



ECOFUNGI

A mycorrhiza (Greek for fungus roots) is a symbiotic association between a fungus and the root system of a plant. One of the main groups of mycorrhizae is the Arbuscular Mycorrhizal Fungi (AMF), which exchange mutual benefits with about 80% of plants (Berruti et al. 2016)*.

ECOFUNGI is an arbuscular mycorrhizal (AMF) inoculant in powder, registered in the USA by the Organic Materials Review Institute (OMRI) and The California Department of Food and Agriculture (CDFA) for use in the production of organic food and fiber.

Composition

ECOFUNGI is a blend of selected strains of *Rhizophagus intraradices*, *Funneliformis mosseae*, *Rhizophagus aggregatum* and *Claroideoglossum etunicatum* at a concentration at 100 spores per gram (2835 spores per ounce).

ECOFUNGI also contains a formulation of free-living microorganisms that act synergistically with the mycorrhizae.

Dr. William Wheeler, curator of INVAM (International Culture Collection of Vesicular Arbuscular Mycorrhizal Fungi), an institute attached to West Virginia University, and owner and caretaker of the world's largest collection of vesicular-arbuscular mycorrhizal fungi, evaluated the infectivity of the ECOFUNGI mycorrhizae, comparing them with the selected mycorrhizae of their institute.

Dr. Wheeler stated that colonization with ECOFUNGI reached a level of 58% in a period of only 21 days, compared to the level obtained with the institute's standard of 48%. Dr. Wheeler stated that a level of 58% is very high for this type of trial. The report is attached to our website.

* Berruti A, Lumini E, Balestrini R and Bianciotto V (2016). Arbuscular Mycorrhizal Fungi as Natural Biofertilizers: Let's Benefit from Past Successes. *Front. Microbiol.* 6: article 1559. 13 pages.

Free-living microbes present in formulation

<i>Bacillus firmus</i>	10 million CFU/gr.
<i>Bacillus amyloliquefaciens</i>	10 million CFU/gr.
<i>Bacillus subtilis</i>	10 million CFU/gr.
<i>Bacillus licheniformis</i>	10 million CFU/gr.
<i>Bacillus megaterium</i>	10 million CFU/gr.
<i>Bacillus pumilus</i>	10 million CFU/gr.
<i>Bacillus azotoformans</i>	10 million CFU/gr.
<i>Bacillus coagulans</i>	10 million CFU/gr.
<i>Paenibacillus polymyxa</i>	10 million CFU/gr.
<i>Paenibacillus durum</i>	10 million CFU/gr.
<i>Pseudomonas aurofaciens</i>	2 million CFU/gr.
<i>Pseudomonas fluorescens</i>	2 million CFU/gr.
<i>Pseudomonas putida</i>	2 million CFU/gr.
<i>Streptomyces coelicolor</i>	2 million CFU/gr.
<i>Streptomyces lydicus</i>	2 million CFU/gr.
<i>Streptomyces griseus</i>	2 million CFU/gr.
<i>Trichoderma harzianum</i>	2 million CFU/gr.
<i>Trichoderma reesei</i>	2 million CFU/gr.
<i>Trichoderma hamatum</i>	2 million CFU/gr.

Total counts of free-living microbes: 1.18×10^8 CFU/gr.

ECOFUNGI needs to be applied so the mycorrhizae spores have direct contact with the roots.

- ECOFUNGI can be mixed with the seeds before planting
- The roots of plants can be dipped in a solution made with ECOFUNGI
- ECOFUNGI can be inoculated in a drench application
- ECOFUNGI can be injected in the soil in proximity to the roots of established plants

Plants need in general to be treated only once with ECOFUNGI throughout their growth cycle. Additional applications of ECOFUNGI can be performed at transplanting, after a fungicide root treatment, or during the growth season in the case of turf.

Application rates

Seeds

Treat the seed with 0.45 to 0.9 lbs/acre (0.5 to 1 kg/ha) for grain crops such as alfalfa, corn and wheat. When treating smooth seeds such as corn, we recommend to dissolve ECOFUNGI in water before being mixed with the seed.

