

PHC - MYCONATE:

Brief Technical Background

What is Myconate[®]?

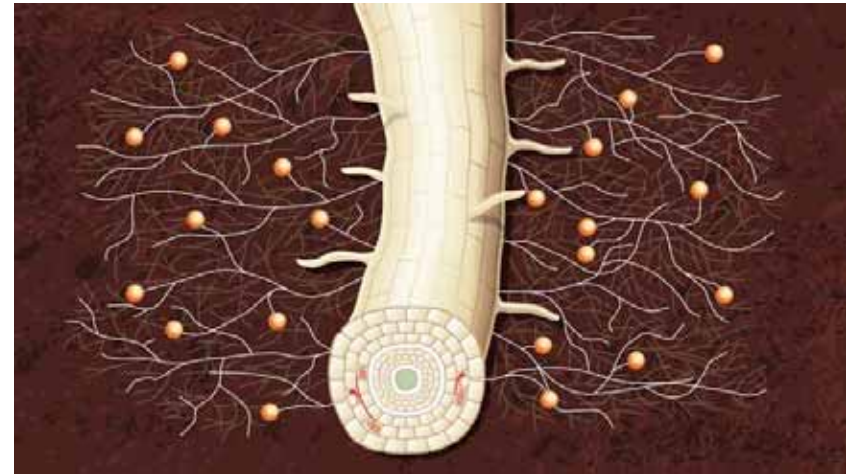
Myconate[®] is the isoflavone
– formononetin – originally
isolated and identified from
P-deficient clover roots

Myconate[®] increases the
growth and colonization of
roots by beneficial
Vesicular-Arbuscular
Mycorrhizal (VAM) fungi



The Importance of VAM

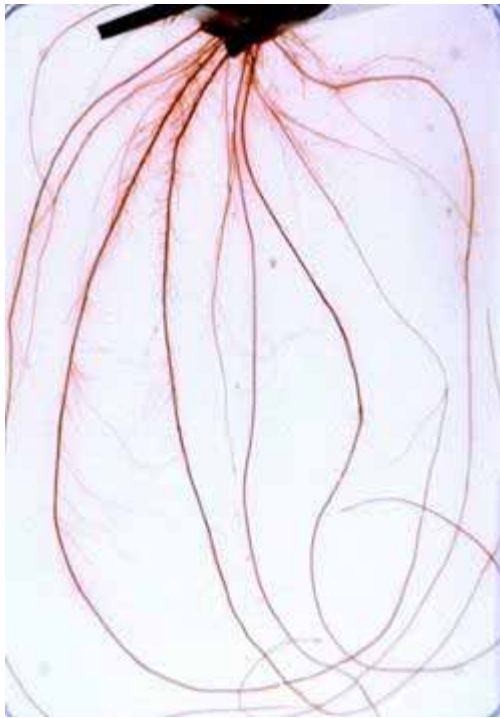
VAM increase the ability of plants to absorb water and nutrients by increasing the effective absorbing surface area of root systems.



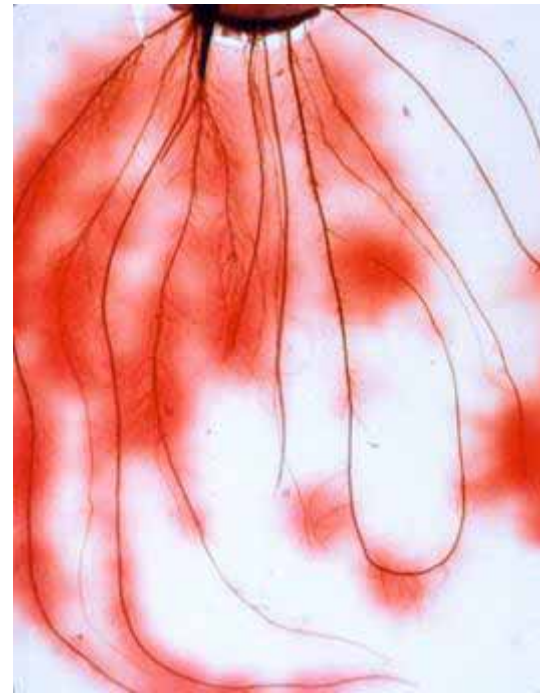
Field trials have shown that VAM increase yields of most agricultural crops grown under standard practices



Absorbing Root Area Comparison +/- Vesicular-Arbuscular Mycorrhizae (VAM)



Non-mycorrhizal roots of a fescue plant. Red stain indicates the effective absorbing area.

