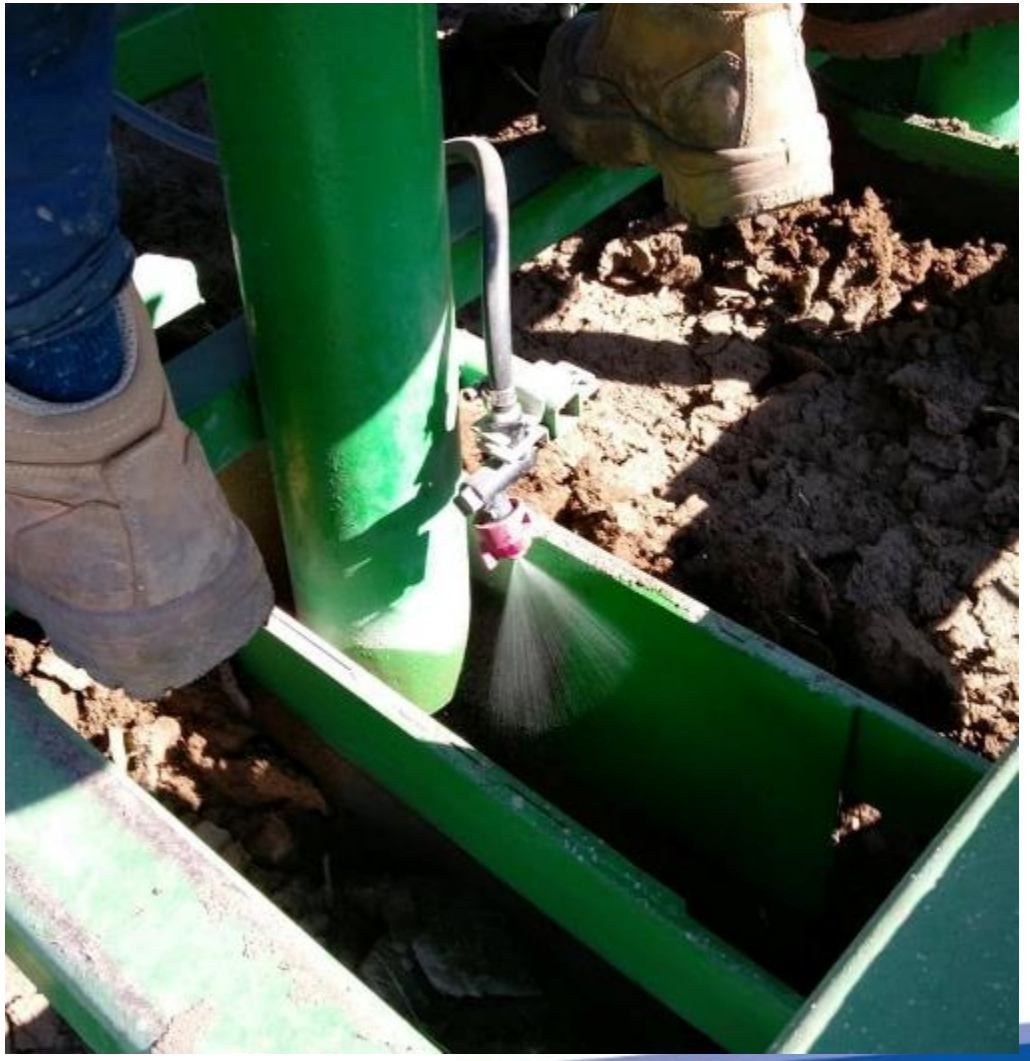
EndoPrime Application



EndoPrime applied by in-furrow spray (with Amistar) at 100g/Ha

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Rules of thumb for application

- Get direct contact with plant roots
- Mycorrhizal colonization lasts for the life of annual plants.
- For annual crops, inoculation at every planting is recommended.
- For perennial and permanent crops, inoculation is not required every year (at planting and top-up periodically). Perennial crops with a long dormant period benefit most from annual re-inoculation as levels can drop significantly during winter.
- Requires 3-4 weeks for symbiosis to establish, 2 months to see benefits
- Cannot “over-dose” with mycorrhizal fungi

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AgroSolutions Division

Endo Prime™

Rates

- **Vegetable Transplants**
  - <37,500 plants per ha — 100-150 g/ha
  - 37,500 - 75,000 plants per ha — 150-200 g/ha
  - 75,000 – 112,500 plants per ha — 200-250 g/ha
  - >112,500 plants per ha — 250-300 g/ha

- **Onion Transplants** — 100-150 g/ha
- **Seeded Vegetables** — 100-150 g/ha
- **Potato & Sweet Potato** — 100-150 g/ha
- **Strawberries, Rasberry & other berries (excluding Blueberries)** — 150-200 g/ha

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AgroSolutions Division

Endo Prime™

Rates

Field crops including Sorghum, Cotton, Mungbeans, Wheat, Soybeans, Barley, Oats, Corn, Chickpeas, Faba Beans, Lentils, Rice, Sugarcane, Pigeon Peas, Lablab, Sunflowers, Linseed, Field Peas, Triticale, Navy Beans, Peanuts, Hemp, Poppies & Pyrethrum	100 g/ha
Trees and Vines (new plantings)	
o Bare root spray	50 g/1,000 plants
o Container drench	80 g/1,000 plants
o In-field drench	100 g/1,000 plants
Trees and Vines (established)	
o In-field drench (use higher rate on plants above 2 years)	100-150 g/1,000 plants
o Directed spray	100g/1,000 plants (1 year old or less) 150 g/1,000 plants (2-4 years of age) 400 g/1,000 plants (5 + years of age)

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EndoPrime® Formulation

1. WP formulation with excellent solubility
2. Contains 4 key Endo-mycorrhizae strains plus Humic Acid
3. The 4 AMF strains are *glomus intraradices, glomus aggregatum, glomus mosseae and glomus etunicatum*
4. 2,250 endo-mycorrhizae propagules per gram
5. Humic acid has been shown to help stimulate (signal) the mycorrhizae, enhance the uptake of nutrients, and condition soil parameters such as carbon, pH and CEC.
6. Humic acid also acts as a highly soluble and effective carrier for the AMF propagules
7. Highly compatible with most seed treatment, in-furrow or drench products.

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Sumitomo are one of the only groups producing AMF In-Vitro

In Vivo	In Vitro
Virtually all AMF species can grow this way	Only certain species of AMF can be produced this way.
Produced under natural condition	Produced under controlled conditions.
Spore concentration is less	Concentrated spores and propagules
Contamination risk is high	Contamination risk is negligible
Presence of non-soluble substrates	Minimal non-soluble substrates
Not suitable for irrigation systems	Suitable for irrigation systems
Quality control is not easily possible	Quality control is easy with excellent traceability.
Many variable production processes	Proprietary production process

Drip Irrigation

- EndoPrime has minimal insoluble substrates - meaning it is compatible with most drip irrigation systems
- This is relatively unique within mycorrhizae formulations
- Sumitomo recommend as a precaution 50 mesh filters be used post the injection point

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Packaging

- 500g foil satchels
- Shipper = 10 x 500g

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Endo Prime™

When should EndoPrime be used?

- When growing a highly mycorrhizae dependent crop.
- When trying to optimize yield and quality.
- When field has been devoid of vegetation for any length of time, 6 months or more.
- When soil nutrition is not expected to be ideal.
- When soil moisture is not expected to be abundant or crop is non - irrigated.
- When soil constraints are present such as sodicity or salinity.
- When soil structure is in decline and needs improving.
- When a non-mycorrhizal crop like a brassica has been grown previously
- When soil carbon is low and increased carbon levels is desired.
- When a soil fumigant has been used.
- When soil cultivation has been used

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Endo Prime™

Summary

- Improved nutrient foraging and utilization
- Improved Water Use Efficiency (WUE)
- More resilient plants
- Often higher yields
- Excellent insurance policy against non-ideal growing conditions

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Endo Prime™

Mycorrihzae

TRIAL DATA

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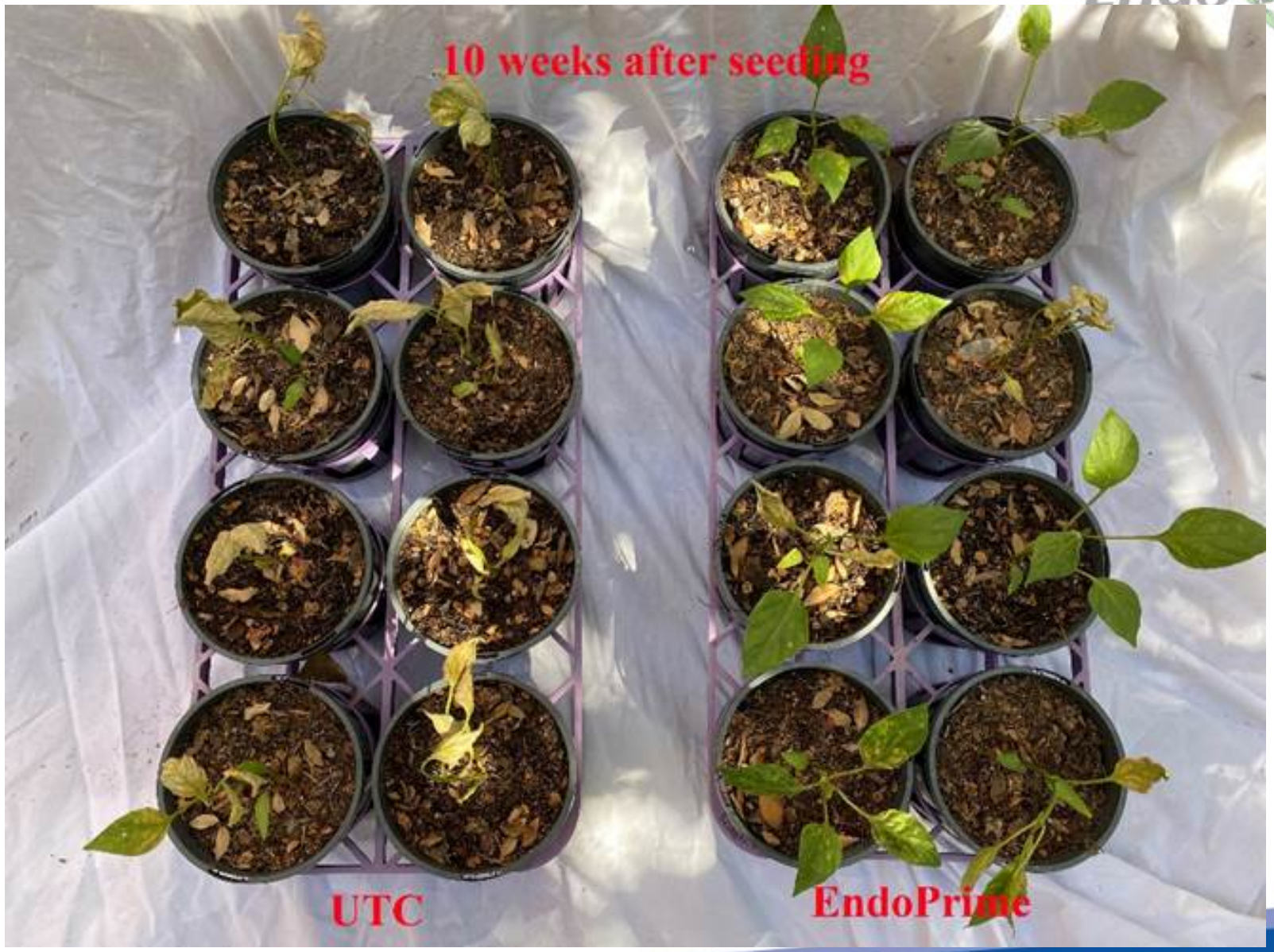
Endo

Capsicum Trial WA 2021

1. Treated in nursery trays as a drench
2. Transplanted to larger pots simulating transplant shock in the field
3. 8/8 UTC died, and only 1/8 EndoPrime treated died 10 weeks after seeding



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Endo Prime™

Almond transplant trial Carrathool - 2020/2021/2022

Location	“Quindalup”, Carrathool, NSW
Application/Planting Date	30/06/2020
Crop	Almonds
Variety	Non-Peril
Soil type	Red Loam
Crop Management	As per standard
Weather Conditions	Planted winter 2020, la nina for 2020.21 summer producing above average rainfall and mild growing condtions.

