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Article

Biofertilizers and Their Role in The Availability of Nutrients in The Soil (A Review)

Ayad T. Shayal Alalam*; Nagham S. Salim; Yusra M. saleh; Ayad H.E. Alalaf and Badran S. agha

Hort. & Landscape Design Dept. College of Agric. & Forestry, Mosul Univ. **Iraq.**

***Corresponding author:** ayadtaruq75@uomosul.edu.iq

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Abstract: Many soils, especially Iraqi soils, contain pH The high level contains many nutrients, but it is not ready for absorption by the plant, and thus symptoms of deficiency appear on the plants gown in those soils, but when adding biofertilizers that contain beneficial microorganisms, it works to reduce pH These soils and thus increase the readiness of the nutrients present in them, which reflects positively on the characteristics of the root, vegetative and fruitful growth of the cultivated plants, and from this standpoint it is possible to reduce the use of excessive chemical fertilizers and compensate for them with biological fertilizers and preserve human health and the environment around us.

Key words: biofertilization, fertilization, available nutrients in the soil.

INTRODUCTION

In recent years, many countries of the world have paid geat attention to human health, food product quality, and food safety, by encouraging organic production and using nutrients of biological origin as an alternative to chemical fertilizers and reducing environmental pollution resulting from the excessive use of chemical fertilizers, and among these alternatives are biofertilizers. Where the world is moving towards clean agricultural technologies while minimizing pollution as much as possible through the use of natural fertilizers such as bio-fertilizers to reduce these problems. The use of biofertilizers is also one of the important technologies that have been introduced in the agicultural field to increase production in quantity and quality. Biofertilizer contains microorganisms that have a role in preserving the ecosystem, improving the biological, chemical and physical properties of the soil, and increasing the readiness of many nutrients in the soil, thus increasing the growth of plants and agicultural crop productivity.

Biofertilizer

Biofertilizers are defined as a microbe or a goup of microbes added to agicultural soils, which work on the readiness of one or more nutrients in the soil that are necessary for plant growth . some types of bacteria and fungi and blue-geen algaefromBiologyallowed to be used in biofertilization **(Yusef, 2011)**. Farmers have found out before the seventeenth century AD, leguminous plants gow well in some agicultural soils without the addition of chemical fertilizers. And it was a discovery fertilizer svitality After the discovery of microbiology by the Dutch scientist Anthony Var Leevmatic General 1676. After that Scientists have discovered the role of many microorganisms in Soil fertility and plant nutrients missions **(Al-Shahat, 2007)**. And used fertilizers and Biofertilizers to Inoculating the soil with microorganisms that change the biological content of the soil in the area near the root hairs, which is called rhizosphere Rhizosphere **(Sylvia *et al.*, 2005)** which helps the plant to obtain its nutritional needs, There are many microorganisms in biofertilizers, which differ according to the purpose of using this fertilizer. Biofertilizers are divided in terms of their nature and behaviour in the soil into:

1. Symbiotic Biofertilizers: Where are produced from the activity of microorganisms, which are in cooperative coexistence with the roots of the plant, as these microbes provide the plants with some nutrients while taking their nutritional needs, especially the carbon source from the plant, and thus an exchange of benefit occurs between two different organisms Mutualism and they live with each other, that is, they guarantee each other, and they are called Symbionts Mycorrhiza dendrite vesicle (VAM) Vesicular arbuscular mycorrhizae And rhizobiarhizobiaThe cells of both microbes live inside the plant cells, or the microbe is present around the root of the plant, forming a layer or sheath attached to the root, and it is called the external symbiont. Ectosymbiont as in the case of ectomycorrhizae Ectomycorrhiza This cooperation may be compulsory or voluntary.

2. Asymbiotic Biofertilizers: This type of biofertilizer is characterized by the fact that the microorganisms used in its production live freely in the soil and obtain their nutritional needs from the soil. The secretions of some root plants may encourage the vital activity of these organisms, and then increase their efficiency as a biofertilizer such as Azotobacter *Azotobacter* and azospirillum *Azospirillum*(Stabilizersnitrogen aerosol) and phosphate-dissolving bacteria Phosphate dissolving bacteria and blue-geen algae **(Yusef, 2011)**.

