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OPEN ACCESS JOURNALS

Journal of Agricultural Science & Crop Research

**Review | Vol 1 Iss 1**

# Role of Fungal Biofertilizers in Agricultural Production

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**Received:** October 20, 2020; **Accepted:** December 25, 2020; **Published:** December 31, 2020

## Abstract

**Many studies and research in the last four decades have addressed the topic of biofertilizers, as the scientific leap and recent discoveries allowed scientists to develop new technologies to include them in agriculture and return to the so-called integrated agriculture or clean sustainable agriculture to achieve increased production and environmental protection at the same time and the production of crops and free food of pollutants. A biological fertilizer is a substance that contains beneficial microorganisms added to the soil that can supply plants with part of their nutritional needs, or it can be defined as all additives with a biological source called microbial inoculants that supply plants with their nutritional needs by transforming them (in their vital activity) from Its unprepared forms to its ready-to-absorb images as well as providing it with stimulating and stimulating substances for plant growth such as hormones and growth regulators, stabilizing atmospheric nitrogen through its symbiotic or non-symbiotic livelihoods, and protecting the plant family from some pathogens, mm It contributes to reducing the use of chemical fertilizers by about 25% and thereby reducing the costs of the agricultural process.**

**Keywords:** ***Biofertilizers; Mycorrhizal fungus; Agricultural production***

## 1. Introduction

Biofertilizers were discovered after the discovery of microorganisms by the Dutch scientist Antony Var Leevmatic in 1676 AD. After this period, scientists discovered the role of many microorganisms in soil fertility and the supply of plants with

**Citation:** Hassoon AS, Kadhim AA, Al-Taee MM. Role of Fungal Biofertilizers in Agricultural Production. J Agric Sci Crop Res. 2020;1(1):103.

nutrients and biological fertilizers are useful microorganisms added to the soil that can supply Plants have a portion of their nutritional needs, or it can be defined as all additives with a biological source called microbial inoculants that supply plants with their nutritional needs by transforming them (in their vital activity) from their unprepared forms to their ready-to-do In addition to providing them with stimulants and stimulants for plant growth, such as hormones and growth regulators, stabilizing atmospheric nitrogen through their symbiotic or non-symbiotic livelihood, and protecting plant families from some pathogens, which contributes to reducing the use of chemical fertilizers by about 25% and thus reducing agricultural costs [1,2].

The use of biofertilizers is one of the modern technologies in the agricultural field to reduce the use of mineral fertilizers and to reduce environmental pollution and biofertilizers are preparations that contain one or two types, or a combination of microorganisms added to seeds, plants or the soil surface to increase the readiness of plant nutrients Improving soil fertility and thus increasing production. These fertilizers are environmentally friendly and do not pose any risk to them, as well as their role in analyzing organic waste and in the secretion of some enzymes, growth regulators and plant hormones and their importance in biological control [3].

## 2. Mycorrhizal Fungus

The term Mycorrhizae was used for the first time by the German scientist Frank in 1885 AD to describe the symbiosis association between living organisms belonging to two different kingdoms, namely fungi and plant roots. Improved absorption of macronutrients and micronutrients, so infected plants look better than uninfected, and fungal biofertilizers include a large group of beneficial fungi such as *Penicillium* sp., *Aspergillus* sp., *Tri*coderma sp. Mycorrhizae fungi can infect 90% of plant species [4].

## 3. Division of Mycorrhizae

Depending on the nature of its presence, the Mycorrhizae are divided by the root system [5] into:

### 3.1 External mycorrhizae (ECM) ectomycorrhizae

Sometimes called external roots, and these are formed after the contact that occurs between the fungal strands and between the feeding roots of the plant families with which it is present.

### 3.2 Inner mycorrhizae (ENM) endomycorrhizae

This group is the most common of the three groups and it is one of the most important types economically, as it affects most types of plants and increases the readiness of phosphorous, in addition to nitrogen and other nutrients such as K, Ca, Mg, Cu, Zn, Fe.

### 3.3 External mycorrhizae - internal Ectoendomycorrhizae

Fungi of this group are an intermediate condition between the previous two groups. Fungi of this group grow in the cells of the root shells as well as their growth around the cells of the shell. Trees in nurseries

TABLE 1. **The Most Important Gender Belonging to The Liposome Mycorrhizal Fungi**

| **Gender** | **Family** | **Order** | **Class** | **Divide** |
|---|---|---|---|---|
| Ambispora | Ambisporaceae | Archaeosporales | Glomeromycetes | Glomeromycota |
| Archaeospora | Archaeosporaceae | | | |
| Intraspora | | | | |
| Geosiphon | Geosiphonaceae | | | |
| Acaulospora | Acaulosporaceae | Diversisporales | | |
| Diversispora | Diversisporaceae | | | |
| Otospora | | | | |
| Entrophospora | Entrophosporaceae | | | |
| Gigaspora | Gigasporaceae | | | |
| Scutellospora | Scutellosporaceae | | | |
| Racocetra | Racocetraceae | | | |
| Cetraspora | | | | |
| Dentiscutata | Dentiscutataceae | | | |
| Fuscutata | | | | |
| Pacispora | Pacisporaceae | | | |
| Glomus | Glomeraceae | Glomerales | | |
| Paraglomus | Paraglomaceae | Paraglomerales | | |