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Endo Prime™

Almond transplant trial Carrathool - 2020/2021/2022

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Endo Prime™

Almond transplant trial Carrathool - 2020/2021/2022

There was 100% survival of the trees in all mycorrhizae treatments compared to 4% mortality across the untreated control plots.

Removed need to come back and replant lost trees and removed lost growth in replanted trees

Trial ongoing

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Endo Prime™

Fresh Market Potatoes Boat Harbour Tasmania 2020/2021

- Soils: Ferrosols on deeply weathered basalt
- Soil depth >25cm
- Depth to compacted layer approx. 40cm
- Rocks and clods present, varied sizes
- 20yrs since last cropped
- Land Capability: Classes 2 & 3
- Site Conditions: Good soil moisture levels
- Soil temp: 1.7 to 12.7OC
- Ambient temp: 14.7 to 21.0OC
- Lots of worms

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Fresh Market Potatoes Boat Harbour Tasmania 2020/2021

1. Trial Site: Boat Harbour
2. Date: 2/12/20
3. Variety: Clearwater Russets
4. Treatment:
5. EndoPrime @ 150g/ha
6. Control

SUMITOMO CHEMICAL
AgroSolutions Division

Fresh Market Potatoes Boat Harbour Tasmania 2020/2021

1. Trial Site: Boat Harbour
2. Date: 2/12/20
3. Variety: Clearwater Russets
4. Treatment:
5. EndoPrime @ 150g/ha
6. Control

SUMITOMO CHEMICAL
AgroSolutions Division

Fresh Market Potatoes Boat Harbour Tasmania 2020/2021

1. Trial Site: Boat Harbour
2. Date: 2/12/20
3. Variety: Clearwater Russets
4. Treatment:
5. EndoPrime @ 150 g/ha + Viva 20 L/ha
6. Control

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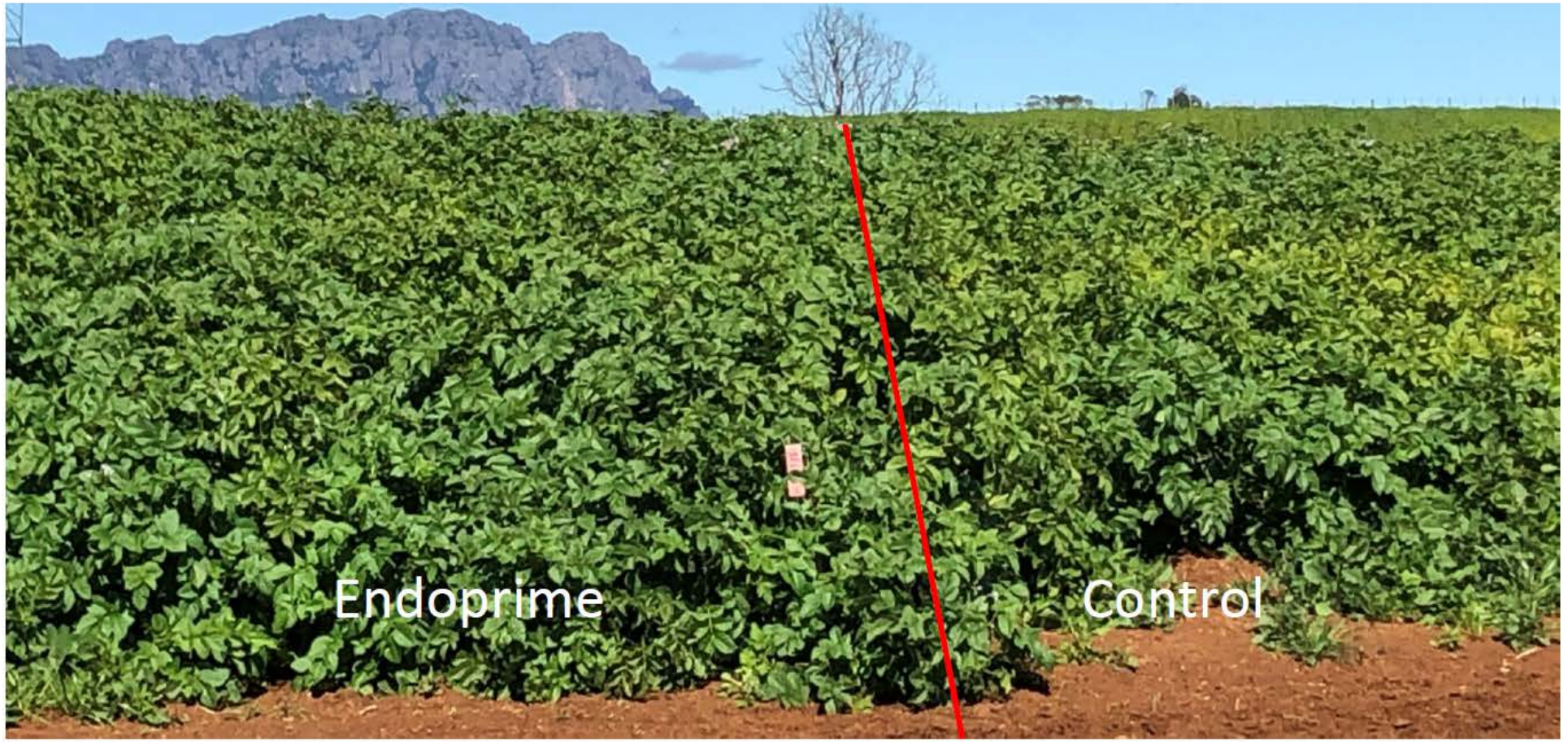
Endo Prime™

Fresh Market Potatoes Sheffield Tasmania 2019/2020

EndoPrime – Site 3 Three Year Rotation



March 23 2020

SUMITOMO CHEMICAL
AgroSolutions Division

Endo Prime™

Fresh Market Potatoes Sheffield Tasmania 2019/2020

EndoPrime – Site 3 Three Year Rotation

March 23 2020

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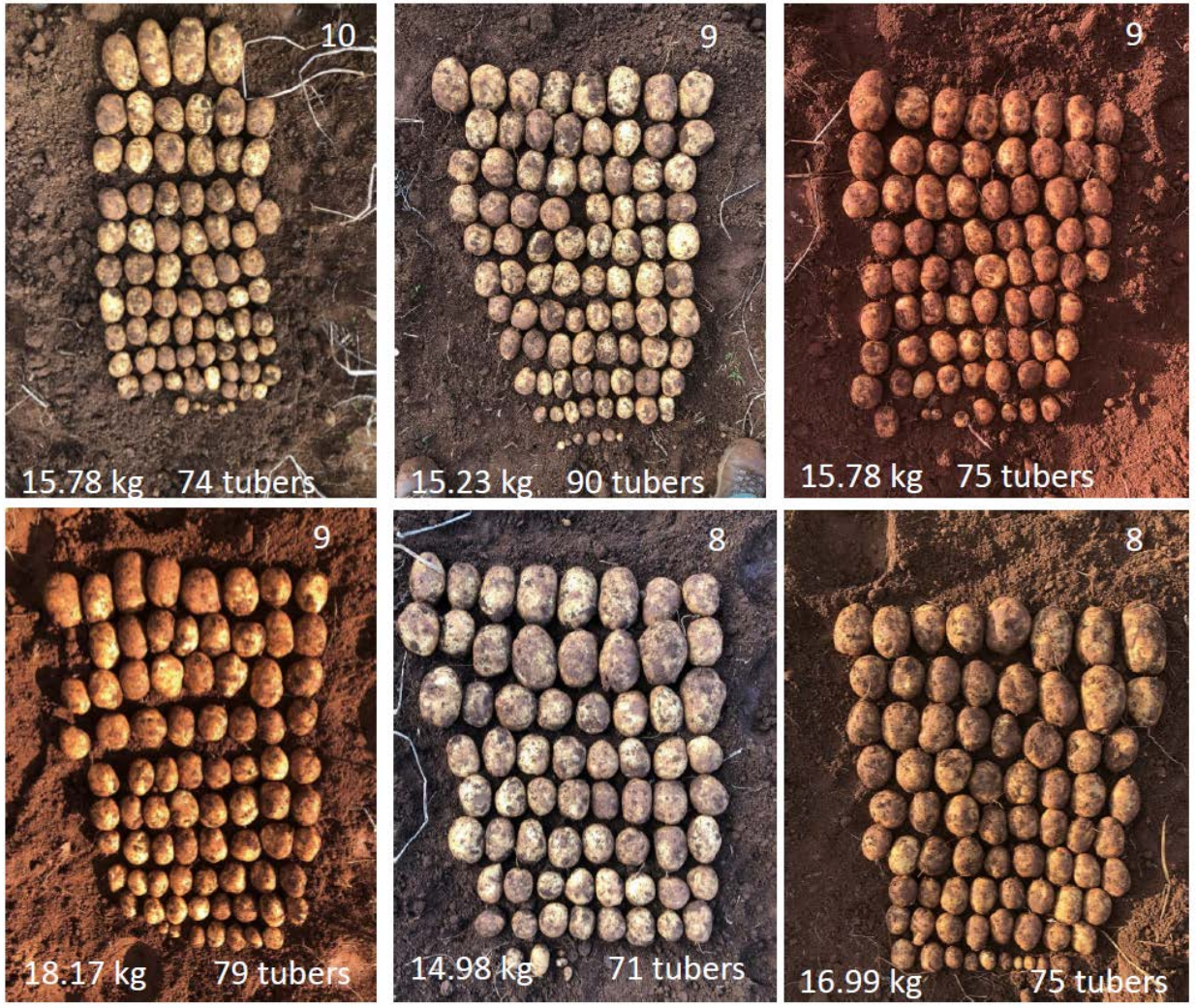
Endo Prime™

Fresh Market Potatoes Sheffield Tasmania 2019/2020



EndoPrime tubers were more uniform in size than the controls.