And one of the basics of organic farming is not to use any chemicals, whether they are chemical fertilizers, pesticides, pesticides, or herbicides, to produce healthy food for humans and animals and reduce environmental pollution. using in organic agriculture, it is a biological fertilizer or fertilizer, which is intended to pollinate the soil, seeds, or tubers with microorganisms that change the biological content of the soil in the area near the root hairs, which is called the rhizosphere **(Ahmad *et al.*, 2005)** and help the plant to get his need nutritional, and there are in biofertilizers many of beneficial microorganisms such as fungi and bacteria, so investigate bio-compost benefits. Many of them increase processing quantity big from the elements nutrition AL major and important to plant at nitrogen through Install it from the air. The possibility of compensating for the rapid loss of the nitrogen element due to the dissolution of its compounds or their volatilization in the form of ammonia (NH_3), and secretion some plant hormones, such as GA_3 and IAA important for plants, and secretion types of antibiotics which Slathering resistance many of Pain diseases. There is in soil the plants which lead to an increase in the growth productivity, and processing lands that suffer from a lack of organic matter and availability and therefore properties improvement the soil physical, chemical and biological, and more amount absorption water and nutrients from the soil by increasing the space the surface to root, and increase the aggregation of sandy soil granules through the secretion of viscous materials by the existing organisms, and improving the properties of sandy soils by excreting some viscous substances that collect soil particles, and reduce from the pollution high score for environment. Where plants are gown, few costs for cheapness prices vital fertilizer comparison with chemical fertilizer and so lack of quantification added for soil and reduce the number of workers during composting, and provide food healthy and high quality and safe for people and cut toxicity of the food product through on use compost, with the possibility of obtaining good growth and radical and vegetative sum strong to plant coming, so more they got and the same qualitative it's good **(Alwan and Raeda, 2012)**.

Prepare use biofertilizer one of the technologies important in the entire agricultural field to increase production and kind, contains bio-fertilizer microorganism which has a role in maintaining ecosystem and feeling properties biological and chemical and soil physiotherapy and plant growth and increase the productivity of agricultural crops **(Sahoo *et al.*, 2014)**. Biofertilizers also differ according to their vital activity and the type of nutrients they provide to the plant. Some of them provide the plant with nitrogen, phosphorus, potassium, sulfur, or some microelements, and improve soil properties. The microbes used during their growth and reproduction secrete substances that regulate plant growth, such as gibberellins and similar substances, which it is secreted by some microbes in the rhizosphere, such as microbes *Azotobacter* and *Arthrobacter* and some algae and external mycorrhiza, and some microbes secrete auxins such as IAA and cytokinins, some of which are used in biological resistance by secreting antibiotics or substances that inhibit the growth of other organisms. They also work to reduce soil acidity and thus prevent the spread of some types of pathogenic bacteria.

Biofertilizers work on:

1. Providing a large part of the nutrients to feed the plant, thus reducing agricultural production costs and environmental pollution rates, and reducing dependence on chemical fertilizers.

2. Acceleration of seed germination.

3. Encouraging the formation of root hairs and increasing the surface area of the root system, and thus collecting granules in the root zone, which leads to an increase in the absorption of nutrients and water, resistance to water stress, an increase in the rate of aeration around the roots, and an improvement in the performance of the root system.

4. Increasing the vegetative system, increasing and improving production, early harvesting, and increasing the nutrient content of fruits.

5. Reducing the accumulation of chemical pollutants in plant tissues, protecting them from the pathogen present in the soil, and increasing immunity against diseases and injuries.

6. Increasing soil fertility by providing the soil with large numbers of beneficial microorganisms that change the microbial balance in the soil in favors of beneficial microbes, activate beneficial biological processes, and improve the natural properties of the soil **(Yusef, 2011)**.