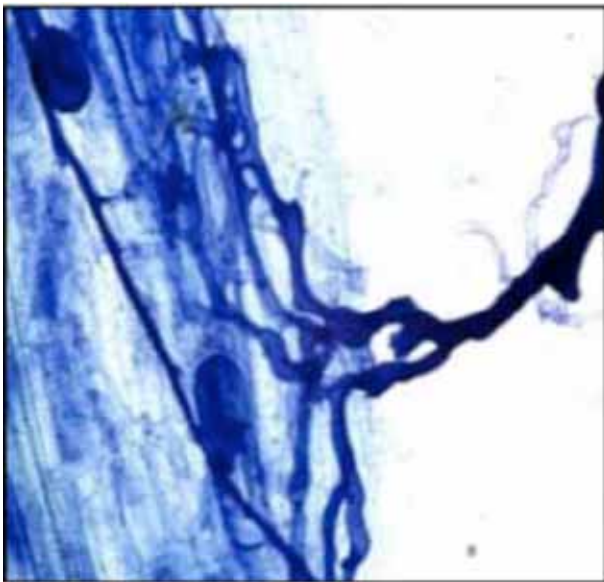


VAM roots of fescue. The red stain indicates the effective absorbing area.

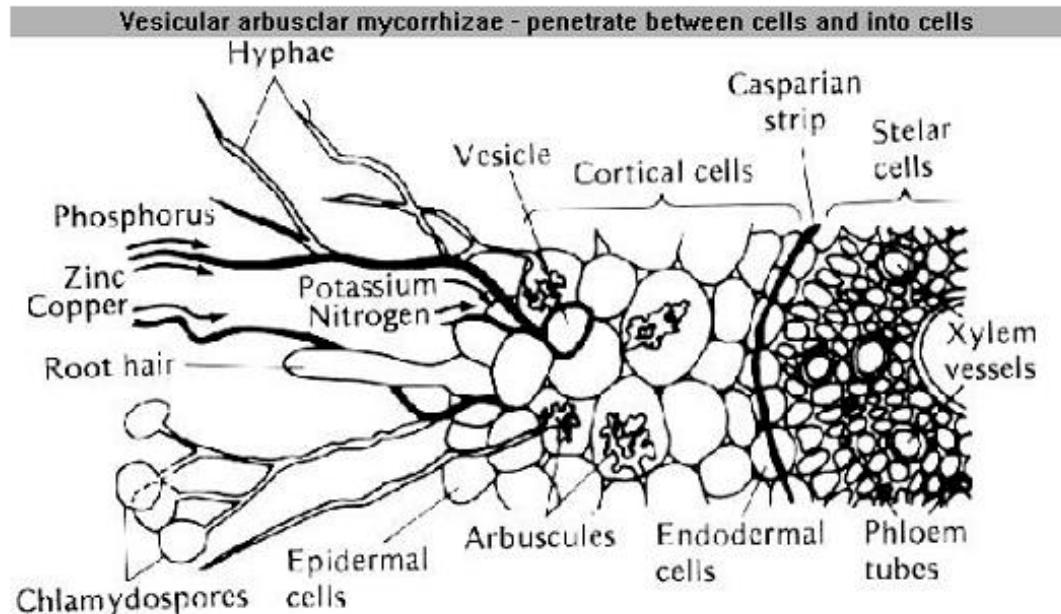
Photos by Darius Malinowski, ARS/USDA

How VAM Work

- Plants under stress exude organic compounds from their roots.
- The exudates are a chemical signal for soil microorganisms including VAM.
- Spore germination, growth direction and rate of VAM are affected
- VAM fungi form a symbiotic association with plant roots.
- Host plant receives minerals and water: the fungi obtain carbon compounds.