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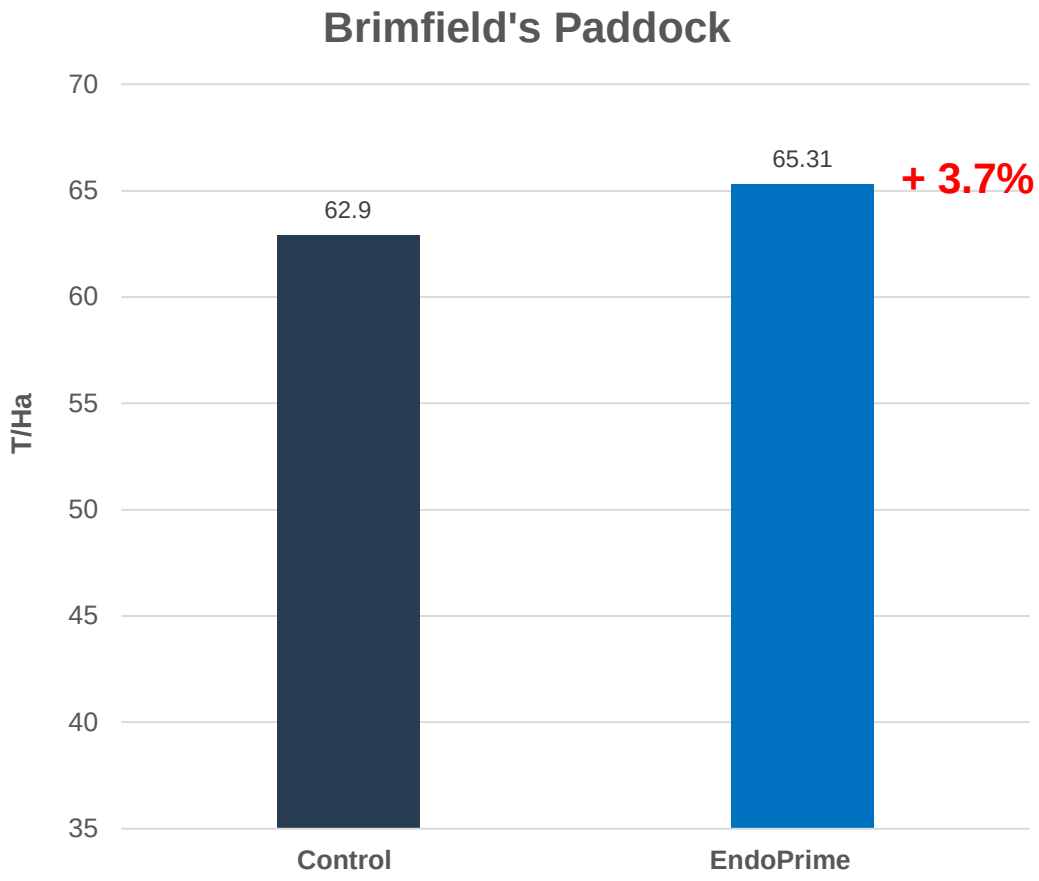
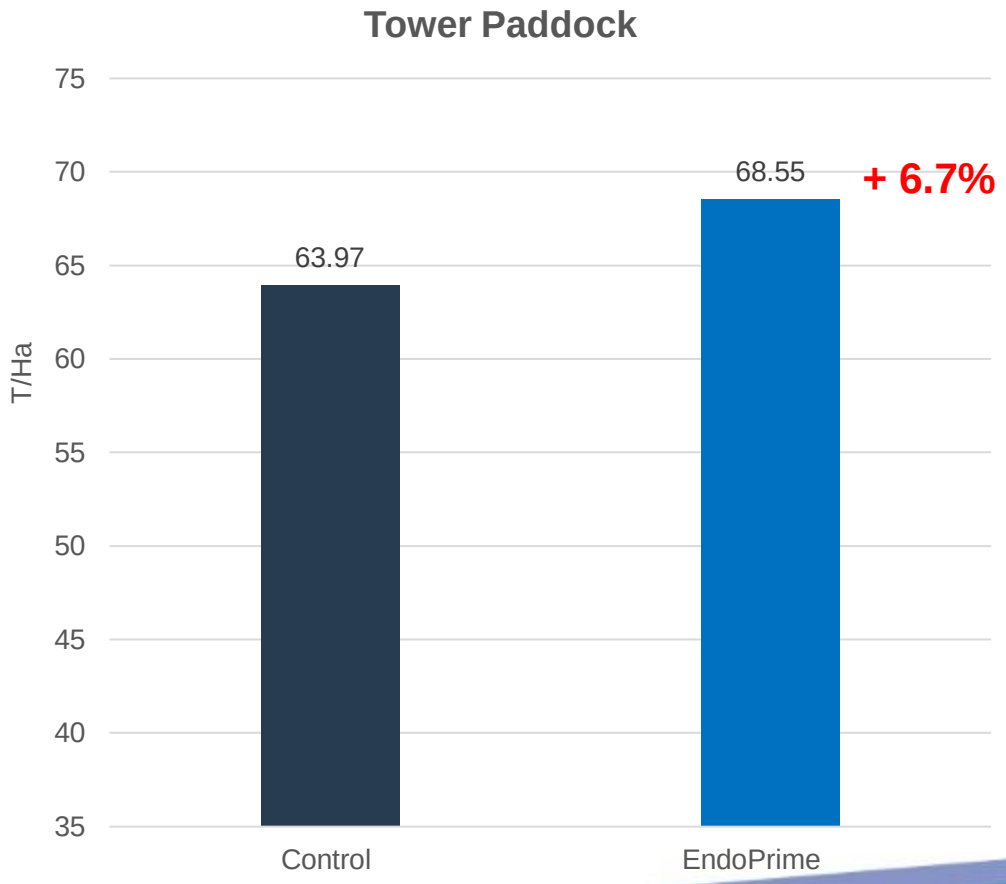
Fresh Market Potatoes Sheffield Tasmania 2019/2020





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Endo Prime™

East Gippsland lettuce trial - EndoPrime

Crop: Cos and Iceberg lettuce

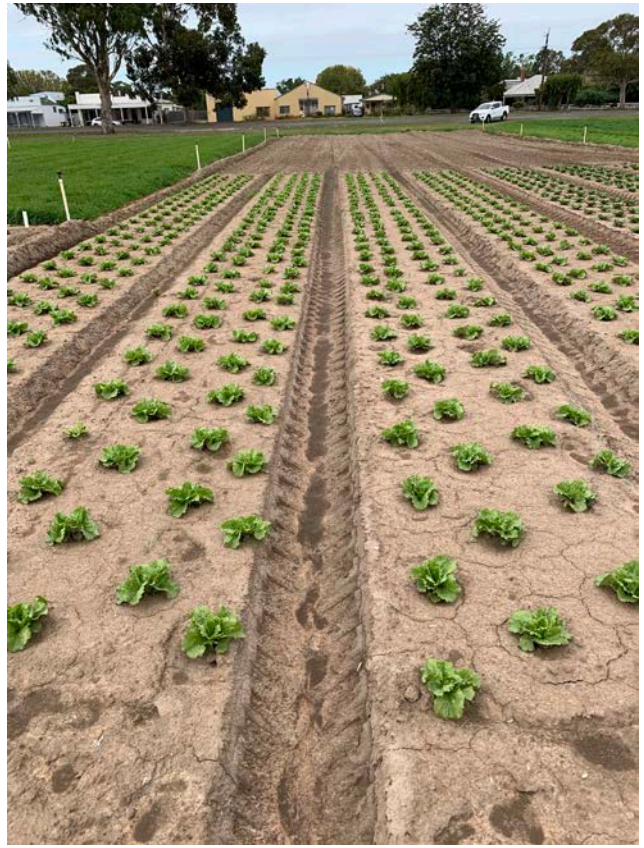
Sowing Date: 27th Feb 2020

Treatment: EndoPrime 100 g/ha

Treatment method: EndoPrime was mixed in correct proportions and watered in along the rows of newly transplanted lettuce seedlings on the 28th Feb

Other:

- The site was out of vegetable production for approximately 12 months having grown a mustard cover crop during Spring 2019 which was terminated in November 2019. The site also had 1 tn/ha of Ground Burnt Ag Lime applied as a risk management strategy for Club Root although site pH was measured at 7.2 (CaCl).
- Seedlings were Confidor treated
- Grower standard fertilizer treatment was used.
- Grower standard fungicide program used with Intuity applied in addition late season.



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East Gippsland lettuce trial – EndoPrime – Soil disease test

Two samples taken

	R. solani AG2.1 ***pgDNA/g Sample****	***Pratylenchus crenatus*** ***nematodes/g soil***	***Pratylenchus neglectus*** ***nematodes /g soil***	***Pratylenchus thornei*** ***nematodes/g soil***
Sample 1	153	0.0	11.1	0
Sample 2	14	0.0	7.2	0

	Pythium violae ***kDNA copies/g Sample****	***S. sclerotiorum*** ***kDNA copies/g Sample****	***Phoma terrestris*** ***kDNA copies/g Sample****	***Black root rot*** ***kDNA copies/g Sample****
Sample 1	0.2	1	48	1
Sample 2	0.4	84	47	0

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AgroSolutions Division

Endo Prime™

East Gippsland lettuce trial – EndoPrime – Tissue disease test

SUBMISSION DETAILS

Date Received: 29-Apr-2020

Number of Samples: Submitted Samples: 1

SUBMISSION REASON AWM Vegetable Diagnostic

Cos lettuce to be checked for cause of stunting.

Reference: Lindenow

TESTING DETAILS

SUMMARY

Test Name	Not Detected	Detected	Pending	Total
Cucumber mosaic virus	1	0	0	1
Potyvirus (NIb2F/NIb3RN)	1	0	0	1
Tobamovirus	1	0	0	1
Tomato spotted wilt virus	0	1	0	1
Tospovirus	0	1	0	1

Virology : Cucumber mosaic virus

Sample ID	Result
0001-Cos Lettuce (Plant)	*Test Date: 09/06/2020*
CMV	Negative

Cucumber mosaic virus: NATA accreditation does not cover the performance of this service

Virology : Molecular Identification by PCR

Sample ID	Result
0001-Cos Lettuce (Plant)	*Test Date: 09/06/2020*
PCR Target/Species	Polerovirus
PCR Result	Not Detected
Negative	