Influence soil pH depends on the type and activity of microorganisms that live in the soil, as the dominance of fungi at a pH less than 5.5, while the dominance of bacteria at pH higher than that, and this means that many biological activities and associated processes are determined by the soil pH

However, neutral conditions are often appropriate for most of these processes **(Alwan and Raeda, 2012)**.

Readiness The nutrients in the soil are affected by several factors, such as the biological composition of the soil, the type of plant, the availability of nutrients in the soil, the processes of plant uptake and the transfer of nutrients to the different parts of the plant. Regarding the availability of nutrients in plants, it depends on the availability of these elements in the soil and soil rich in organic matter, minerals, and microorganisms can be more readily available for nutrients and the accumulation of nutrients in plant parts can also be affected by many factors, such as the availability of nutrients in the soil, their availability to the roots, the activity of soil microorganisms, environmental conditions and climate. In addition, cultivation, fertilization and soil management practices can affect the availability of nutrients in plants like that fertilizer effect chemical natural, irrigation techniques, tillage, and the cycle agriculture can affect availability and absorption of nutrients in plants. So it is important to regulate and manage your soil and farming practices sustainably to ensure that nutrients are in stock soil and plants and a healthy, balanced diet. Regular soil analysis, application of appropriate fertilizers and farming practices are advised to enhance Ready nutrients in the soil **(Mosa *et al.*, 2014)**.

If use **(Shayal Alalam *et al.*, 2020a)** Bio-compost Follzyme Plus Fulzyme plus_SP and by levels zero and 1 f 2 g transplant^{-1} and organic fertilizer residues of rice levels zero,1 and 2 kg transplant^{-1}, so it contains bio-compost microorganisms are two types of beneficial bacteria *bacillus subtilis* and *Pseudomonas putida* able to provide plants with the nutrients they need from natural sources, especially phosphorus and its effect on the readiness of some nutrients in the soil and its degree of acidity. When beneficial microorganisms multiply in the soil, which convert some compounds containing nutrients from an unready form to a form ready for absorption by plants **(Alwan and Raeda, 2012)**, and increases the availability of phosphorous for plants when pollinated with the bacteria genus *Bacillus.* It is due to the role of bacteria in dissolving precipitated phosphorus compounds, encouraging root growth, increasing the demand for phosphorus, and thus increasing the amount absorbed **(Shayal Alalam *et al.*, 2020b)**, and the reason may be due to the ability of these bacteria to transform tri-calcium phosphate into non-calcium phosphate the dissolved into soluble mono calcium phosphate, which is easy for the roots to absorb. In this transformation, the roots secrete carbon dioxide and some organic acids such as fumaric, formic, succinic and acetic acid, and this increases from the readiness of phosphorus in the soil, its transfer into the plant, its access to the leaves, and its increased concentration in them **(Yusef,2011)**.

It can also Increasing the soil nitrogen content for the role of bacteria *Bacillus subtilis* and *Pseudomonas putida* In the mineralization of complex organic matter in the soil and its conversion into inorganic (mineral) ions such as ammonia and nitrate by the process of nitrogen mineralization nitrogen mineralization capacity bacteria Bacillus on the mineralization of organic compounds through the production of enzymes such as enzyme Phosphoesteras and Phosphodiesterases and Phytases **(Walpola and Yoon, 2012)**.

There are many researchers used bio fertilizer if found **(EL-Sabagh *et al.*, 2011)** when fertilizing two grape varieties "Thompson Seedless" and "Flame Seedless" at the age of 3 years with the biofertilizers Nitrobeine, Hizobacterine and Biogen at an amount of 20 g. Vine^{-1} and dry yeast at an amount of 16 g. yeast. Vine^{-1} each alone, the increase was significant compared to the comparison treatment. Concentrations of nutrients N, P and K in grape leaves.

I got **(Khalil,2012)** showed a significant increase in the concentrations of nitrogen, phosphorus and potassium in the leaves and the number of bacteria in the orchard soil when treated with the biofertilizers Nitrobine + Phosphorein + Halex) at an amount of 50 g. vine^{-1} each with 125 g of ammonium sulfate, 100 g of calcium superphosphate and 50 grams of potassium sulfate for grape vines of "Flame Seedless" cultivar, aged 5 years, compared to the comparison treatment.

