



## WMF VAM PLUS (MYCORRHIZA) - IMPROVING UPTAKE OF NUTRIENTS :

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### Introduction

"Mycorrhiza" literally means "fungus-root" and defines the mutually advantageous relationship between specialized beneficial soil-inhabiting fungi (mycorrhizal fungi) and plant roots. *Mycorrhiza* symbiotically colonise the roots of the majority of terrestrial plants including trees, vines, ornamentals, crops and pasture plants<sup>(1,2,3,4)</sup>. These fungi attach to the plants roots and function as an extended root system for the plant. The fungi provide nutrients (particularly phosphorus, zinc, silicates etc) to the plant. In exchange, the plant provides sugars (derived from plant photosynthesis) and organic compounds for the fungi via root secretions<sup>(5)</sup>.

Vesicular arbuscular mycorrhizal (**VAM** or **endomycorrhizal fungi**) actually grows into the root cells of the host plant, producing abundantly branched structures (known as arbuscules, or "little trees")<sup>(6)</sup> inside the cell wall but outside the plasma membrane, providing a large surface area for the exchange of nutrients between plant and **fungus**<sup>(7,8)</sup>. Growth of the plant is more rapid in these relationships as the presence of the fungi vastly increases the root surface area and accelerates nutrient uptake from the soil<sup>(2,9,10)</sup>.

Spores of VAM fungi germinate and send out hyphae (fine thin webbed, thread-like tubes) which then colonise a plant root<sup>(11)</sup>. After infecting the root, hyphae grow away from the root and penetrate the surrounding soil to extract nutrients<sup>(12,13,14,15)</sup>.

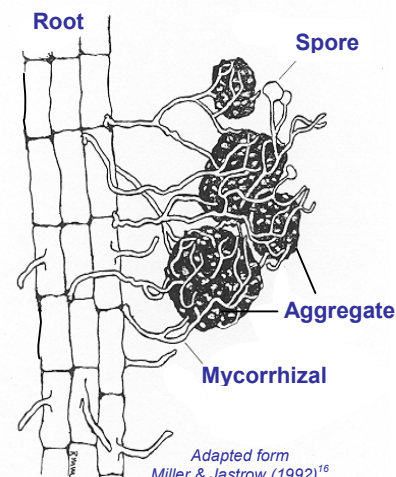
### WMF VAM PLUS – What are they & what do they do?

**Western Mineral Fertilisers VA Mycorrhiza (VAM Plus)** are a combination of beneficial soil microbes (that colonize plant root zones) and specially selected Mycorrhizal fungi (that grow as minute filaments that attach and penetrate the roots of most plants). The thin filaments absorb from the soil and deliver to the plant water and nutrients – a bio-fertiliser role. In return the plant provides essential sugars and other nutrients to the fungus. VAM also produce compounds that stimulate the plant to produce additional roots on which the fungi can grow.

**VAM Plus** produce compounds that dissolve hard to absorb elements such as phosphorous, iron, silicates and other partially soluble soil nutrients. These extraction processors are particularly important in plant nutrition and explain why non-mycorrhizal plants require high levels of soil fertility to maintain their health. Over 80% of all plants have developed some form of symbiotic mycorrhizal association.

VA Mycorrhiza form an extensive filament system within the soil that is many times larger than the plant root system. Crop & ornamental plants colonized by VAM fungi have demonstrated increased advantages over non-colonized plants. VAM improves the plants ability to tolerate & recover from drought & water deficits. Other advantages include increased growth, reduced pathogen pressure, activation of plant defense mechanisms, and general benefits to plant health<sup>(17,18,19,20,21)</sup>.

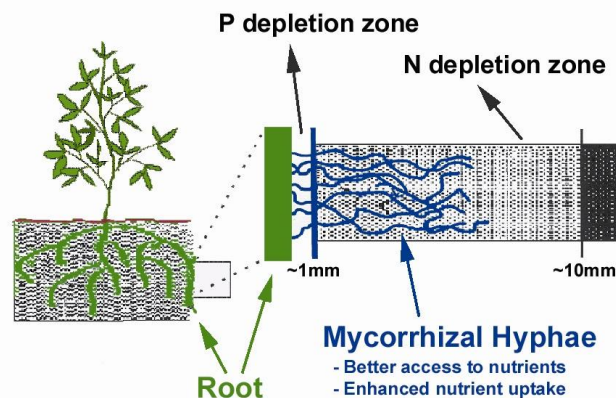
VA Mycorrhiza actively work at improving soil structure with the filaments producing humic compounds and organic 'glues' that bind soil into aggregates and improve soil porosity<sup>(22)</sup>. In sandy or compacted soil the ability of VAM fungi to promote soil structure may be the most important factor to improving long term plant performance and the prevention of erosion<sup>(23,16,24,25)</sup>.



### Nutrient Depletion Zones - and the significance of Mycorrhiza

Root hairs can only absorb nutrients (such as P and N) from the soil from a distance of a few millimeters (as shown in Figure to right)<sup>(39,35,36)</sup>, whereas Mycorrhiza are far more efficient at nutrient uptake.

