



Mycorrhized rhodes grass. Thanks to extended roots, mycorrhizal plants explore a larger soil volume than untreated plants and can better absorb minerals.

Photo: B. Bordoloi

Mycorrhiza for global sustainable development

Crop cultivation using synthetic fertilisers and pesticides results in large-scale destruction of the beneficial micro-flora found in soils and ecosystems. Continuous application of harmful chemicals leads to the development of resistance among many crop pests. A cost-effective and non-destructive means of achieving high productivity rests on establishing a viable, low-input farming system. It is highly likely that, in the near future, crop production constraints in the world will be circumvented by technologies based on biological processes like mycorrhiza.

Mycorrhiza is a symbiotic, non-pathogenic, permanent association between the roots of land plants and a group of

fungi called mycorrhizal fungi. They provide extended arms to the plant root system, helping it to exploit the soil nutrients that are beyond its reach.

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The main mycorrhizal response is one of increased efficiency of mineral uptake, especially of poorly mobile ions, and plays a very important role in enhancing plant growth and yield due to an increased supply of phosphorus to the host plant.

■ Mycorrhiza for sustainable agriculture

Mycorrhizal roots explore a larger soil volume and have a greater absorptive area than non-mycorrhizal roots. They also have chemical mechanisms for liberating fixed inorganic ions or minerals incorporated in organic matter in the soil. In infertile soils, nutrients taken up by the mycorrhizal fungi can lead to improved plant growth and

How mycorrhiza is superior to other biofertilisers

Mycorrhiza	Other biofertilisers
Mycorrhiza is a fungal biofertiliser.	All others are bacterial biofertilisers.
It is applicable to a wide range of plants, from floricultural, horticultural, silvicultural to agricultural species including legumes, tree and plant species, except a few like mustard (<i>Brassica sp.</i>) and sugar beet (<i>Beta vulgaris</i>).	Products are specific to crops or plant type.
It has easy storage at ambient temperature.	Require low temperature for storage, hence are cost ineffective.
It has a prolonged shelf life (more than 2 years) at room temperature.	Shelf life is limited under strict conditions of maximum storage.



reproduction. As a result, mycorrhizal plants are often more competitive and can more readily tolerate environmental stresses than non-mycorrhizal plants. By virtue of their ubiquity and their key role as biofertiliser, bioregulator and bioprotector, mycorrhizal fungi have become an essential component of soil biota.

Mycorrhiza colonisation has a beneficial impact on the population of free-living N-fixing bacteria and thus stimulates more efficient plant growth. Mycorrhiza also has a stimulatory effect on various non-legume N-fixing plant species.

■ Wasteland reclamation through mycorrhiza

Mycorrhiza technology is extremely successful in reclaiming diverse problematic man-made sites, such as fly ash dumps, chlor alkali sludge dumps and land affected by distillery effluents. Mycorrhiza supports plant growth and can establish lush greenery on these wastelands. The physical and chemical properties of soil on such land can be improved and the concentration of many harmful trace elements can be reduced.

Understanding and research has advanced from merely knowing about the existence of mycorrhiza to exploring various aspects of mycorrhizal application for the benefit of human society. The many areas in which mycorrhiza may be beneficially applied can be enumerated as follows:

- Commercialisation of mycorrhizal technology
- Biotechnology
- Energy sustainability
- Disease control – biocontrol

When treated with mycorrhizal fungi, plants usually cultivated on poor and marginal soil have a better plant growth. Mycorrhized wheat (above) and cabbage (below) in a desert area of Qatar.

Photos: B. Bordoloi



Photos: B. Bordobai

- Sustainable agriculture and plant growth
- Functioning in soil polluted by heavy metals
- Wasteland reclamation
- Mycorrhizal technology in forestry and as a tool in reforestation
- Desert greening

■ Production of mycorrhiza

If mycorrhiza is to be used in crop fields (on farms / agricultural land) and if its beneficial dimensions are to be utilised, it needs to be commercially produced. The conventional mode of production for mycorrhiza inoculum is the pot culture method. Several industrial facilities based on this mode of

production have been set up in North and South America, Europe and Asia to tap the huge market and leverage the first mover's advantage. The various problems entailed by commercialisation of the pot culture method are its high costs, transportation, the limited quantity produced, the risk of contamination of the inoculum, and the excessive amount of time required due to the plants having to be grown in pots.

Accordingly, researchers all over the world are focusing on growing mycorrhiza under laboratory conditions on a synthetic medium. In-vitro, or lab-based, mycorrhiza production technology enables the mass production of viable, healthy, genetically pure and

Granular form (left) and in-vitro production of mycorrhiza.

high-quality fungal propagules without any pathogenic contamination in a sterile environment. The technology is economical and does not require any heavy hardware or infrastructure. It offers a biological means of assuring plant health in an economically profitable and ecologically friendly manner.

The mycorrhiza-based microbial concentrate raw material needs to be diluted post-production with adequate carrier material in order to make it user-friendly upon application. This requires specific steps to formulate products for plant-specific application.

Zusammenfassung

Mycorrhiza ist eine symbiotische, nicht-pathogene, dauerhafte Lebensgemeinschaft zwischen den Wurzeln von Pflanzen und einer Gruppe von Pilzen mit der Bezeichnung Mycorrhiza-Pilze. Sie verlängern durch ihr Pilzmycel die Wurzeln der Pflanze, so dass diese Nährstoffe aus dem Boden aufnehmen kann, die sie sonst nicht erreichen würde. Mycorrhiza ist auch bei der Erschließung von Böden hilfreich. Die Mycorrhiza-Technologie kann einen Beitrag zu einer nachhaltigen Landwirtschaft leisten, da sie chemischen Dünger ersetzt. Kommerzielle Mycorrhiza-Produkte sind in verschiedenen Formen erhältlich, zum Beispiel als Tabletten, Granulat, Pulver oder flüssig. Häufig wird für die Mycorrhiza-Produktion noch das konventionelle Verfahren der Topfkultur genutzt, das jedoch durch

hohe Transportkosten, begrenzte Produktionsmengen, Risiko der Kontamination des Impfstoffs usw. problematisch ist. Die In-vitro- oder laborgestützte Mycorrhiza-Produktion ermöglicht die Massenerstellung nutzbarer, gesunder, genetisch reiner und hochwertiger Pilzkulturen ohne pathogene Kontamination in steriler In-vitro-Umgebung.

Resumen

La micorriza es una asociación simbiótica no patógena permanente entre las raíces de plantas terrestres y un grupo de hongos denominados "hongos de micorriza". Estos hongos se convierten en una extensión del sistema de raíces de las plantas, ayudándolas a explorar los nutrientes del suelo que se hallan fuera de su alcance. La micorriza también es de utilidad para la regeneración de

terrenos degradados. La tecnología de micorrización podría contribuir a la agricultura sostenible, puesto que permitiría sustituir el uso de fertilizantes químicos. Los productos comerciales para fomentar la micorrización están disponibles en diferentes presentaciones como tabletas, gránulos, polvo o líquido. Muchas empresas involucradas en la producción de agentes micorrizantes todavía utilizan el método convencional del cultivo en maceta, que plantea diversos problemas como altos costos de transporte, limitaciones en las cantidades producidas, riesgo de contaminación del inóculo, etc. La tecnología de producción de micorrizantes in-vitro en los laboratorios permite la producción masiva bajo condiciones in-vitro en un ambiente estéril, dando lugar a propágulos de micorriza viables, saludables, genéticamente puros y de alta calidad.