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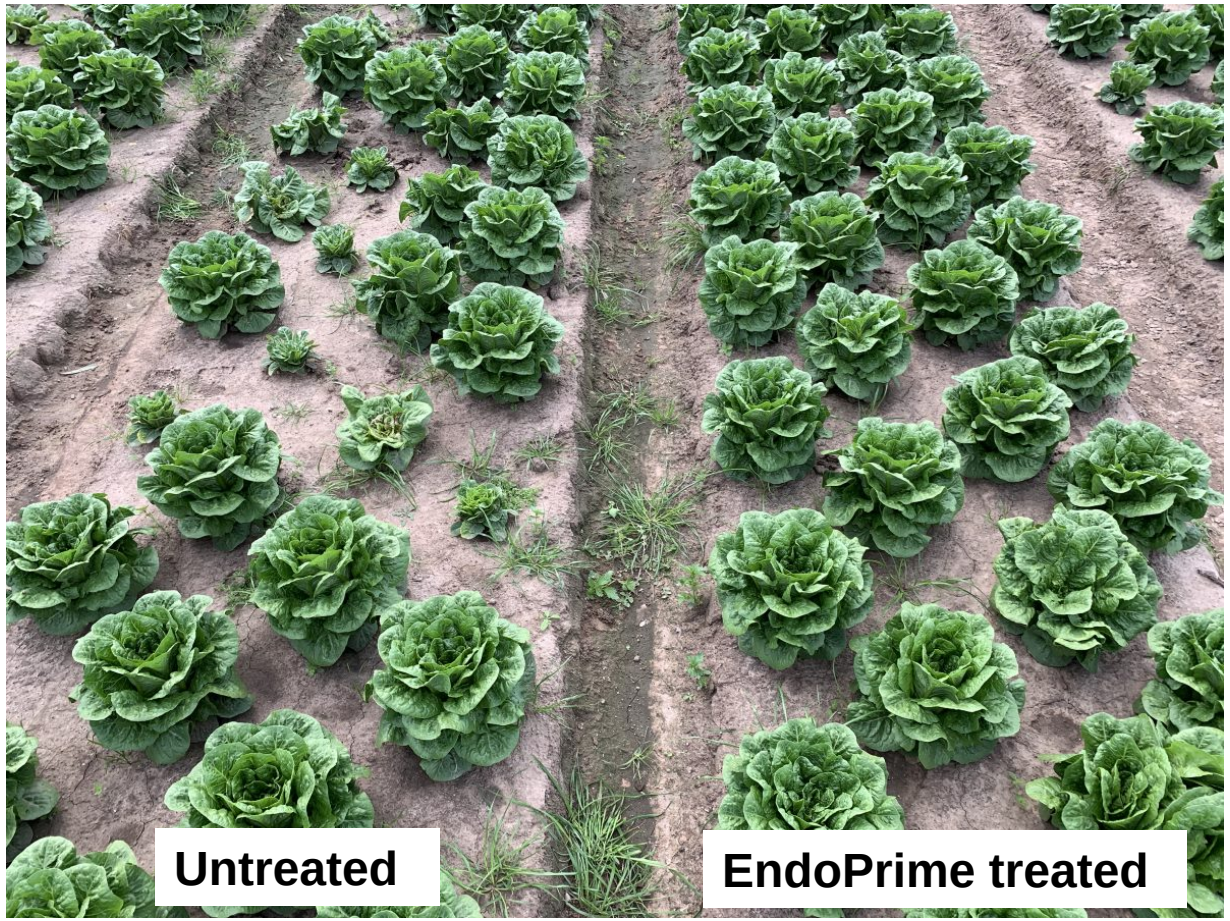
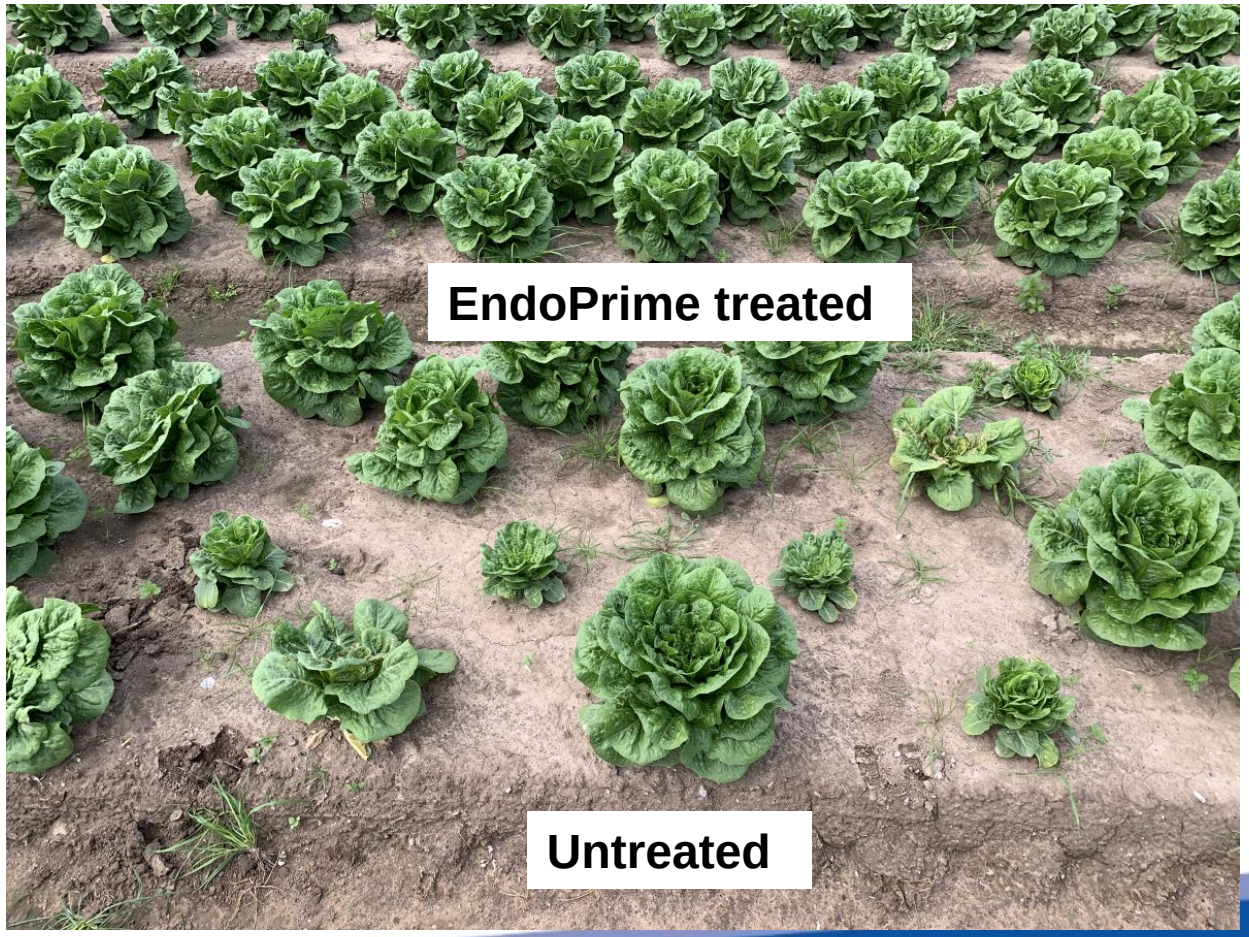
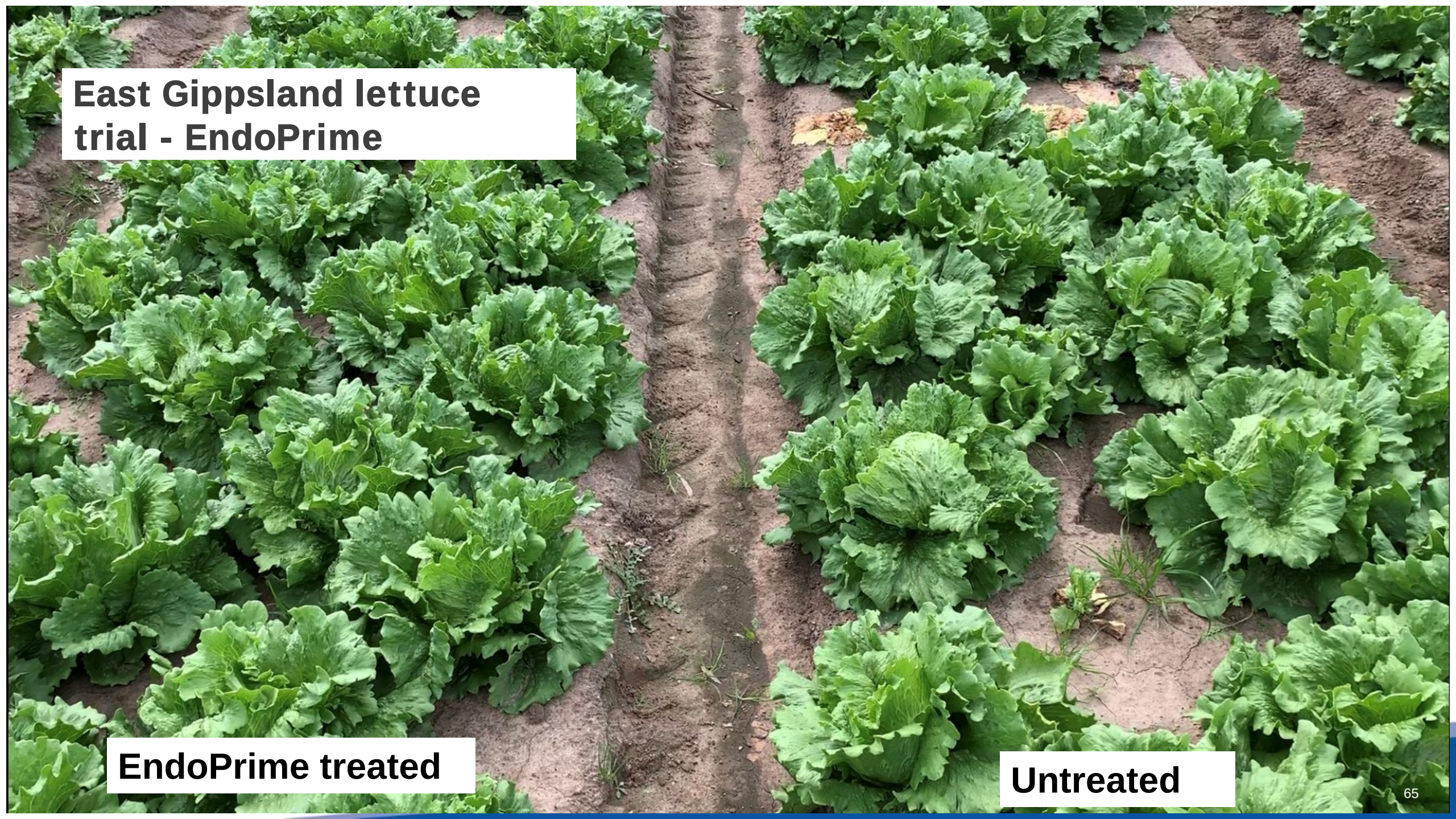
East Gippsland lettuce trial - EndoPrime

EndoPrime seems to have helped lettuce overcome symptoms of Tospovirus infection






East Gippsland lettuce trial - EndoPrime
EndoPrime treated
Untreated

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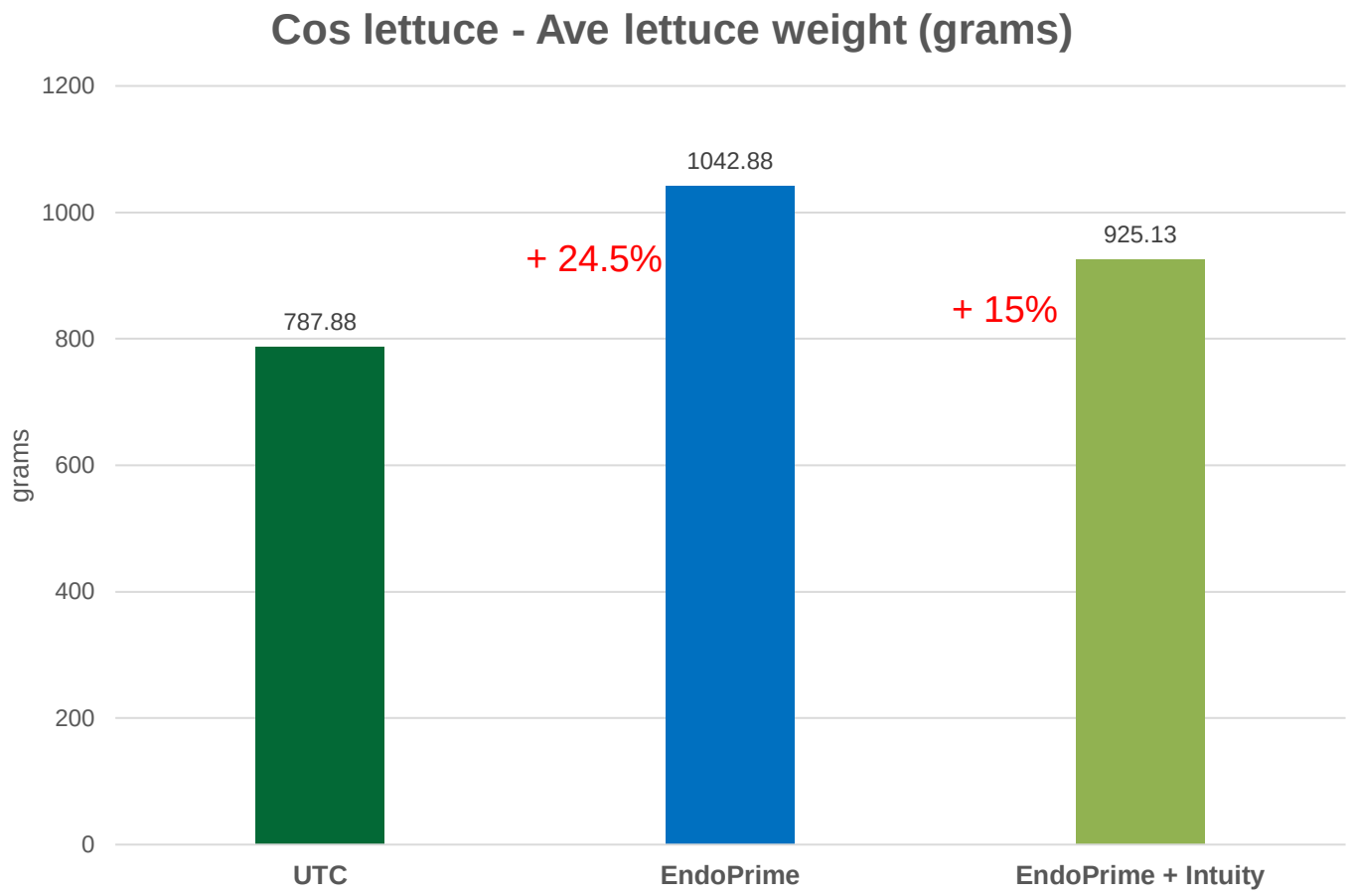
East Gippsland lettuce trial - EndoPrime