For the treatment of vegetable seeds and potatoes we recommend a dose rate of 0.9 to 1.8 lbs/acre (1 to 2 kg/ha) or 0.3 to 1 Lb/10 Lbs seed (03 to 1 kg/10 kg). For fruit and nut tree seeds we recommend a dose rate of 0.2 to 0.5 gr/tree.

Nurseries

Add 0.5 to 1 lbs/yard³ (300 to 600 gr/m³) of potting soil. For drench applications, dissolve 13 ounces of ECOFUNGI in 100 gallons of water (368 gr/378.5 liters).

Transplants

Dip roots of plants at a rate of 0.05 to 0.2 gr/plant. Immerse roots in an ECOFUNGI solution and plant immediately. Treating the plants in the early stages of root development (3 mm to 1.2 cm root length), or halfway the cycle of cultivation in the nursery maximize colonization and protection

Touch damp roots with the inoculum so a small amount sticks to the roots, or sprinkle into planting holes. Use 1 to 2 grams under each cutting, 2 to 5 grams/plant with substrate covering the roots, 14 grams (½ oz) per inch of stem caliper planting. Working doses in standard plantations of peppers, strawberries and tomatoes are 1.8 lbs/acre (2 kg/ha).

Established Plants, bushes and trees

Potted plants

Container size	4 inch	1 gallon	2 gallons	5 gallons	10 gallons
Dose in grams	0.6 to 1.2	1.6 to 2.4	3 to 6	8 to 18	16 to 32

Use lower values for irrigated plants, good soils, small plants, non-stressed environments. Use higher values for drought conditions, poor soils, large plants and stressful environments.

Turf in golf courses and lawns

Apply 1 to 3 pounds of ECOFUNGI to treat 5000 ft² of porous soil (100 to 300 grams/100 square meters). Water thoroughly after application. For best results apply twice a year.

Hydroponics

Blend ECOFUNGI on the root substrate or directly in the nutrient solution reservoir. Add 7 to 10 gr/2 gallons of water (10 to 13 gr/10 liters) and apply as top drench or add 7 to 10 gr/20 gallons (8 to 12 gr /50 liters) of nutrient reservoir.

- Keep pH between 5.5 to 7.5
- Maintain an available P concentration below 70 ppm
- Use aeration system or water circulation as the mycorrhizae are aerobic
- Once the roots have been infected by the mycorrhizae, fertilization can be reduced by 30%
- Best results are obtained with multiple applications throughout the production cycle.
- There is no need to apply ECOFUNGI once flowering starts.

Recommendations

Avoid using seeds treated with non-compatible fungicides (list below); however, these compounds do not cause significant reduction in mycorrhizal infection rate. If an antagonistic fungicide is to be applied we recommend to wait until the mycorrhizae has established association with the plant. Foliar systemic fungicides do not cause problem except for those containing Triamidedon or Bayleton.

High concentrations of nitrogen and phosphorus inhibit the colonization of roots by mycorrhizae. We recommend to reduce the supply of fertilizers until after the colonization, or to use NPK fertilizers with P lower than 7. Soil concentrations of N and P favorable for mycorrhizal colonization are lower than 110 ppm of N and 80 ppm of P, while optimal concentrations of these elements should be 60 and 50 ppm, respectively.

Flush irrigation systems with plenty of water from any pesticide residue before applying ECOFUNGI. Avoid applying pesticides one week before and one week after applying ECOFUNGI. To avoid retention of ECOFUNGI the nozzle of the equipment should have orifices bigger than 0.5 mm.

Keep product dry in an airtight container. Avoid prolonged exposure to direct sunlight.

Plants that form association with ECOFUNGI

Fruits and Nuts

Almond, Apple, Apricot, Avocado, Banana, Blackberry, Cherry, Citrus, Currant, Guava. Grapes (table and wine), Fig, Mango, Papaya, Peach, Peanut, Pineapple, Pistachio, Plum, Raspberry, Strawberry, Walnut.

Grains and Vegetables

Asparagus, Artichoke, Barley, Beans, Carrot, Celery, Corn, Cucumber, Garlic, Grass, Lettuce, Lentil, Millet, Onion, Potato, Pumpkin, Pepper, Tomato, Rice, Soy, Sweet potato, Turf, Wheat, Yam, Yucca.

