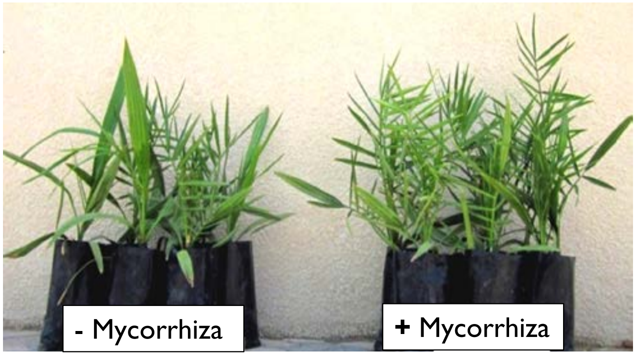
Technical Handbook

Mycorrhizal fungi as natural bio-fertilizers: How to produce and use

In brief

This technical handbook provides an easy to follow guide describing the process on how to produce home-made mycorrhizal inoculants using different types of propagation units and how inoculants can be applied as bio-fertilizers in the nursery and during field transplantation for improving the growth and stress tolerance of crop plants.



Mycorrhizal fungi as natural bio-fertilizers

Application of arbuscular mycorrhizal fungi (AMF) is a simple technique for improving the growth of date palms and other tree seedlings (pomegranate, olive, argan) or medicinal shrubs (lavender, rosemary) at nursery stage and to increase their stress tolerance when transplanted to the field. The aim of this technical handbook is to illustrate how inoculates of beneficial soil fungi, the arbuscular mycorrhizal fungi, can be produced and used on the farm to improve the growth of date palms and other perennial crops pre-grown under nursery conditions.

Under regular field conditions date palm roots are well colonized by AMF[1] and their symbiotic association positively impacts the growth and health of date palms[2]. AMF can increase water and nutrient uptake of date palms under saline and drought conditions[3,4] and enhances their tolerance against Bayoud disease[5]. Using AMF under nursery conditions promotes the growth of plantlets and offshoots, even without fertilizer addition when using nutrient rich nursery substrates like peat[6].

Several commercial AMF products are on the market, but some aspects should to be considered and checked:

- Certain products do not contain viable propagules
- They might contain "non-adapted" mycorrhizal fungi deriving from a contrasting climate so that they might only show a limited performance under stressful environmental conditions
- Products are more expensive.

Follow this guide, produce your own mycorrhizal inoculants and promote the performance of your crops with only little costs.

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What is needed

Depending on the availability of materials and the desired amount of fungal inoculates to be produced, different types of propagation units can be established. It can be chosen between container units, pot units, concrete units or simple ground units. Also the propagation substrate and the host plant species can be chosen according to local availability.

Propagation unit

The container unit consists of a plastic beaker with holes at the bottom (to allow water passage), the pot unit of two pots with a garden fleece in between (to prevent inoculate leakage), the concrete unit consists of a tank made e.g. from cement or PVC tubes and the ground unit is a hole in the ground covered with a strong plastic foil and a PVC board to prevent roots passing the plastic. Beaker and pot units should be placed on a stony surface, wood or a saucer to prevent roots growing through. Units can be placed in the shade house or should be fenced to prevent animals feeding on host plants and wind to carry unwanted particles into the system.

Different types of propagation units: container (a), concrete (b), pot (c) and ground unit (d)

Propagation substrate

The propagation substrate consists of 1 part soil mixed with 9 parts co-substrate (e.g. 5 kg soil + 45 kg Perlite).
The soil is collected from a local site where no vegetation is growing. Soil can be sterilized by soil solarisation (= scattered soil covered with a black or transparent plastic foil and exposed to direct sun light for a minimum of 3 days).
The co-substrates can be chosen according to local availability e.g. Vermiculite or Perlite. It is recommended to use a light substrate in order to facilitate the handling and transport when applied into the field.
For fertilization urea with an application dose of 100 mg nitrogen per kg substrate and/or mature, pathogen-free compost at a rate of 1% of the substrate is mixed into the substrate.

Host plants

A mixture of minimum two plants should be preferred; it can be selected between e.g. sorghum-barley, sorghum-flax, maize-barley or leek-flax. To accelerate germination, seeds can be soaked in water for several hours.

Starter inoculant

Starter inoculant is added by a rate of 2% of the propagation substrate. If no original mycorrhizal inoculant can be obtained, also soil from a healthy and fruiting date palm tree, another adult fruit tree or shrub can be used.

Material (per unit)

- Materials to build propagation unit
- Fencing material
- Sterile soil and co-substrate
- Starter inoculant
- Urea/compost

How to set up, harvest and apply

Set up and harvest

Propagation units are filled with pre-mixed substrate and irrigated (a). Starter inoculant is added as a layer 5-8 cm below the surface of the substrate (b) and covered with another layer of substrate (c). Host plants seeds are distributed onto the surface (d), covered with a layer of substrate (e) and irrigated.

Ninety days after sowing, irrigation is stopped to dry the substrate completely. Shoots are removed and roots of all host plants are cut inside the propagation unit into small pieces of 1- 1.5 cm using scissors and mixed with the substrate. Then the mycorrhizal inoculate is ready.

For quality check, root samples can be taken before drying the substrate to measure mycorrhizal colonization (%RLC) and subsamples of the dried inoculants to assess spore abundance and purity. Analysis can be performed at ENA Meknes.

Application

Mycorrhizal inoculants can be used for applications at nursery stage by adding approx. 100 ml of inoculant to the root system of the plant and during field transplantation by spreading 200 ml inoculant into the planting hole below the root system of the plant.

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About fertiledatepalm

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Swiss Programme for Research on Global Issues for Development

In light of global challenges, the Swiss Agency for Development and Cooperation (SDC) and the Swiss National Science Foundation (SNSF) launched in 2012 the joint «*Swiss Programme for Research on Global Issues for Development*» (r4d programme). The main goal of the r4d programme is the generation of new knowledge and the application of research results that contribute to solving global problems and securing public goods in low- and middle-income countries within the framework of global sustainable development. The r4d programme consists of six modules, five with thematic priorities and one for thematically open calls.
www.r4d.ch

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