Cos Lettuce Weights		Grams	
	UTC	EndoP	EndoIntu
Average	787.88	1042.88	925.13
Diff to UTC (%)	-	+24.5	+14.92
Paired T-Test (Treatment vs UTC)			
P-value	-	0.0013	0.0629
P-value (pooled UTC vs pooled EndoP	-	0.0244	

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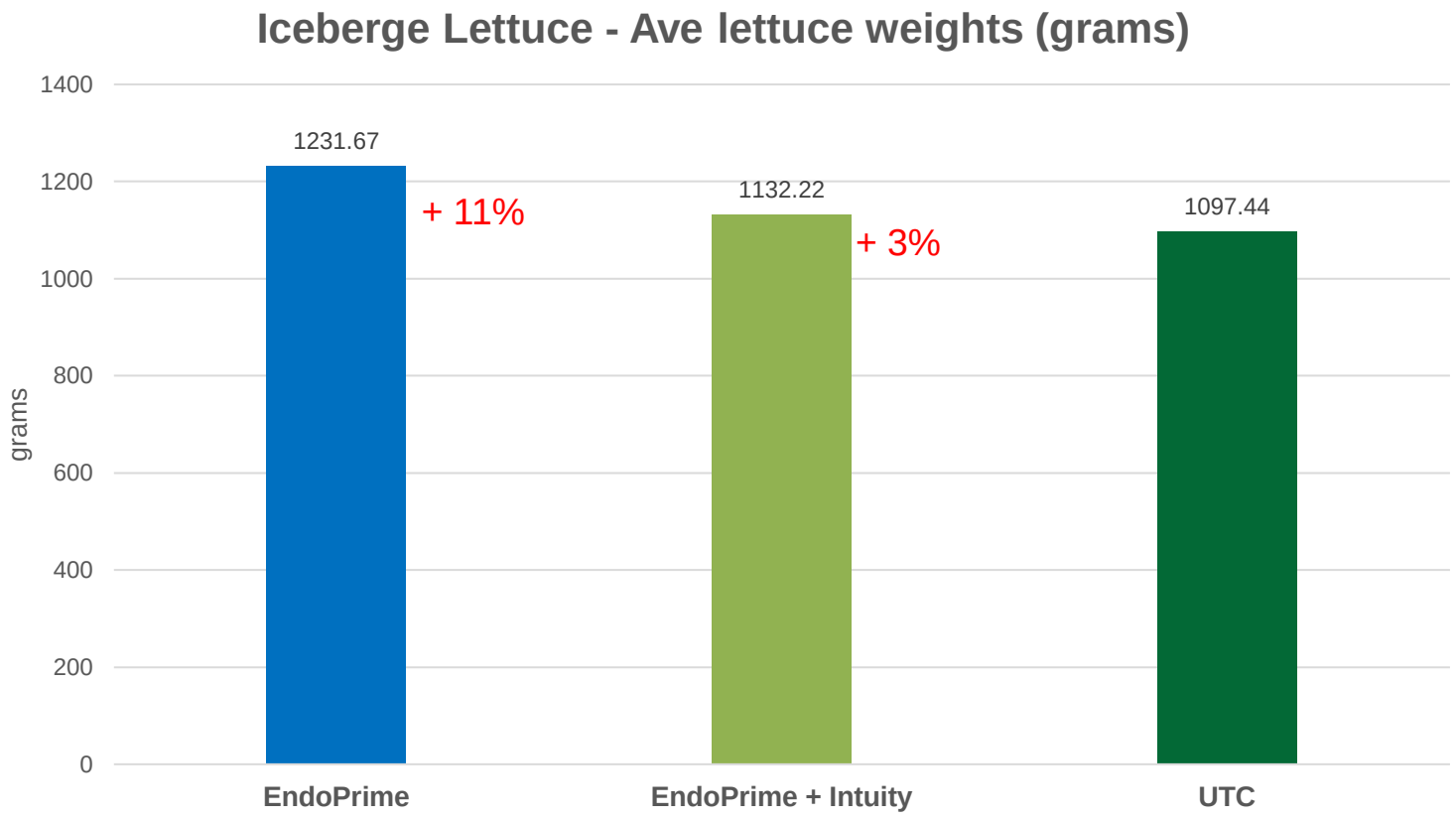
East Gippsland lettuce trial - EndoPrime



Iceberg Lettuce Weights - whole			Grams
	Endo	EndoIntu	UTC
Average	1231.67	1132.22	1097.44
Diff to UTC (%)	+11	+3.2	-
Paired T-Test (Treatment vs UTC)			
P-value	0.1845	0.8385	-
P-value (pooled UTC vs pooled EndoP	0.1004		-

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Endo Prime™

Pistachio Trial – SA Mallee

Aim

The Aim of the trial was to measure the impact of fertigating the soil with EndoPrime on the growth rates of newly planted pistachio trees in a commercial orchard.

Co-operator

Ian Mau, Mallee Orchard Pistachios, Peebinga, South Australia

Treatment and Trial Design

- The EndoPrime treated area consisted of a separate irrigation section of a commercial planting.
- The application of EndoPrime occured as a fertigation treatment.
- In order to assess the impact of the EndoPrime an untreated block was part of the trial.
- Untreated plants (control) occured as re-plants with the same rootstock and the same age and source as treated.
- Both the EndoPrime treated and Untreated blocks received the same fertiliser and disease control programme (standard grower management programme) throughout the trial period.
- EndoPrime was applied at 400g per 1000 trees. The irrigation section contains 12,000 trees.

Trial Assessment

The diameter of the root stock were measured at the time of planting and prior budding with the commercial cultivar.

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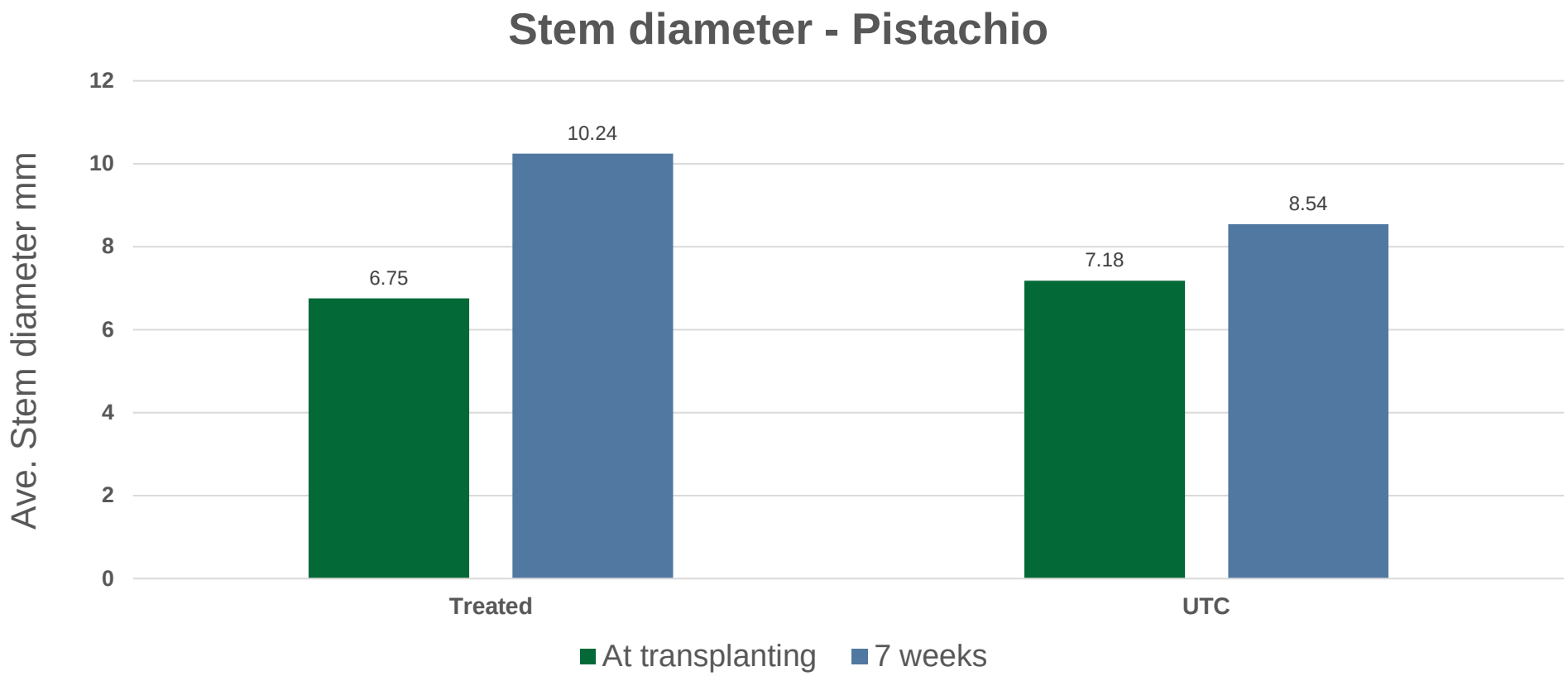
Endo Prime™

Pistachio Trial – SA Mallee



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Endo Prime™

Oranges Glen Prairie , Moree

1. Treated with EndoMaxx September 2017
2. Applied as a pot drench prior to transplanting
3. 1 row of 140 trees treated in the middle of the orange grove
4. Mixed 3g Endomaxx in 14 lts water to treat 140 trees.
5. Each tree drenched with 100 mls solution in the pot just prior to sowing.
6. 476 trees a Ha, so .3 Ha treated.

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Endo Prime™

Oranges Glen Prairie , Moree.

Trunk Diameter (mm) measured above graft 28 Nov 2019.

	Ave Diameter	Range	Range variability.
EndoMaxx	35.28	30.5 - 39.8	9.3
UTC	30.44	20.2 - 36	15.8

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AgroSolutions Division

Endo Prime™

ENDOMAXX APPLIED AT PLANTING SPRING 2017
PHOTOS 28 OCT 2019. ORANGES, MOREE.

Endomaxx

UTC

SUMITOMO CHEMICAL
AgroSolutions Division

ENDOMAXX SPRING 2017 APPLIED AT PLANTING PHOTOS 28 OCT 2019. ORANGES , MOREE.