## 4. The Effect of Biofertilization on Field Crops

Their findings Results [6] revealed different response wheat (*Triticum aestivum L.*) of the tested recombinations for biofertilizer effects. The recombination wahat al Iraq, Babil, M707, Mexipaq, Furat, Dijla, Um-rabee, Tamose2, Tamose3, Ure, M619B, M613, M606, M615A, M630, M621, and Noor revealed significant increasing differences in most growth and productivity parameters specially Wahat al Iraq, M707, Mexipaq, M613 which recorded yield increment at 96%,89%,59%,57% respectively, while the recombination Tellaafar3, Adnaaia, Medaaen, M612, M633A, M615B, M633B showed a negative response and recorded reduction percentages 10%,15%,4%,12%,9%,45%,24% as a comparison with control respectively.

Khalaf [7] showed that application of fungal (*Glomus mosseae*) biofertilizer for Maize significantly increased the grain yield, biological yield and percentage N, P, K, in grain irrespective with and without phosphorous fertilizer, which was (17.66%, 14.77%, 6.63%, 33.33% and 5.40%) respectively compared without the addition of biofertilizer.

The results on the barley yield showed that the different treatments significantly affected the physiological traits, especially when adding superphosphates with the above two concentrations with *Glomus mosseae* such as plant height, plant leaf area, total dry weight of the plant, dry weight of leaves and stems, number of shoots, leaf area the flag, the dry weight of the leaf, and both the growth rate of the CGR increased [8].

Ahmed and Hashem [9] indicate Bio-fertilizers were significantly excelled in the traits of vegetative growth for rice plants (plant height, area of flag leaf, the flag leaf content of chlorophyll, length of panicle, number of tillers per $m^2$), where the plants treated with Mycorrhiza (C1) has excelled by giving it the highest average for the number of tillers per $m^2$ amounted to (449.24, 437.26 tillers.$m^{-2}$) for both seasons, respectively, while plants of the control treatment (C0) gave the lowest average amounted to (406.70, 408.75 tillers.$m^{-2}$) for both seasons, respectively.

Alaa [10] showed Treatment that inoculated cotton plants with *Gigaspora* spp. fungi and fertilized by 20 kgp/ha gave the highest concentration of N and P as compared with other treatments. The addition of 40 Kg P/ha caused a significant decrease in the percentage of root infection with mycorrhizal fungi as compared with treatment fertilized by 20 KgP/ha and non-fertilized treatment .4. The highest values for harvesting stage, cotton weight/plant, number of balls/plant and seed index (weight of 100 seeds) were (13.25, 8.56,12.56) respectively for (F1P1) treatment with significant increase as compared with other treatments .5. Inoculation with (*Gigaspora* Spp.) fungus with the addition of 20KgP/ha or without, showed the of a significant increase in cotton weight gm/plants as compared with other treatments. the significant difference between (F1P1 and F1P0) refers to the importance of fungi use .6. The treatment that inoculated with (*Gigaspora* Spp. fungus and fertilized with 20 KgP/ha or without fertilizer (F1P1 and F1P0) were significantly increased in weight of yield gm/plant compared with other treatments that indicate fungi could be used instead of phosphorus, or to reduce the levels of phosphorous fertilizer.

In India, a cultivation experiment was conducted by Sabannavar and Lakshman [11] in pots of sesame plants, phosphate rock was used in different concentrations (0, 15, 30, 45 kg P e-1) and in the presence of a biofertilizer mixture consisting of the mycorrhizal species fungi *Glomus* and bacteria *Pseudomonas striata* to find out Effect of adding phosphate rock and phosphorous solvents to plant growth and vegetative and root system when taking readings in durations (30, 60, 90 days), the researchers have found an increase in plant height, root length, dry and soft weight of the root and vegetative group and an increase in the number of root mycorrhizal colonies And high phosphorous content of the vegetable total Winning high when there are a fungus and bacteria with rock phosphate together.

## 5. The Effect of Biofertilization on Vegetative Crops

Munam and Hadi [12] were found tomato roots treatment with *Glomus mosseae* without Humic acid adding results increase of tomato roots infection 29.10% after 30 days of planting in comparison to control treatment (0.0) and product increase was 69.338 Ton / H., and with Humic acid addition results increase of tomato infection 58 .50 % in comparison to control treatment (0.0) and product increase was 95.153 Ton/H. The treatment with *G. mosseae* interrelated with *T. harzianum* without Humic acid results increase of tomato roots infection 38% comparison to Trichoderma treatment (0.0) and product increase was 83.606 Ton /H. The Treatment with *Glomus mosseae* and *Trichoderma harzianum* interrelated with Humic acid exceeded all the other types of treatment and it showed an increase in tomato roots infection with Mycorrhiza 64.2% which reflected an increase in tomato product 117.609 Ton / H.