Above from: Soil Fungi. Location:
<http://www.soilhealth.see.uwa.edu.au/page/59599>
© University of Western Australia, 2004



Above: Unit 9 - Soil Organisms & Nitrogen Cycle
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Brief Review of Mycorrhizae in Agriculture

- A survey of 78 published field trials: increased VAM colonization resulted in an average yield increase of 37% percent (McGonigle et al., 1988).
- Another study of 290 published field and greenhouse studies: increased colonization by VAM resulted in a 23% yield increase (Lekberg and Koide, 2005).
- Early season phosphorus supply is known to be critical for obtaining optimum crop yields. An inadequate phosphorus supply during early plant growth limits crop growth which cannot be recovered later in the season (Grant et al., 2001).
- In addition to phosphorous, VAM stimulate the uptake of Fe, Cu and Zn (many literature citations).

Exposing the Mycorrhizae in Agriculture

Marie-Soleil Turmel, Dept. of Plant Science, University of Manitoba

Brief Review of Crop Dependency on Mycorrhizae

- Crops such as corn and flax are highly dependent on VAM to meet their early phosphorus requirements (Plenchette 1983; Thingstrup, 1999).
- Wheat, oat and barley benefit significantly from mycorrhizal symbiosis especially where soil fertility is below optimal (Plenchette 1983).
- Legumes, beans and potatoes also benefit significantly from mycorrhizae (Plenchette, 1983).
- Crops plants found in the families Polygonaceae and Brassicaceae do not form symbiotic relationships with VAM (Harley and Smith, 1983). This includes canola, mustard, beets and buckwheat.

Benefits of Mycorrhizae

- Increase Mineral Uptake (esp. N and P)
- Increase Water Uptake and Availability
- Reduce Disease and Pests
- Protect against Toxins - e.g. salts/heavy metals
- Improve soil structure
- Secrete growth-promoting hormones
- Degrade organic matter

Discovering the Technology

- The Myconate technology was developed by Michigan State University and is licensed exclusively to Plant Health Care.
- Stressed red clover plants were grown in a phosphorus deficient medium.
- Resulting root exudates were collected.
- Active compounds were identified as isoflavones.
- Formononetin, the most active compound, was synthesized and is the active ingredient in our Myconate formulations.