Endomaxx

UTC

SUMITOMO CHEMICAL
AgroSolutions Division

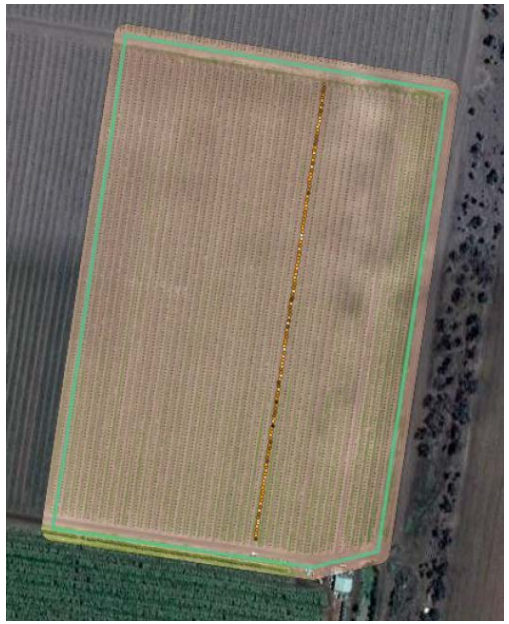
Oranges Glen Prairie , Moree

STEVTECH

Canopy measurement and NDVI via Drone

Block size 15 hectares
There was a total of 5875 trees analysed.
Trees were grouped into 4 groups to enable variations to be considered for analysis.
These groups consisted of:

- The row of treated trees (treated trees, n=140),
- The two rows directly east of the treated trees (Eastern Non-Treated Trees, n=282)
- The two rows directly west of the treated trees (Western Non-Treated Trees, n=280)
- And all non-treated trees excluding the row of trees directly to the east and west of the treated trees (All non-treated trees with exclusions, n=5452). Non-treated rows immediately adjoining the treated trees were excluded because AMF can migrate, especially over 2 years.



The Treated Trees performed better in all analysis categories together with lower standard deviation than other analysed groups.

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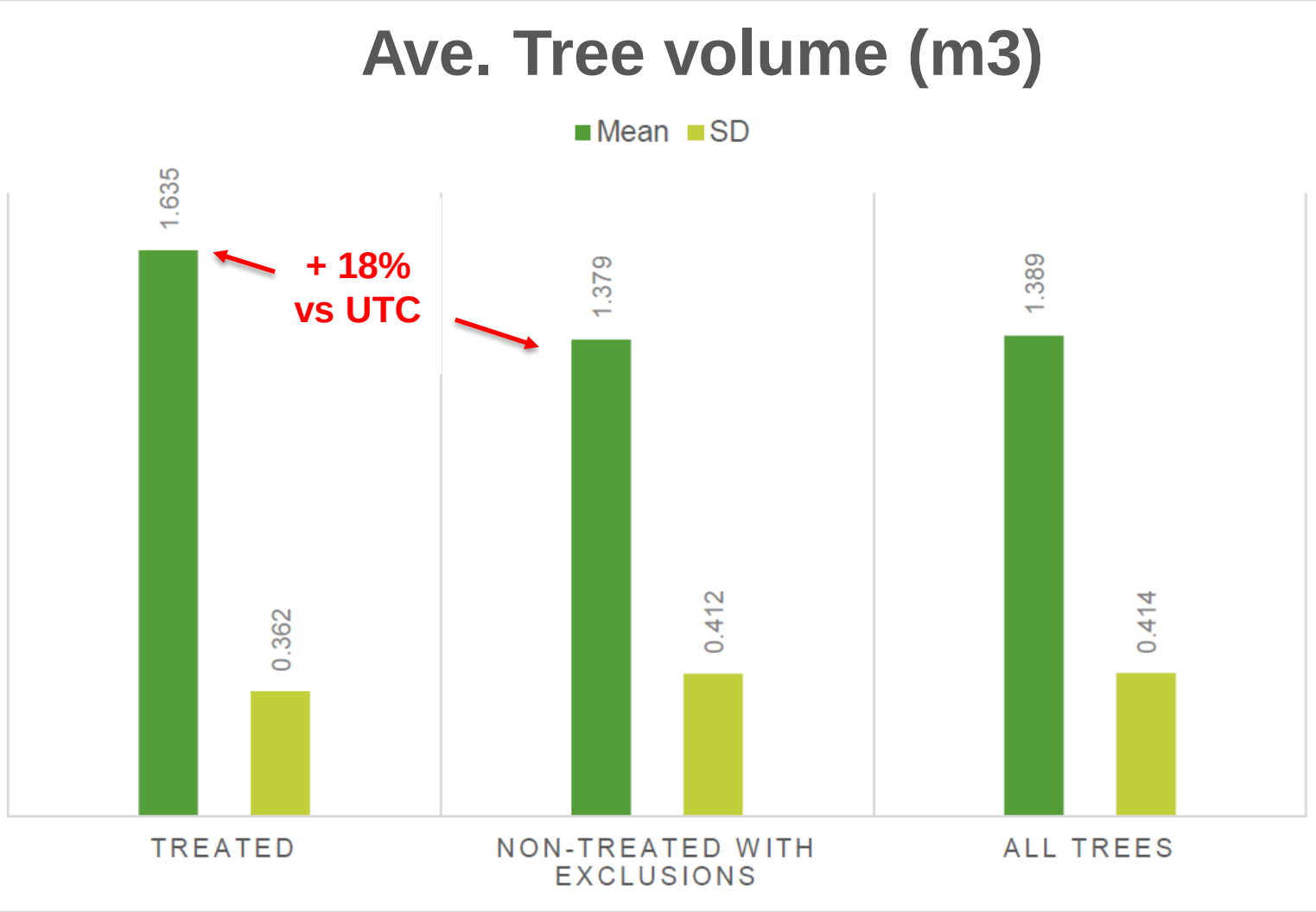
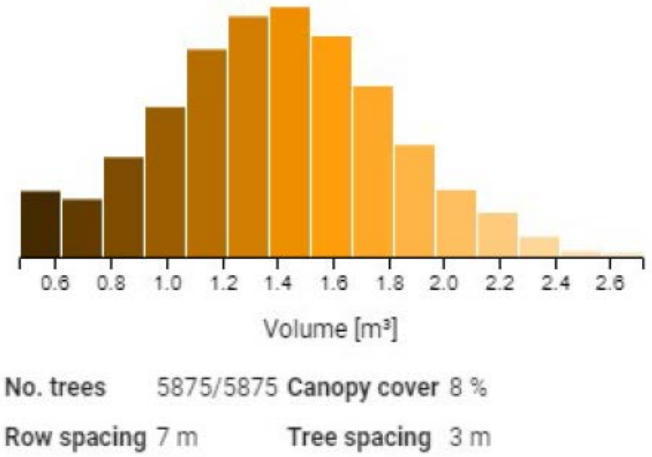
Oranges Glen Prairie , Moree

STEVTECH

Canopy measurement and NDVI via Drone

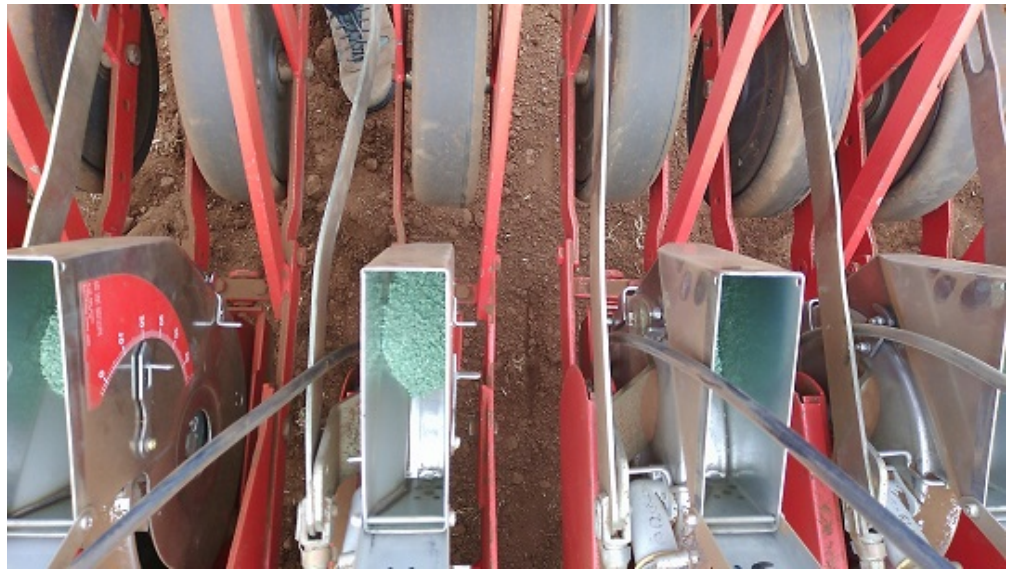




SUMITOMO CHEMICAL
AgroSolutions Division

Mycorrhizae: EndoMaxx and EndoPrime on carrots

- Deloraine, Tas, on red ferrous soil
- Carrot seed coated by BRA 6 days prior to sowing
- EndoPrime 150g/kg EndoMaxx 15g/kg
- Seed sown at 1kg/Ha on 28 Oct 2019
- Growth assessment on 10 Feb 2020 (8 reps of 10 carrots)
- Harvest during winter 2020



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Endo Prime™

EndoPrime Lettuce Trial – Forthside Tas 2018

1. Red ferrosol soil
2. Lettuce cv Exponent
3. Transplanting date: 19-9-2018
4. Harvest date: 21-11-2018
5. Irrigated
6. Plant density 60,000/ha
7. EndoPrime applied as a seedling drench at 100g/ha

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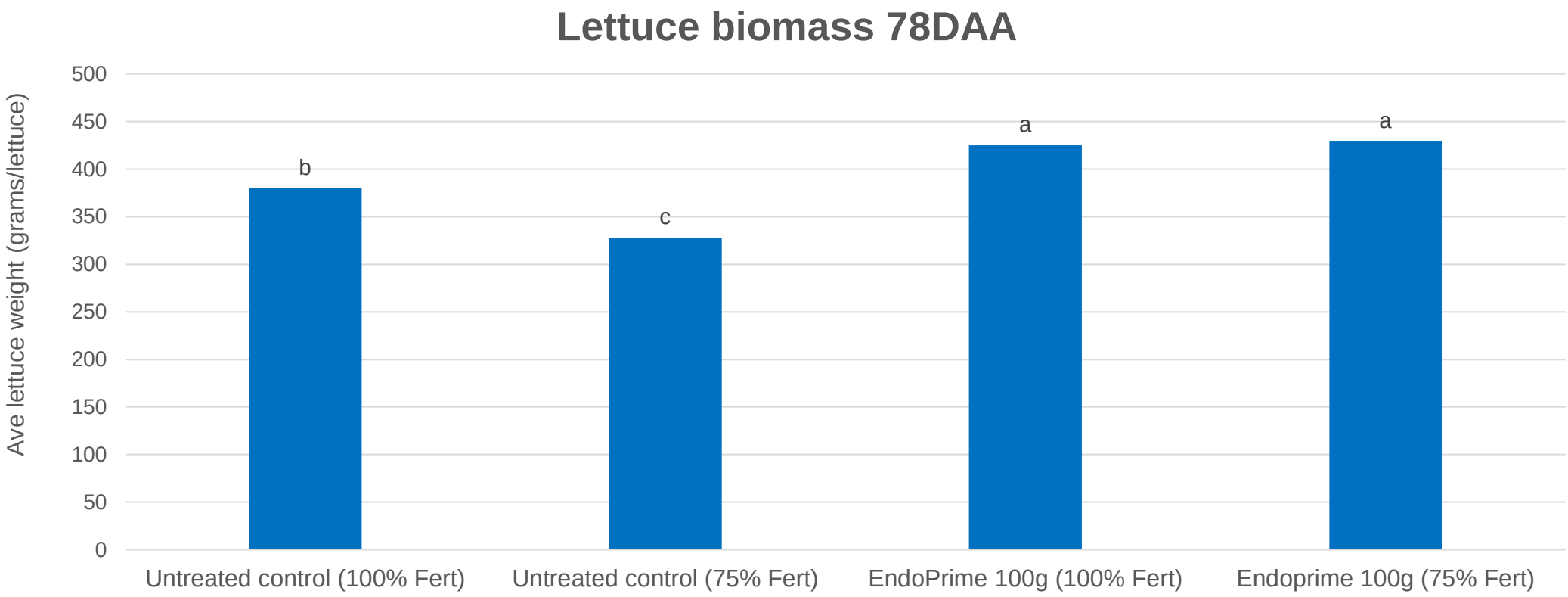
EndoPrime Lettuce Trial – Forthside Tas 2018