Happened **(Grzyb *et al.*, 2012)** showed a significant increase in the number of lateral branches, diameter and height of apple seedlings "Topaz" and "Ariwa", which were grafted on M26 rootstock at the age of one year when adding 1 g of mycorrhizal fungi, Pseudomonas and Bacillus bacteria.

Notice **(Shaheen *et al.*, 2013)** that the addition of biofertilizers (biogen, phosphorin and potassiumag) at an amount of 30 g. vine^{-1} with compound fertilizer NPK, phosphate rock fertilizer and aluminum silicate to grape vines of "Superior Seedless" at the age of 10 years gave a significant increase in the length of the branches and the number of leaves For each branch, the leaf area, and the concentrations of nutrients N, P, and K in the leaves were superior to the rest of the treatments and the comparison treatment.

Is found **(Shalan, 2014)** a significant increase in the studied growth characteristics when the biofertilizer treatment of 200 cm^3. Tree^{-1} EM with 75 cm^3. Tree^{-1} NPK Humate compared to the control treatment and the rest of the treatments when fertilizing pear trees cultivar "Le Conte" at the age of 15 years.

Is found **(EL-Gioushy and Baiea, 2015)** significant increase in the studied vegetative growth characteristics when fertilizing apricot trees (Canino) at the age of 10 years, which were grafted on the local apricot root with a mixture of biofertilizers (Nitrobine + Phosphorein + Potassin) at an amount of 2 kg. feddan^{-1} and 10 tons. 1 acre of sheep manure and 75% of the compound fertilizer compared to the rest of the treatments.

Happened **(El-Sehrawy, 2015)** showed a significant increase when fertilizing apple trees of "Anna" cultivar at the age of 13 years with 30 ml. tree. year^{-1} of each of the biofertilizer EM, yeast and humic acid with 60% inorganic nitrogen fertilizer (1165.0g ammonium sulfate) in Characteristics of leaf area and leaf concentration of N, P, and K compared to the rest of the treatments.

Confirmed **(Sharaf *et al.*, 2015)** when studying the effect of biofertilizer on the growth of apricot trees (Canino) at the age of 10 years, grafted on local apricot roots, the treatment was 30 g. tree^{-1} EM, 50% NPK and 50 ml.L^{-1} humic acid with 2 L of tea compost led to a significant increase in tree diameter, branch length and diameter, number of leaves, leaf area, leaf dry weight and leaf concentration of studied macro- and microelements compared to the control treatment.

pointed out **(Wassel *et al.*, 2015)** indicated that adding biofertilizer EM at concentrations of 20, 30, 40, and 50 ml. tree^{-1} with poultry waste and chemical fertilizer N to fig trees of "Kadotta" at the age of 14 years led to a significant increase in the length of the main stem, number of leaves, leaf area, and chlorophyll a. and b, the concentrations of nitrogen, phosphorus and potassium in the leaves when treating 40 ml. tree^{-1} EM + 50% poultry manure + 50% N compared to the rest of the treatments and the control treatment.

Proved **(Al-janabi *et al.*, 2016)** that the fertilization of two-year-old seed apricot seedlings of the cultivars "Qaisi", "Bayaa", "Labib1" and "Zini" with the biofertilizer EM^{-1} at two levels (1 and 2 ml.L^{-1}) both of which resulted in a significant increase compared to the Acadian organic fertilizer. And for both levels (1 and 2 $g.L^{-1}$) in height, the diameter of seedlings, number of leaves, leaf area, leaf dry weight and total chlorophyll.

Confirmed **(EL-Gioushy,2016)** the presence of a significant increase in the studied vegetative growth characteristics of pomegranate seedlings of "Manfalouty" cultivar at the age of one year when adding 300 ml. $tree^{-1}$ of biofertilizers (Nitrobine + Phosphorein + Potassiin) and the compound fertilizer NPK and organic fertilizer compared to the rest of the treatments and the treatment of comparison.