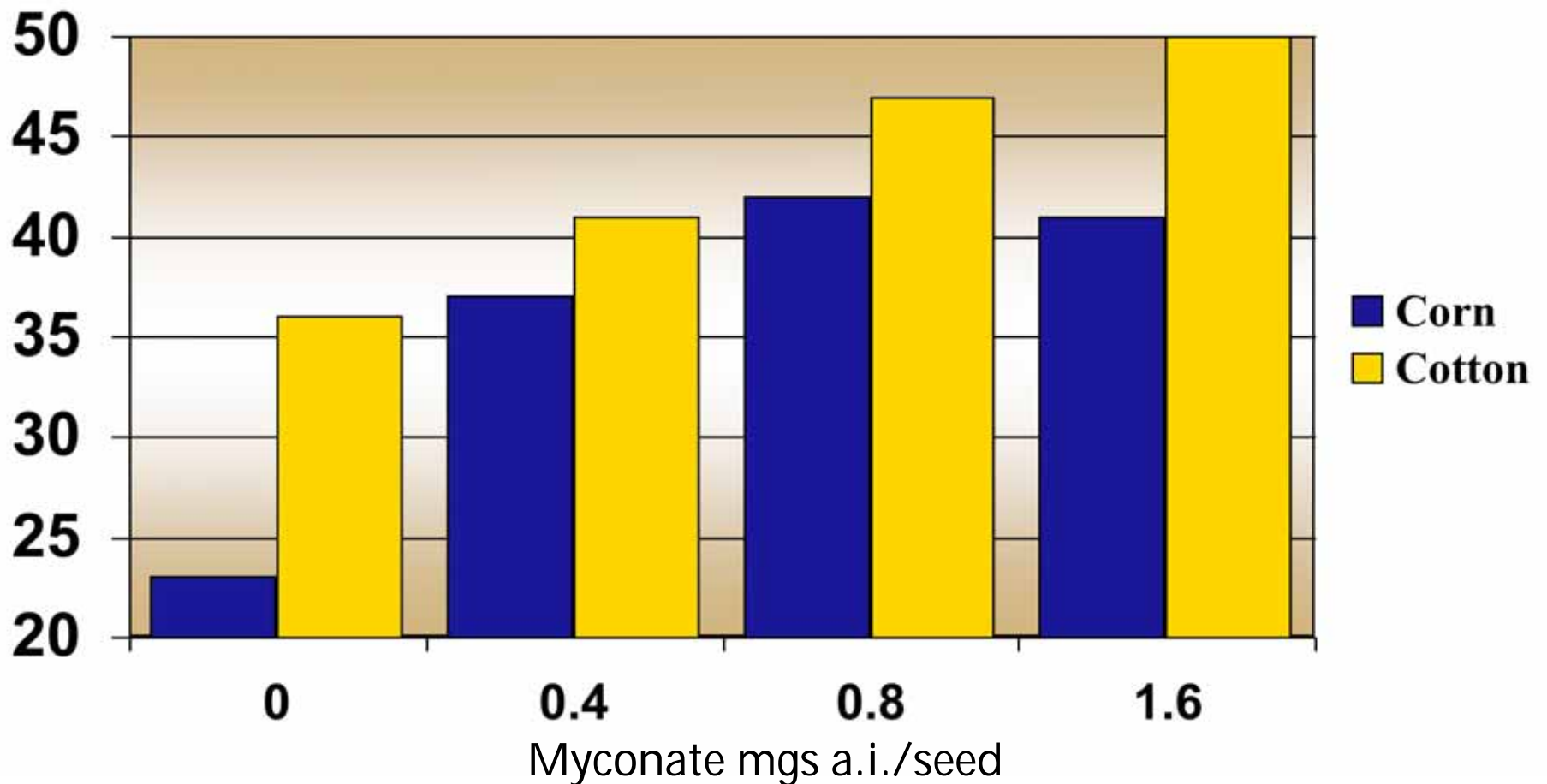


Photo: Dr. Mary L. Dubler, DVM, Fort Collins, Colorado
Wildflowers Of Colorado; wildflowersofcolorado.com

Stimulation of VAM Colonization by Myconate[®]

VAM Colonization (% roots colonized)

Pot tests, recorded 8 – 10 weeks after sowing treated seeds



Benefits of Myconate®

- Myconate has been shown to increase the rate and extent of VAM colonization. As such Myconate treated plants can be expected to profit from the known benefits of mycorrhizal colonization, such as:
 - Effective increase in soil volume available for exploitation by the plant.
 - Increased access to water, improved uptake of phosphorus and other soil nutrients.
 - Increase nodulation and nitrogen fixation in legumes.
 - Increased plant size, plant health, and crop yields.

The biology of Myconate:

Factors favoring a major response to Myconate:

- Climatic conditions outside the optimal range for the specific crop, especially drought conditions.
- Marginal or poorer soils in general, providing one or more sub-optimal factors which VAM are known to alleviate:
 - poor water-holding capacity
 - nutrient deficiencies
 - cold stress
 - low organic matter
 - salinity

Factors reducing or inhibiting a response to Myconate:

- Optimal edaphic and climatic factors for the specific crop.
- High P-levels.
- Formulation conditions, especially the use of certain antibiotics or preservatives.
- Use of certain anti-VAM fungicides.
- Over- and under- application rates of Myconate.
- Absence of VAM spores:
 - Very intense soil fumigants such as methyl bromide can destroy mycorrhizal spores and inhibit a response to Myconate.

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If you have an interest in testing or using Myconate[®] please contact one of the individuals listed on the previous slide.