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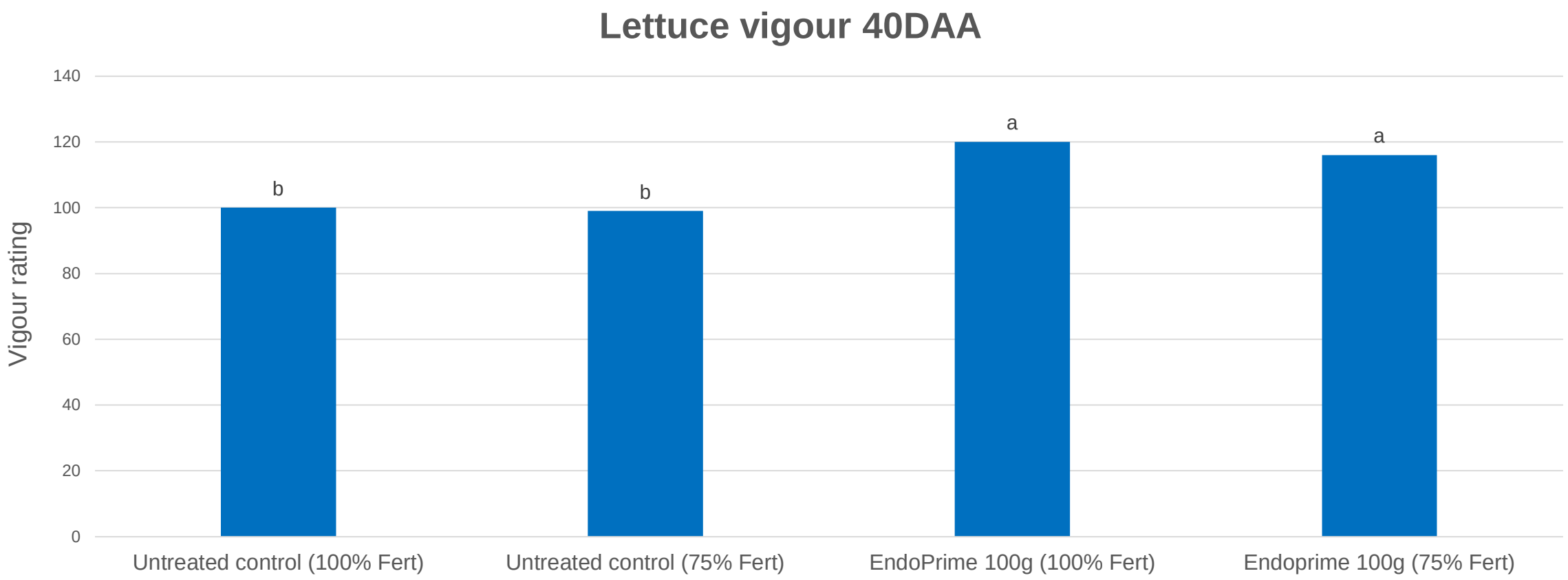
EndoPrime Lettuce Trial – Forthside Tas 2018



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EndoPrime on lettuce - Forthside TAS, 2019

Small plot with 6 reps, red brown clay loam. Wheat the season before
Applied by seedling tray drench 14 days prior to planting

UTC 100% fertilizer

EndoPrime 180g/ha 75% fertilizer

Photos 26 days after planting

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AgroSolutions Division

Endo Prime™

Mycorrhiza on avocado

V16-006

Bburg QLD

45 or 90 glomus propagules in 1 or 2mL of water mixture pipetted into root ball base in nursery bags. Planted 6 days later 50 plants per treatment in single rows

SUMITOMO CHEMICAL
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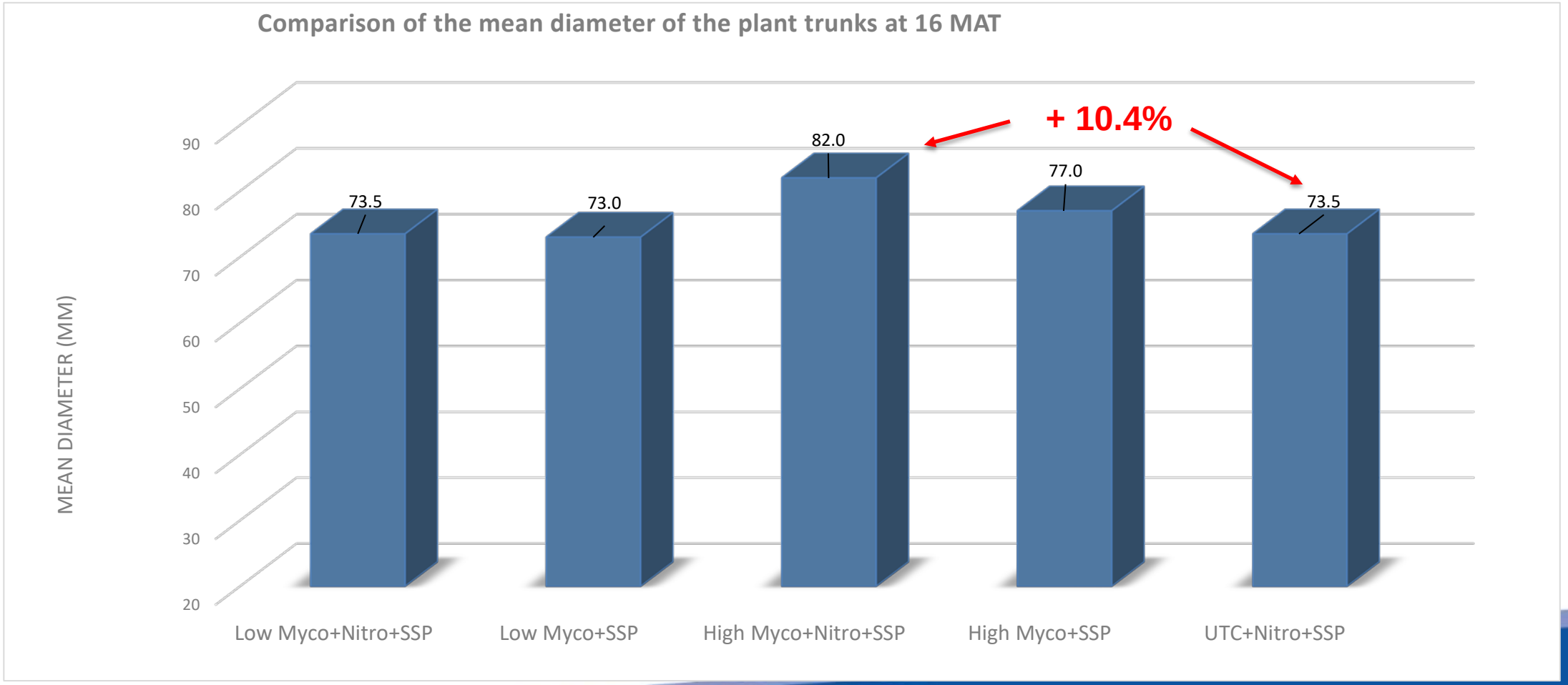
Endo Prime™

Mycorrhiza on avocado

V16-006

Bburg QLD



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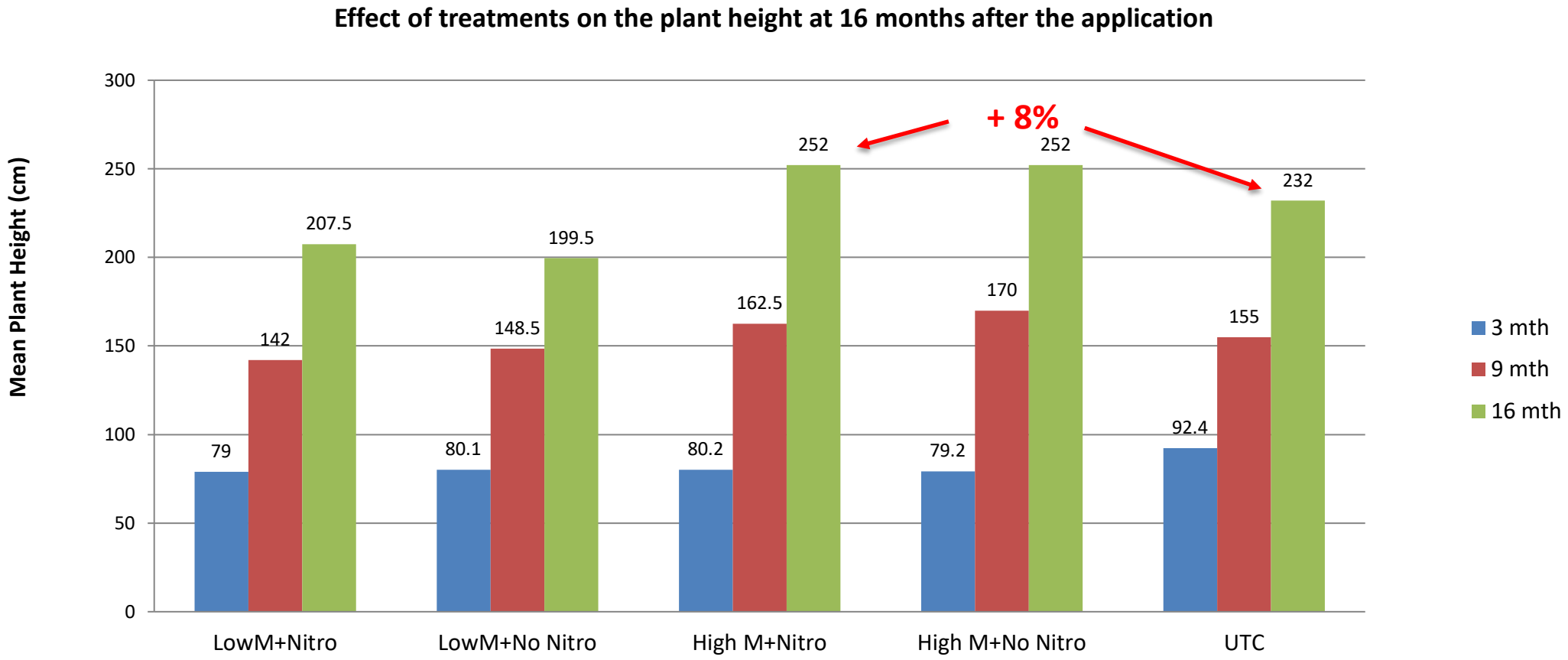
Endo Prime™

