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# Contributions of Arbuscular Mycorrhizal Fungi to Soil Fertility

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## Abstract
The rate of soil deterioration throughout most of the globe is worrying. The degradation of soil fertility has been attributed to several factors, including climate change, various agricultural management techniques, such as tillage, and the over use of chemicals. At a global level, soil erosion, soil organic carbon, excessive input consumption, and nutrient imbalance pose the biggest challenges to soil performance. Due to unsustainable land management practices, bush burning, ongoing crop cultivation, and tillage methods, the world's soil fertility has decreased. An environmentally friendly method to increase soil fertility has been identified as inoculation with arbuscular mycorrhizae fungi (AMFs).

## Introduction
Franciszek Kamienski identified a mutualistic relationship between fungi and roots in 1881. The AM association is the most prevalent mycorrhizal association. More than 80% of plants have a symbiotic connection with AMF, which is the most common soil microbe (Prasad *et al.*, 2017). AMF are obligate symbionts rather than parasites. They collaborate symbiotically with vascular plants, which serve as their hosts and provide them with the energy they need. The highly branched intracellular fungal structures or arbuscules that are the site of the nutrition exchange between the fungus and the host plants are what give the AM fungi their name.

**AMF's Impact on Soil Nitrogen Availability**: Nitrogen (N) is essential to plants. It is a component of amino acids, coenzymes, and phospholipids (Hawkesford *et al.* 2012). N is found in organic matter in the soil and in crystalline forms (ammonium ions, nitrites, and nitrates). Plants that prefer nitrogen in the form of nitrate are only poorly able to absorb the ammonium form of nitrogen. AMF aids in the soil's inorganic nitrogen's mobilization. The AMF mycelium has the capacity to take nitrogen in the forms of ammonium ions, nitrates, and amino acids.

**AMF's Effect on the Availability of Phosphorus in the Soil:** Plants take up phosphorus in the form of orthophosphates (inorganic phosphate Pi), but there is a limited supply of this mineral form of phosphorus in the soil. As a result, areas around the roots are quickly depleted when root

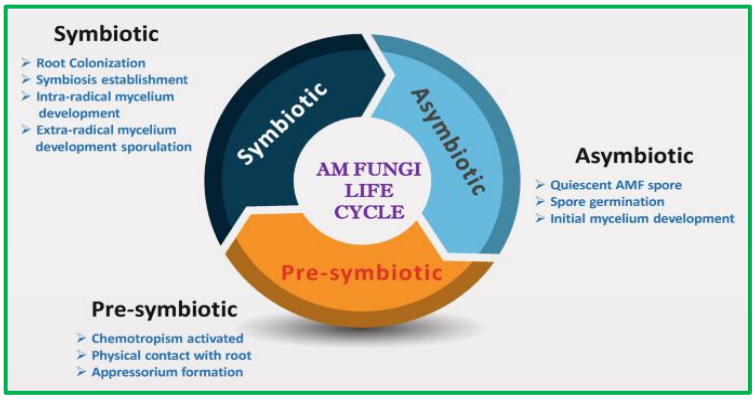
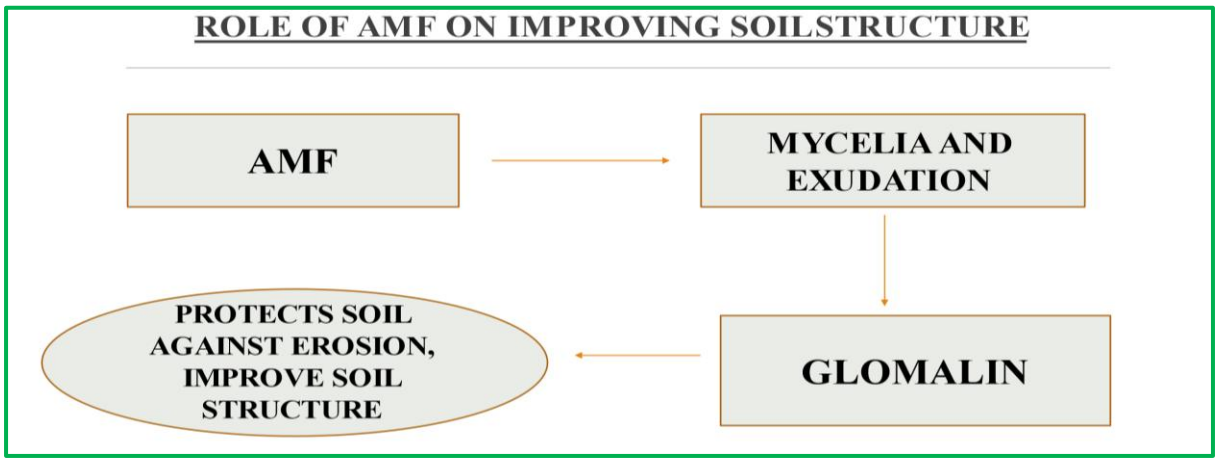



Fig: AM fungi life cycle (Parihar *et al.*, 2020)

sampling is used because of the slow supply of P, the slow phase of the soil, and the low mobility of P in soils. The enhancement of P availability in the soil is largely due to AMF. It is a P activator, after all, that can speed up the process of converting P into forms that are bioavailable through a variety of chemical processes and biological interactions. The plants' ability to absorb soluble P is improved by AMF mycelia. Through the mechanisms of acidification, chelation, exchange reactions, and formation of organic acids, $H^+$, and metabolites, AMF can also solubilize inorganic phosphate into soluble forms.




**Role of AMF on Biological Properties of Soil:** Studies have demonstrated that mycorrhizae and their extra-root hyphae can pass through the microscopic pores between soil particles, and their secretions, such as glomus associated proteins (GRPS), organic acids, and polyamines, can be used as adsorption agents for the adhesion of soil particles, promote the formation of soil aggregate structures, and enhance soil pH, water stability, aeration, and water permeability. Other fungi, nematodes, and bacteria can all be directly impacted by the exudates produced by plant roots that are symbiotic with AMF.

## Conclusion

One of the most crucial soil organisms to consider seems to be arbuscular mycorrhizal fungi. It is well known that AMF is essential for enhancing soil fertility. By producing glomalin, a substance that aids in the storage and movement of soil carbon and hence enhances soil structure. The inorganic forms of nitrogen and phosphorus in the soil are mobilised by AMF, increasing their availability and assisting in the maintenance of soil fertility.

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