Pointed out **(Mosa *et al.*, 2016)** indicated that there was a significant increase in the diameter of the stem of apple trees, "Topaz" variety when adding biofertilizer containing Bacillus and *Pseudmonas* bacteria at an amount of 1 $g.m^2$.

Notice **(Amin *et al.*, 2017)** when fertilizing pomegranate seedlings, one-year-old cultivar "116", with 300 ml. $tree^{-1}$ of the biofertilizers Nitrobine, Phosphorein and Potassiin alone or mixed with NPK organic fertilizer at levels 500, 1000, 1500 and 2000 g. $tree^{-1}$ significantly increased the height and diameter of the stem. The head, length and number of branches, number of leaves per branch, leaf area, total chlorophyll and leaf concentration of the elements N, P, K, Fe, Mn and Zn when treated with NPK 2000 g. $tree^{-1}$ + 300 ml. $tree^{-1}$ of biofertilizer compared to the rest of the treatments and the comparison treatment.

Notice **(Baiea *et al.*, 2017)** showed that there was a significant increase in the studied vegetative growth characteristics when fertilizing pomegranate seedlings at the age of one year of the "Wonderful" variety with 300 ml. $tree^{-1}$ of the bio-fertilizer consisting of a mixture of Nitrobine, Phosphorein and Potassiin with 500 g of organic phosphate rock fertilizer $tree^{-1}$ with NPK fertilizer consisting of 400 g $Tree^{-1}$ of ammonium sulfate and 400 g $tree^{-1}$ of superphosphate and 200 g of potassium sulfate.

Happened **(Beslic *et al.*, 2017)** showed a significant increase in leaf area, leaf area, branch length and diameter, and root fresh weight of Cabernet Sauvignon gape trees when fertilizing with Bactofil B10 at an amount of 50 ml. $Liter^{-1}$ water compared to the comparison treatment.

Lesson **(Mohamed, 2017)** the response of pear trees of "Le-Conte" cultivar at the age of 12 years to biofertilizers (Rhizobacterin, Phosphorine and Potassium) at an amount of 40 g. $tree^{-1}$ and observed a significant increase in tree diameter, branches, length, number of leaves, dry and fresh weight, and leaf area compared to the comparison treatment.

Confirmed **(Taha and El-Shahat, 2017)** indicated that there was a significant increase in the vegetative growth characteristics and the studied soil when fertilizing apricot trees (Canino) at the age of 10 years when treated with blue-green algae biofertilizer at an amount of 1 L compared to the control treatment.

Is found **(Olyaie Torshiz *et al.*, 2017)** when fertilizing pomegranate trees at the age of 6 years, the "Bajestani" cultivar had a significant superiority in the studied traits when treated with 1 L. $tree^{-1}$ of a mixture of the biofertilizers azetobarvar, phosphobarvar, and potabarva, and 2 kg. $tree^{-1}$ of granulate humic.

Found **(Shayal Alalam, 2020b)** when adding the biofertilizer, the biofertilizer Follzyme plus containing beneficial bacteria (*Pseudomonas putida* and *Bacillus subtilis*) and for both levels 1 and 2 g. $transplant^{-1}$, a significant increase in the growth of apricot seedlings Prunus armeniaca L. one-year-old cultivar "Zaginia", especially nitrogen concentrations and phosphorous and ready potassium in the soil and the degree of soil reaction pH.

Notice **(EL-Gioushy, 2021)** that the fertilization treatment of fig seedlings of "Sultani" variety with a mixture of 10 ml bio-compost (Nitrobein, Phosphorene and Potassein) + 75% NPK + 25% compost gave the highest levels compared to the rest of the treatments, but it did not differ significantly with it in all The studied traits, while the NPK 100% fertilization treatment gave the highest levels in all the studied traits.

I got **(Elamary and El-Sayed, 2021)** showed a significant increase in the growth of fig trees of the "Sultani" cultivar at the age of 10 years when using foliar spraying of EM biofertilizer at the level of 1000 mg L^{-1} in terms of total chlorophyll, leaf area, nitrogen, phosphorus and potassium concentration in the leaves compared to the rest. levels (0 and 500 mg L^{-1}).

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