In a study on the potato crop, Results also revealed that the interaction between *Glomus* spp and *Azotobacter chrococcum* significantly increased the fresh weight of root, leaf area and total yield for spring and autumn seasons [13].

Maitham et al. [14] Mentioned that Isolate fungi showed superiority over others in a number of root nodes, biological yield, number of corns, 100 seed weight, seed yield, harvesting index, protein content of seeds. M1 isolation was the most potent, as compared to M2, since it gave the highest plant height, number of root nodes, 100 seed weight, seed yield, and harvesting index.

Pollination of eggplant plants with *T. harzianum* and *A. niger* fungi and in combination with the *G. mosseae* fungi gave a significant increase in the amount of phosphorus absorbed and the percentage of mycorrhizal infestation as well as other studied characteristics compared to the individual addition parameters of the fungi.

A study conducted on okra found inoculation with the mycorrhizae was superior in giving higher values of plant height, a number of branches and a total number of leaves per plant; 139.97 cm, 15.00 branch. plant-1 and 165.85 leaf. plant-1, respectively. The M1F0A0 combination treatment recorded the highest number of branches per plant (16.50) while the M1F2A1 treatment recorded the highest values of plant height (145.66 cm), total leaves number (170.33 leaf. plant-1), leaf area (731.36 DCM-2. plant 1), number of pods (19.20 pod. plant-1), and plant yield (809.40 g. plant-1) [15].

Findings results indicated treatment outweigh the vital of bio-fertilizer in all the traits of Basil Plant *Ocimum basilicum* [16], were gave the highest value for recipes (cm plant height, number of branches .n.bat -1, plant dry weight (g), leaves yield Tun.hectar-1, the proportion of nitrogen, phosphorus, potassium, iron, zinc, oil content violation, a specific weight, density, and coefficient break it) was (48.83 cm, 58.29, 88.20 g, 2.07 T.hectar$^{-1}$, 2.34%, 0.26%, 2.17%, 2.18 ppm, 2.15 ppm, 2.34%, 0.991%, 0.978%, and 1.48%) on the relay.

## 6. The Effect of Biofertilization on Ornamental Plants

Microscopic fungi are considered to be one of the most important soil revitalizations affecting plants in general and ornamental plants in particular. The researcher Scagel [17] conducted a study to demonstrate the effect of mycorrhizae on the growth and flowering of Brodiaea laxa (Queen Fabiola) plant, as the fungus *Glomus intraradices* are used to pollinate plant corms, The researchers study during the initial growth cycle after germination that the addition of mycorrhizas worked to accelerate the days required for flowering and increased the number of flowers as it prolonged flowering life and improved the quality of corms and also increased the number of corms for each plant The proportion of nitrogen, potassium, zinc, and sugars increased in the corms produced from pollinated plants, and the researcher indicated that pollination with mycorrhizal fungi may lead to better growth of ornamental plants, especially cut flowers, and affect the prolonged flowering life. The pollination of the *G. fasciculatum* plant showed a significant increase in the characteristic of the inflorescence 50 cm, the number of florets 21 flowers. The diameter of the florets 11.5 cm compared with the comparison treatment recorded 30 cm, 10 flowers, and 10.0 cm, respectively [18].

Ashjan et al [19] mention Inoculation of Chrysanthemum Plants with Trichoderma fungi significantly improved leaves content of nitrogen 2.38%, potassium 3.05%, and copper 0.093 mg/l compared with control. Application of paclobutrazol at concentration 50 mg/l resulted in a significant decrease in potassium percent in leaves 2.68%, while copper and zinc content in leaves 0.091 mg/l and 2.43 mg/l respectively. Fertilization with nitrogen at 20 g/pot resulted in a significant increase in nitrogen, potassium, and zinc in leaves 2.38 and 3.25% and 2.47 mg/l respectively.

Karishma et al. [20] found when using several types of fungi such as *G. mosseae*, *Acaulospora leavis*, *Pseudomonas fluorescens* and their effect on the growth, flowers, and extension of flowering life of L plant. *Chrysanthemum indicum*, which was added with an amount of 10% of the soil volume in pots with a height of 25 cm and a diameter of 25 cm consisting of soil and sand, this addition led to an increase in the flower diameter, flowering age, and the volume of water absorbed which amounted to (10.23 cm, 14.66 days, 11.80 ml), respectively. While the comparison treatment was recorded (4.43 cm, 8.33 days, 9.53 ml), respectively, the researcher concluded that these neighborhoods have a role in prolonging flowering life by increasing the effectiveness of SOD enzymes that have a role in reducing the effectiveness of the Peroxidase enzyme.

And Garmendia Mangas [21] pointed out that the rose hybrid plant when adding the mycorrhizal *G. mosseae* and *Glomus intraradices* to it resulted in a significant increase in the percentage of flowers reached 80% compared to untreated plants as well as its effect on increasing the biomass of plants and the nutritional state in Leaves.

## 7. Conclusion

In light of previous studies and what we have come to, we can conclude that the biological fertilizer is of great importance in increasing the growth of the various crops of vegetables, field crops, and ornamental plants. We recommend expanding it widely in agricultural production.

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