

Perspective

Challenges and solutions in conserving beneficial soil fungi for sustainable land management

Rinah David*

Department of Land Economy, University of Cambridge, England, UK.

Received: 11-Aug-2023, Manuscript No. AAB-23-115606; Editor assigned: 14-Aug-2023, Pre QC No. AAB-23-115606 (PQ); Reviewed: 29-Aug-2023, QC No. AAB-23-115606; Revised: 05-Sep-2023, Manuscript No. AAB-23-115606 (R); Published: 12-Sep-2023

ABOUT THE STUDY

Soil fungi play a crucial role in maintaining the health and vitality of plants in various ecosystems. These microscopic organisms form symbiotic relationships with plants, helping them absorb nutrients, enhance their resistance to diseases, and improve overall plant health.

Mycorrhizal fungi and nutrient uptake

One of the most well-known groups of soil fungi involved in plant health is mycorrhizal fungi. Mycorrhizae are symbiotic associations between fungi and plant roots, where both parties benefit. These fungi extend the root system's reach, effectively increasing the plant's access to water and essential nutrients, such as phosphorus and nitrogen, which are often limited in the soil.

Mycorrhizal fungi form intricate networks, connecting multiple plants and facilitating nutrient exchange among them. These networks, known as the "Wood Wide Web," allow plants to share resources and communicate with each other, enhancing their collective health and resilience.

Disease suppression by beneficial fungi

While some soil fungi establish mutualistic relationships with plants, others play a crucial role in suppressing plant diseases. These beneficial fungi, often referred to as "biocontrol agents" or "antagonistic fungi," protect plants from harmful pathogens. They do so through various mechanisms:

Antagonism: Beneficial fungi can directly compete with plant pathogens for resources, such as nutrients and space. By outcompeting the pathogens, they limit their growth and prevent diseases from taking hold.

Production of antibiotics: Some soil fungi produce antibiotics that inhibit the growth of pathogenic microbes. For instance, the fungus *Trichoderma* spp. is well-known for its ability to produce antifungal compounds that protect plants from soil-borne diseases.

Induced resistance: Beneficial fungi can stimulate the plant's immune system, making it more resistant to pathogens. This

induced resistance can help plants ward off diseases more effectively.

Decomposition of pathogens: Certain soil fungi are efficient decomposers of organic matter, including plant pathogens. They break down the remains of diseased plants, reducing the pathogen's survival rate in the soil.

Endophytic fungi and plant health

The endophytic fungi are a group of fungi that live inside plant tissues without causing harm. Instead, they often provide benefits to the host plant. Endophytes can enhance plant health in several ways:

Enhanced stress tolerance: Endophytic fungi can help plants tolerate environmental stresses such as drought, salinity, and extreme temperatures. They do so by producing protective compounds and promoting root growth.

Resistance to herbivores: Some endophytic fungi produce secondary metabolites that deter herbivores from feeding on the host plant. This can reduce damage to the plant and enhance its overall health.

Improved nutrient uptake: Just like mycorrhizal fungi, some endophytes enhance nutrient uptake by the host plant, particularly phosphorus and nitrogen. This can lead to healthier and more robust plant growth.

Challenges and conservation

While soil fungi play crucial roles in promoting plant health and disease suppression, their populations can be affected by various human activities. Agricultural practices, such as excessive use of synthetic fertilizers and pesticides, can harm beneficial fungi, disrupting their natural functions.

Conservation efforts are essential to maintain healthy soil fungal communities. Some strategies for preserving these valuable organisms include

Reducing chemical inputs: Reducing the use of synthetic fertilizers and pesticides in agriculture can create a more hospitable environment for beneficial fungi.

*Corresponding author: Rinah David, Email: rinahs01@yahoo.com

Crop rotation: Implementing crop rotation practices can help break disease cycles and maintain a diverse soil fungal community. Organic farming practices often focus on building healthy soil ecosystems, which can support beneficial fungi.

Restoration of natural habitats: Protecting and restoring natural habitats, such as forests and grasslands, can provide reservoirs of beneficial fungi that can recolonize disturbed areas.

Soil fungi are indispensable allies in promoting plant health and suppressing diseases in various ecosystems. Mycorrhizal fungi improve nutrient uptake, endophytes enhance stress tolerance, and antagonistic fungi protect plants from pathogens.

Sustainable land management

Sustainable Land Management (SLM) is an integrated approach to land use and resource management aimed at promoting the long-term health and productivity of terrestrial ecosystems while ensuring the well-being of current and future generations. SLM recognizes the finite nature of land and its vital role in supporting agriculture, forestry, biodiversity, water resources,

and human settlements. It seeks to balance human needs with environmental stewardship by adopting practices and policies that conserve natural resources, enhance ecosystem services, and foster resilience in the face of environmental challenges.

Key principles and components

Soil conservation: Protecting the soil from erosion, degradation, and contamination through practices such as reduced tillage, cover cropping, and terracing. SLM aims to maintain soil fertility, structure, and health for sustainable agricultural production.

Water resource management: Efficient and responsible use of water resources, including the prevention of waterlogging and the adoption of irrigation and water harvesting techniques that reduce water waste.

Biodiversity conservation: SLM acknowledges the importance of biodiversity in maintaining ecosystem stability. It promotes practices that protect and enhance biodiversity, such as afforestation, reforestation, and the preservation of natural habitats.