Mycorrhiza on avocado

V16-006

Bburg QLD



SUMITOMO CHEMICAL
AgroSolutions Division

Effect of EndoPrime on Kipfler potatoes. Mornington Peninsula, Vic 2019

- EndoPrime applied at 100g/ha at sowing
- Sandy loam soil
- EndoPrime was applied in Furrow with Amistar (its compatible) on 8th October 2018. Emblem (fluazinam applied 2 days prior)
- Visual difference was obvious from second half of growing season
- Very high fertiliser rates used,
    - 1 tonne of 7,7,15 (plus added Mg & B) pre-planting
    - 1 tonne of 7,7,15 (plus added Mg & B) at planting
    - 800kg of 15,0,17 early season OTT (with added Sulfate of Potash)
- Grower periodically fumigates (with chloropicrin) to help manage disease and nematodes – fumigant wipes out mycorrhizae
- Grower uses aggressive ground preparation – which also contributes to low mycorrhizae leves

SUMITOMO CHEMICAL
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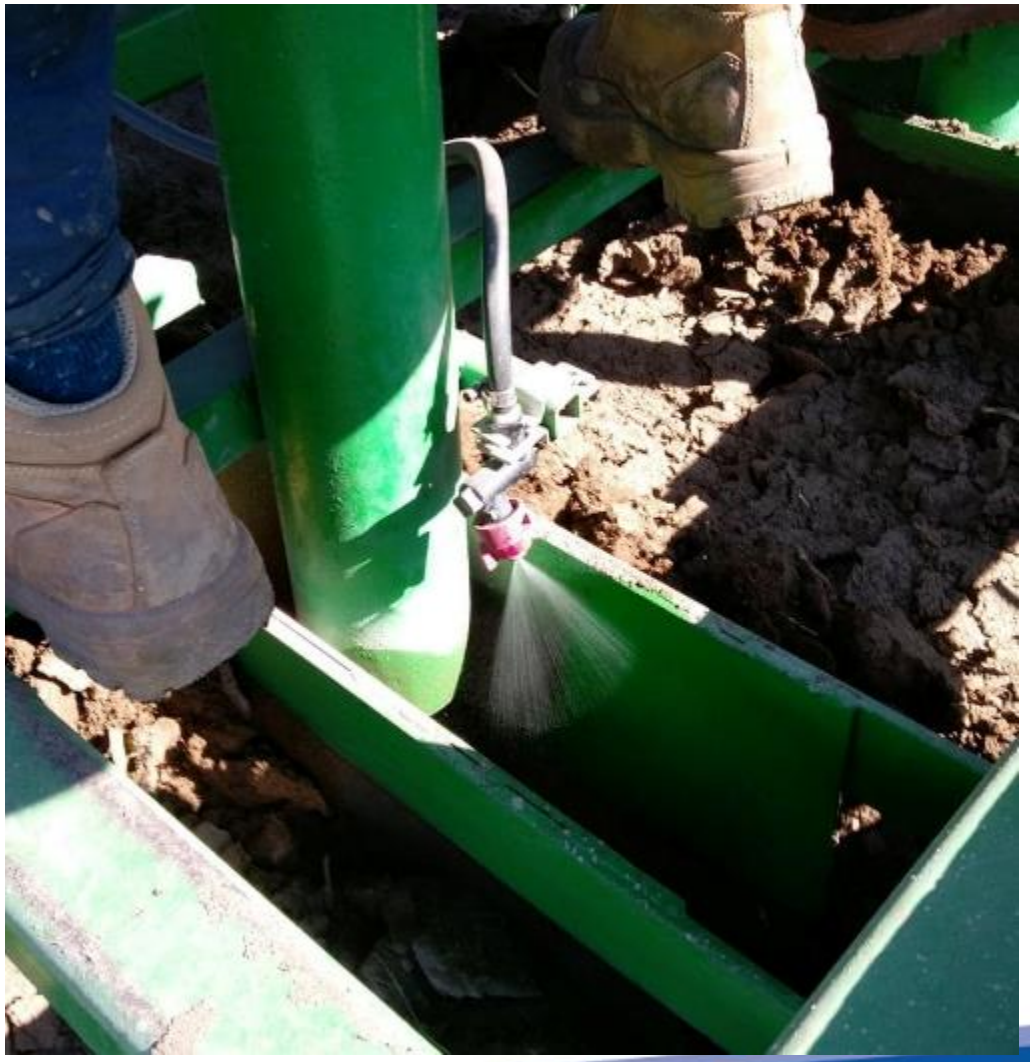
EndoPrime on Potatoes – Mornington Pen



EndoPrime applied by in-furrow spray (with Amistar) at 100g/Ha

Emblem applied (fluazinam) 2 days prior

SUMITOMO CHEMICAL
AgroSolutions Division

Endo Prime™

Effect of EndoPrime on Kipfler potatoes. Mornington Peninsula, Vic 2019

Grower uses aggressive ground preparation – which wipes out mycorrhizae

Differences in growth evident at mid growth stage

SUMITOMO CHEMICAL
AgroSolutions Division

Endo Prime™

Effect of EndoPrime on Kipfler potatoes. Mornington Peninsula, Vic 2019

EndoPrime treated tubers were similar length but were noticeably fatter

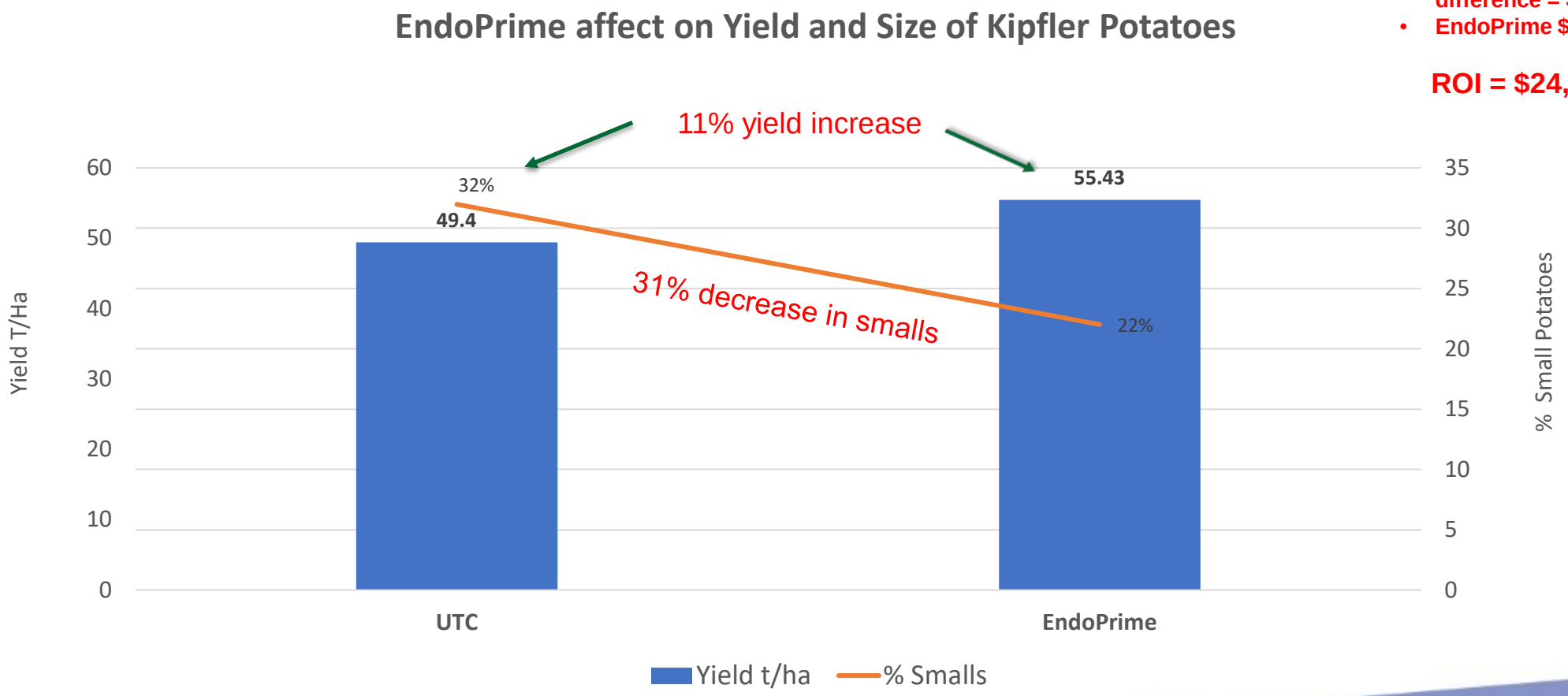
EndoPrime treated plots had less small potatoes
Grower happy as smalls only worth 60% of medium large.

SUMITOMO CHEMICAL
AgroSolutions Division

Effect of EndoPrime on Kipfler potatoes. Mornington Peninsula, Vic 2019

- 6t extra yield @ $3/kg = $18,000/ha
- 10% less smalls @ $1200/t difference = $6,648/ha
- EndoPrime $47/ha

ROI = $24,600/ha



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EndoPrime on Tomatoes – Tatura, Vic 2019

- Red ferrous soil
- EndoPrime applied to Roma tomato seedlings in trays at 150g/Ha on 15th Oct 2018.
- 500mL applied to 198 seedlings / tray – 12,000 seedlings treated (to cover 1.0Ha)
- EndoPrime-treated seedlings planted in 1.0Ha block and compared to rest of field.

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EndoPrime on Tomatoes – Tatura, Vic 2019

	Yield (kg / plant)		
	UTC	EndoPrime	Yield Diff. (%)
Marketable	8.44	9.53	+ 12.9%
Total	8.81	10.00	+ 13.5%
P-value **(paired T-Test)**	P = 0.029		Sig. diff.

Yield assessed at harvest on 8th Feb 2019

Crop at harvest

UTC

EndoPrime

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Yield assessed at harvest by Image Analysis

EndoPrime on Tomatoes – Tatura, Vic 2019

	Red tomatoes (% of image)		
	UTC	EndoPrime	Difference (%)
Tomatoes	4.19	5.04	+ 20.3%
P-value (paired T-Test)	P = 0.028		Sig. diff.

ImageJ
Image Processing & Analysis in Java

Crop at harvest

UTC

EndoPrime

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EndoPrime on brown onions – Forth, Tas, 2018

Red ferrous soil

100g EndoPrime mixed dry with fertilizer and applied in-furrow with onion seed on 19th June 2018 (1.0Ha) – 3.8kg seed/Ha

EndoPrime-treated block in centre of crop and rows running north-south.

No sig. difference in onion leaf length in Nov 2018

Aug 2018

Nov 2018

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Endo Prime™

Yield assessed at harvest on 14th Feb 2019

Yield (kg / m row)		
UTC	EndoPrime	Yield Diff. (%)
11.99	12.89	+ 7.5%
P-value (paired T-Test) = 0.081		not sig.

A second crop to be assessed next week

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Windance Organic Vineyard, Margaret River WA

Photo: Nov 27 2018

- Grower: Michael Wheatley
- Applied to Sav Blanc and Cabernet grapes
- Weeds significantly greener where EndoPrime applied
- Vines showing more growth & treated had to be hedged twice vs once for the untreated.
- Applied through Drip over 3 hours.
- UTC received exactly the same watering as treated
- Soil is brown gravely loam, low fertility
- No herbicide used and native clover & ryegrass under vines.
- Fertiliser was Potassium silicate, guano & humate.
- Observed less garden weevil where EndoPrime was applied

EndoPrime 100 g/ha

Untreated

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Endo Prime™

Goes where roots can't.

Mycorrhizae