THE NEXT GENERATION BIOAGENTS FOR ECOLOGICAL AGRICULTURE - VASCULAR ARBUSCULAR MYCORRHIZA

D. Sripriya
Department of Biotechnology, School of Herbal Studies and Naturo Sciences, Dravidian University, Kuppam – 517 426, A.P., India.
sripriyashok13@gmail.com

Abstract:

India is bequeathed with a variety of crops because of its enormous agro–climate diversity. The diverse agro-climatic conditions of the country give it a unique advantage as well as a competitive advantage over other countries. Because of health hazards created by excessive use of chemicals in agri-business, there is a lot of weight on the production of food using integrated crop management practices where the chemicals are used cautiously in combination with bio fertilizers/bio pesticides. Advances in research on Vascular Arbuscular Mycorrhiza Fungi (VAM) physiology and ecology over the past 35 years have led to a greater understanding of the significance of VAM in the ecosystem. This knowledge applies to human activities of ecosystem management, ecosystem restoration, and agriculture. VAM has a strong influence on plant interactions by aiding plants in resource acquisition, disease suppression, and tolerance to soil pollution and plays a decisive role in plant development. It also boosts the supply of water and nutrients to the host plant. In return, up to 20% of plant–fixed carbon is transferred to the fungus; hence the nutritional exchange is bidirectional. Needless to say, VAM has involved a huge deal of interest from the agricultural world over the years and is therefore being able to substitute for reduced fertilizer and biocide inputs in agricultural practices.

Key Words: Vascular Arbuscular Mycorrhiza (VAM), Fungi, Ecology, and Bio-fertilizer.

INTRODUCTION:

The comprehensive environmental changes caused by human activities are one of the biggest encounters facing our society. The development in the organic sector, increasing public resistance to the use of pesticides, and better emphasis on food quality put forward that there will be an increasing market for foods produced in the systems. To achieve this, agriculturists are following alternate technology, where beneficial microbes are the key players mainly for protecting and recapturing the soil and plant rhizosphere and potential tools for sustainable agriculture.

Agriculture is the most important sector for certifying food security, relieving poverty, and conserving the vital natural resources that the world's present and future generations will be dependent upon for their survival and wellbeing. The disorganized use of chemical herbicides, pesticides, and amplification of agricultural production during the past few decades has led to other harmful effects like nitrate in the groundwater, contamination of food materials, eutrophication, stratospheric changes, etc... To discharge from these harmful effects, VAM fungi can act as a support system in the promotion of plant health, soil fertility, and soil collections stability in developing economies.

VAM also incentive plant growth, assist in contaminant removal, reduce the need for fertilizer application in commercial plant production, and improves the soil structure and health. VAM fungi are characterized by arbuscular which are formed by fine, fork branching hyphae in cortical cells. Hyphae of VAM fungi extend outwards from the root surface, mounting the user-friendliness of the root system for nutrient uptake. VAM fungi can therefore serve as a biofertilizer by facilitating access to nutrients. They are one of the important organisms for improving and sustaining soil potential. The studies conducted with these effective fungi have shown a 15 to 40% increase in yield and are primarily involved in the wide range of resources in both natural and managed ecosystems.

THE ROLE OF VAM FUNGI IN SOIL ENHANCEMENT:

Plant health is closely linked to soil health, managing the soil that conserves and improve the soil biota can expand crop yields and quality. Agricultural management also has reflective effects on soil groups. A varied soil group will not only help prevent losses due to soil–born pests and diseases but also speed up the decomposition of organic matter and toxic compounds, and improve nutrient cycling and soil structure. The most abundant members of the vast community of soil organisms that develops a conjointly beneficial majority of the plant growth are called mycorrhizal fungi. They are adaptable organisms with complex ecological implication in the soil system that has been difficult to study and understand. The photo-centric idea of VAM fungi that has been overcome since the naming of these organisms is being replaced by a universal vision recognizing that VAM fungi are a significant element of soil functioning and health rather than plant root elements.

VAM fungi have been recommended to improve biodegradation of determining organic pollutants because of the enormous size and very high surface interface with soil. VAM fungi are of importance as they play a dynamic role in metal acceptance and accumulation. VAM fungi associations have a straight effect on soil structure, which is especially important in the mixed culture system, where cultivations and low levels of soil organic matter incline to result in damage to soil structure. The critical ecological role played by VAM fungi is their capacity to directly influence the diversity and composition of the aboveground plant community established that plant species fertility can be altered not only by climatic and edaphic factors but also by soil microbial gatherings. In addition, they improve plant growth, help in contaminant elimination, decrease the need for fertilizer, and increase the soil structure and vigor.

VAM FUNGI AND ORGANIC FARMING:

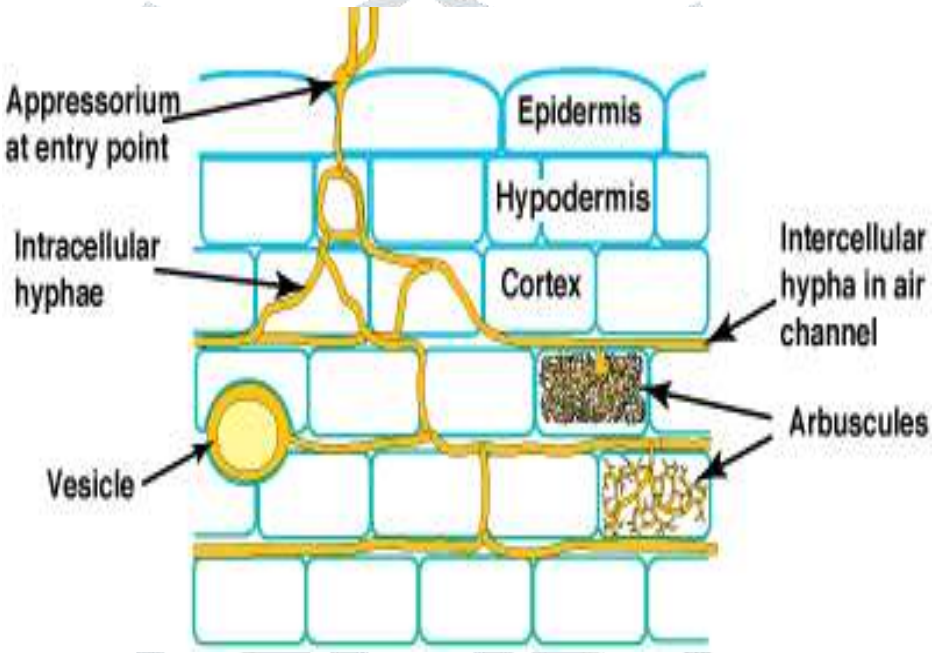
One of the methods in agriculture is organic farming, which conserves and compliments the balance of the environment, improves natural resources, and produces more delicious products. The developed nations of the world are afraid of the spreading contamination of toxic chemicals in food, feed, fodder, and fiber. Organic farming arrangement is looked upon as one of the means to remedy. However, the major problem in India is the unfortunate productivity of our soils because of the low content of organic matter. It is an ecological production management structure that helps and improves biodiversity, biological cycles, and soil biological activity. The efficiency of the organic inputs in the promotion of productivity depends on the organic fillings of the soil. There were a lot of similarities of organic farming principles in the traditional agriculture of India. The broad principles of organic farming are as follows: Prohibiting of synthetic biocides, accumulation of organic fertilizers to the soil and use of crop rotation, etc. Mycorrhizal fungi are prevalent in agriculture arrangements and are exclusively relevant for organic agriculture because they can act as natural fertilizers, improving plant crops.

Additionally, Mycorrhizal fungi can, directly and indirectly, donate to plant productivity in organic farming arrangements. Mycorrhizal effects include improved nutrient uptake, improved seedling establishment, and stimulation of soil structure. Organic farming trusts heavily on active soil microbial groups, and VAM fungi play a dynamic role in agroecosystem function. The wasting effects of intensive farming practices on soil fertility and ecological balance are surfacing which needs instant attention for sustaining the productivity percentage. These disadvantages have controlled increased demands to make agricultural arrangements more sustainable by reforming agricultural practices. As a result, interest in organic farming as an alternative agricultural approach has increased. It is a production system, which favors the maximum use of organic materials and VAM fungi is one of them, which, improves soil health and increased the yield, and also played an important role in reducing the harmful effect of pesticides and herbicides.

RELATION OF VAM FUNGI AND CROP PRODUCTION:

VAM fungi can be found in many different plant species, they can provide their favorite services to almost all terrestrial ecosystems, from grasslands to forests, deserts, and agroecosystems. They form symbiotic relationships with the majority of land plants, including many crops. All VAM fungi are obligate plant symbionts, and generally provide nutrients, especially phosphorus, to plants in exchange for plant carbohydrates, protection against pathogens, and drought. They have been shown to enhance the sustainability of ecosystems by improving the soil structure and by reducing nutrient losses after rain-induced leaching trials.

The existing requirement in agriculture for great yields as rapidly as possible may be an ongoing requirement for future food production. The cumulative consumer demands for organic or sustainably produced food, however, will require changes to include cultural practices that growth of VAM fungi diversity. Sustainable production of food crops in the tropics is often strictly inhibited by the brittleness of soils, being disposed to several forms of degradation. Construction better use of the biological resources in these soils can contribute to improved sustainability. Mycorrhizal fungi establish a significant biological resource in this esteem.



CONCLUSION:

Organic farming is a form of agriculture in which we have minimal or no dependence on chemical fertilizers and pesticides to enhance crop yield. It envisages the use of organic manure, to replenish the soil of its lost nutrients. It is well established that VAM fungi can do crop improvement largely through nutrition, other positive effects are in the biological control of root pathogen, biological nitrogen fixation, hormone production, and greater ability to withstand water stress. Because of their exceptional ability to increase the uptake of phosphorous by plants, mycorrhizal fungi can be utilized as a practical substitute for phosphoric fertilizer.

This approach also augments yield and monetary returns to the farmers, particularly to the small landholders, for which the incremental input cost is low. The combination of these organisms in natural, undisturbed ecosystems would seem to add to the flourishing growth and health of plants. In a sustainable and organic agricultural system, the role of VAM fungi in maintaining soil fertility and biocontrol of plant pathogens may be more important than in conventional agriculture where their significance has been marginalized by high inputs of agrochemicals. VAM fungi have great potential for improving the productivity of most crops.

Further research is imperative for field appraisal of these fungi. Therefore, the management and planned applications of VAM fungi to improve the growth of beneficial and important crops, particularly in India with an understanding of exploiting VAM fungi payback towards sustainable agricultural development is very important. We believe that farming with VAM fungi will help develop eco-friendly and cost-effective plant disease management practices that will open and establish new avenues for the era of next-generation biopesticides cum biofertilizer from nature.

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