Flowers and Ornamental

Bamboo, Begonia, Mouths of dragon, Bulbs, Camellia, Cactus, Marigold, Chrysanthemum, Gardenia, Geranium, Sunflower, Fern, Magnolia, Palm, Poinsettia, Rose.

Others

Acacia, Birch, Cannabis, Cocoa, Coconut Palm, Coffee, Cotton, Cypress, Eucalyptus, Fir, Ginger, Hemlock, Maple, Olive, Pecan, Palm of oil, Spruce, Pine, Oak, Sugar cane, Tobacco, Tea.

Some plants do not form association with ECOFUNGI, such as azalea, carnation, rhododendron, blueberries, orchids and beets.

List of compatible and non-compatible fungicides

Chemical compound (Commercial name)

Compatible	Non compatible
Azoxystrobin (Heritage)	Benodamil (Bayleton)
Boscalid, 3-pyridinecarboxamide,2-chloro-N-(4'-chloro(1,1'-biphenyl)-2-yl) (Endura)	Captan (Captan, Orthocide)
Carboxin + thiram (Vitavax)	
Chloroneb (Terraneb SP, Terremec SP) at low dose	Chloroneb (Terraneb SP, Terremec SP) at high dose
Chlorothalonil (Bravo, Chloroflo, Chlorosip, Chloronil, Daconil 2787, Daconil Ultrex, Daconil Weather Strike, Exothem)	
Copper hydroxide (Kocide)	Copper Oxychloride Sulfate
Cyproconazole (Sentinel)	
Difenoconazole + Metalaxyl (Dividend)	
Dithiocarbamates (Ferbam) at low doses	Dithiocarbamates (Ferbam) at low doses
Ethylenebisdithiocarbamate ion (EBDC) (C ₄ H ₆ N ₂ S ₄) (Powerline MZ)	Folpet (Phaltan)
Fenarimol (Rubigan)	Formalin (Formaldehyde) Iprodione (Rovral)
Fosetyl-Al (Alliette, Alliete Signature, Prodigy)	Pentachloronitrobenzene (Blocker)
Fludioxonil, 70 - N-[3-(1-methylethoxy) phenyl]-2-(trifluoromethyl) benzamide (Maxim, 4F, Mazim MZ)	
Iprodione (Chipco 26019)	Propiconazole (Banner MAXX, Stratego)
Mancozeb (EBDC) (Manzate, Manzate flowable, Fore, Nubark MZ, Ridomil, Tops MZ, Tops MZ Gaucho)	Quintozene (PCNB Terrachlor, Turfcide) at high dose
Maneb (EBDC) (Maneb, Mancozeb)	
Metalaxyl-Ridomil (Apron, Subdue Maxx)	
Myclobutanil (Eagle, Rally, Systhane)	
Propanocarb (Banol, Previcur, Proplant)	
Pyraclostrobin (Headline)	

Compatible	Non compatible
Quintozene (PCNB Terrachlor, Turfcide) at low dose	
Tebuconazole (Folicur, Folicur 3.6)	
Tebuconazole + Metalaxyl (Raxil XT) No effect as seed treatment	Tebuconazole + Metalaxyl (Raxil XT) Avoid use as drench
Tebuconazole + Thiram (Raxil Thiram)	Thiazole (Benomyl, Benlate, Tersan 1991)
Thiophanate-methyl / Etridiazole (Clearly's 3336, Fungo, Systec 1998, Banrot)	Triadimefon (Bayleton)
Thiram (Thiram, Tersan 75)	Tilt (CGA65250)
Zinc ethelene bisdithiocarbamate (Dithane)	

List of compatible and non-compatible insecticides Chemical compound (Commercial name)

Compatible	Non compatible
Abamectin (Avid)	Diazinon (Diazinon)
Acephate (Orthene)	Malathion (Savon, Malathion)
Azaterractin (Margoson)	Oxamil
Bendiocarb (Dycarb, Trumpet)	
Bifenthrin (Attain, Talstar)	
Bromo (Agribrom)	
Carbaryl (Sevin)	
Chinomethionat (Morestan)	
Chlopyrifos (Dursban)	
Cyromazine (Citation)	
Dicofol (Kelthane)	
Dienochlor (Pentac)	
Dimethoate (Cygon)	
Fenbutatin (Vendex)	