Mycorrhizal hyphae can source and transport plant requirements (upto 25%N, 80%P, 10%K, 60%Cu, 12%Si, 25%Zn and other nutrients) from far greater distances to the host plant roots<sup>(40,9,41,42,43,44,21,45,46)</sup>.



## Fungicides and Mycorrhiza:

Unfortunately, many fungicides effect beneficial soil Fungi including Mycorrhiza. As a rule of thumb, “in-furrow” and “seed-coated” fungicides have the greatest negative impact on beneficials, whereas light application of foliar (*except systemics such as Bayleton*) have the least impact. Mixing fungicides can have a cascade effect and may prove to be more deleterious to Mycorrhiza. The longer the period between application of any fungicide (after mycorrhizal fungi inoculation and vice versa), the better the mycorrhizal fungi development, spreading and viability. Contact WMF for a list of Fungicides and their known effects on Mycorrhiza.

## The dependency of various crop species on mycorrhiza

Various crop species (such as linseed, sunflower, mungbean, pea, maize, chickpea) have high to very high dependency on mycorrhiza. Some (such as sorghum, soybean, wheat, triticale, barley) have a medium dependency, whereas other species such as (canola and lupins) have no requirement for mycorrhiza (*source Qld Department of Primary Industries & Fisheries 2005*).

## WMF VAM Plus – Should I introduce them to my soil?

**Apply WMF VAM Plus during seeding or transplanting for the first time into degraded or depleted soils, or on mature plants where previous agricultural practices have significantly reduced the survival of beneficial fungi & mycorrhiza. Subsequently use WMF Ag blend or WMF Hort blend microbes (these also contain some VAM).**

Soils in natural environs are full of beneficial microorganisms including mycorrhizal fungi. Mycorrhizal symbiosis is of great importance particularly in Mediterranean ecosystems <sup>(26,26)</sup>. However research indicates that many agricultural practices significantly reduce the survival of mycorrhiza in soil – leading to the loss of nutrients, in organic matter and in the diversity of living organisms comprising the soil microbiota <sup>(28)</sup>. Activities such as cultivation, ecosystems being converted to monocultures, application of acidic fertilisers, fungicides, fumigation, removal of top soil, and leaving soil without vegetation for a period of time all reduce the population of mycorrhiza in soil <sup>(29,30,31,32)</sup>.

Plants grown in most nurseries usually receive intensive watering and feeding with high levels of nutrients in pre-sterilized soil. Unfortunately high levels of nutrients, aluminium and water and the lack of mycorrhiza discourages the plant to produce the extensive root system it will need for successful transplantation. To restore mycorrhiza populations, it is necessary to use an optimum strategy of sustainable agricultural practice <sup>(33,34)</sup>.

## Conclusion

**VAM fungi colonise roots and surrounding soil and act as an extension of the root system by supplying extra phosphorus, zinc, silicates and other nutrients. In return the plant ‘feeds’ the VAM fungi with sugars produced in the leaves.**

**WMF VAM Plus can greatly increase the absorptive surface of plant roots. In depleted soils (eg low soil Phosphorus or sterile soils), these mycorrhizal associations have been shown to be highly effective at increasing plant P levels, stimulating above ground plant growth, and effectively maintaining the level of nutrients in the leaves and roots. WMF VAM Plus should also be applied to soils that have been treated with fungicides.**

**Enhancing natural plant-fungi interactions can lead to other environmental benefits as well. With reduced need for Phosphate fertilisers, leaching of P into groundwater and waterways will be reduced, decreasing the chance of algal blooms.**

### Storage :

**WMF VAM Plus** is delivered as a dry powder. Store powder in sealed container. Store contents in a dry and cool area. Do not expose dry powder to moisture, freezing temperatures or direct sunlight.

- Do not store in diluted form.
- Not to be taken.
- The user is referred to Material Safety Data Sheets available from Western Mineral Fertilisers.

### Application :

**FOR USE ON :** **WMF VAM Plus will attach to roots of many plants in broadacre, horticulture & nurseries.**

**WMF VAM Plus** can be applied as:

- **Seed / Fertiliser Coating** - at the rate of 600-700g/tonne (see WMF Seed Coating Technical sheet).
- **Transplantation** – dip damp roots into powder or sprinkle onto damp roots. Apply at 2g per young transplant or at rate of 15g per larger transplant.
- **Potting Mix** – add 50g into 25litres soil/potting mix just prior to potting. Mix well.
- **Soil Drench for newly transplanted plants** - Initially water soil around plant. Mix 100g /10Litres clean water – enough for 50 small plants. Agitate well during application. Water well after application.
- **Soil Drench for established plants or soils with low Mycorrhizal numbers** - Initially water soil around plant. Mix 100g /10Litres clean water – enough for 75 small plants. Agitate well during application. Water well after application.
- If equipment has previously been used for pesticide/fungicide, clean thoroughly, neutralize with recommended neutralizing agent and triple rinse.
- Wash equipment after use.



## VAM References : (visit our web site [www.wmf1.com](http://www.wmf1.com))

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