# Current Environmental Issues and Challenges


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Nature Light Publications

**ISBN- 978-81- 954002-9-4**

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| **Title** | : Current Environmental Issues and Challenges |
| **Editor Name:** | Dr. Vilas V. Patil<br>Dr. Praveen G. Saptarshi<br>Dr. Digvijay S. Kumbhar<br>Mr. Agastirishi B. Toradmal<br>Dr. Ashok Kumar Verma |
| **Publishing Agency** | **:** Nature Light Publications, Pune |
| **Publisher Address** | Mrs. Pragati P. Patil<br>309, West 11, Manjari VSI Road,<br>Manjari Bk, Haveli, Pune, 412307<br>Phone: +91 9922489040 / 8625060096 |
| **Printed By** | Milan Digital Printers.<br>Shop No.6 Business Square, Tilak Road,<br>Sadashiv Peth, Pune - 411030 |
| **Edition Details** | : I$^{st}$ |
| **ISBN** | : 978-81- 954002-9-4 |
| **Copyright** | : © Agastirishi B. Toradmal |
| **Publication Date** | : 15/07/2022 |



**Price: 700/-**

## CONTENTS





ISBN-978-81- 954002-9-4

# POTENTIALS OF *MYCORRHIZA* IN SOIL RECLAMATION FOR SEMIARID ZONES

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Introduction of Green revolution, new farming technologies, improvement of seed quality and continuous use of fertilizers have increased the grain productivity to many folds but excessive and increased use of chemicals and fertilizers in agriculture has caused many environmental problems / hazards especially in India. The present world is facing the crisis of environmental degradation and climate change due to various factors.

The concept of Sustainable agriculture using organic farming methods is gaining acceptance in India due to rapid degradation of natural resources, increase of production cost of conventional farming and deterioration of land (Gaur,2010). Environmental conservation, soil sustainability and application of new technologies used to improve Agricultural productivity are the main concern for Research and development.

Microbes are essential components of the ecosystem. The soil harbours many types of beneficial microorganisms that help in soil reclamation and improve the soil fertility. The mycorrhiza are symbiotic associations of fungi and plant roots that helps in promoting the nutrient absorption for the plants. Most of the land plants form symbiotic associations with mycorrhizal fungi. These fungi play an important role in terrestrial ecosystems as they regulate nutrient and carbon cycles that influence soil structure and ecosystems. Up to 80% of plant N and P is provided by mycorrhizal fungi and many plant species depend on these symbionts for growth and survival (Marcel et. Al 2015). There are different types of mycorrhiza in nature that are associated with different types of plant communities. The most common type is endomycorrhiza also termed as Arbuscular mycorrhizal fungi (AM fungi) .

The AM fungi are important components of rhizosphere ecosystem, as they play an important role in establishment of plant community especially for the tropical plant community. They are mutually associated with the plants for getting water and minerals such as phosphorus from the rhizosphere soil. In return they get reduced carbon for their growth and development. They are also playing a critical role in influencing the nutrient cycle, soil structure stabilization, transfer of organic matter and its accumulation (Landis & Fraser 2008; S. Kulkarni & A. Kulkarni, 2018 ; Tisdall ,1991; Barea 1991). Mycorrhizae are one of the potential biofertilizers that can help in improving the quality of soil especially for the semiarid zones from India. They help in mobilizing the phosphates, conserve plant nutrients, are natural renewable sources with low cost inputs and eco-friendly. ( Yawalkar et. Al.). Mycorrhizal fungi have been suggested as having a role in uptake of water at during drought stress, and heavy metals contaminated soil (Courtecuisse, 1999). Studies have suggested that the relatedness of plant and AM fungal communities might



ISBN-978-81- 954002-9-4

change in response to shifts in the biotic or abiotic environment. The preferential carbon allocation towards AM fungi is found to increase under nutrient limitation (Ji & Bever, 2016). Legumes have a high demand for nutrients, especially P for N-fixation, and are therefore thought to strongly rely on AM symbiosis to increase nutrient uptake (Azcon *et al*., 1991).

Mycorrhizal fungi in the rhizosphere support or inhibit plant growth naturally. Plant growth-promoting fungi help to improve crop yield and crop sustainability in adverse environmental conditions including soil salinity, drought, high and low temperatures, and infections from pathogens and pests. Mycorrhizal fungi secrete plant growth-promoting substances, enzymes, and other metabolites, all of which play a vital role in enhancing the productivity of economically important plants. These fungi also reduce the need to use chemicals in agriculture, which helps to minimize soil pollutants. (R. Radhakrishnan, 2021)

The study of mycorrhiza is reported since long back in nature. The study of mycorrhiza started in the 19$^{th}$ century with the work of Frank (1885) followed by contribution in the study by Mosse (1953), Gerdmann and Nicolson (1963), Glenn (1982), Hepper (1984), Bagyaraj (1990-2000), Nair (1995), All the research have improved the knowledge regarding the morphology, taxonomy, identification, status, potentials and functions of mycorrhizal establishments with plants and their role for sustainable agriculture.

The plants growing in disturbed lands or semiarid conditions require the help of mycorrhizal technology to improve the growth conditions for the plant in their initial stages esp. in seedling stages. In recent years more emphasis have been given on production and improvization of this technology. It has been useful for the forest plants, horticultural crops and agroforestry plants. The benefits of mycorrhizal associations are reported in crop plants like wheat, maize, tomato, brinjal, soybean (Kulkarni, 2013), medicinal plants and observed that the crop productivity was enhanced by 35-50%. There is need to popularize and improve the biofertilizer technology with respect to quality improvement of crops in the nurseries and fields through Agricutural universitites and Forest management programmes (kulkarni, 2016).

The recent advances in molecular biology, biotechnology and microscopy has provided insight for mechanisms of interaction between mycorhizza and plants (J. Gilbert et.al 2013). It includes the role of mycorrhiza in stress tolerance management and Genetic analysis of AM fungal communities. These studies will help to understand the molecular mechanism of ecological and evolutionary roles of arbuscular mycorrhizal (AM) fungi in communities and ecosystems. In the recent studies on utilization of mycorrhizal is a sustainable method to reduce the translocation of metal ions to the shoot by improving the immobilization of metal in the root and rhizosphere through phytostabilization. It is studied with respect to agricultural lands that are getting contaminated with heavy metals due to the extensive utilization of agrochemicals and their accumulation in the edible parts of crop plants enhances the chances of heavy metal exposure to human beings (E. Janeeshma, 2022).



ISBN-978-81- 954002-9-4

All the advances in molecular genetics clearly permit the analysis at finer and functional scales than the previous techniques. The classical methods have limitations and thus exploration with molecular analysis is essential for improvement in technology. The research is in progress to understand the the cellular signals at molecular levels and their role in interactions (Enrico Gobbato, 2015).

The studies indicate that alternative technologies like mycorrhiza is a promising technology for sustainable agricultural development and have proved the potential for reclamation of soil types and plant growth from semiarid zones.

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*ISBN-978-81- 954002-9-4*