Al-Farouk journal of sciences
Volume (2), Issue (3) (JUNE, 2026)
ISSN: 3135-2359

مجلة الفاروق للعلوم
المجلد (2) ملحق العدد 3 يونيو 2026
ردمد: 3135-2359

Biofertilizers: Types, Uses, and Importance for Arid and Semi-Arid Soils

Samira .A.Atman
Faculty of Arts - Department of Geography, University of Zawiya
https://orcid.org/0009-0008-2216-7350
S.shaban@zu.edu.ly

تاريخ الاستلام: 2026/05/21 تاريخ المراجعة 06/16/ 2026 تاريخ القبول:2026/06/28- تاريخ النشر: 07/10/ 2026

Abstract:

Organic fertilization is essential for increasing agricultural land productivity and reducing environmental pollution caused by the overuse of mineral (chemical) fertilizers. Organic matter indirectly affects the physical, chemical, and biological properties of the soil. It also influences soil acidity, texture, composition, and fertility. Organic matter provides plants with nutrients released from organic compounds and supplies microorganisms with energy and essential materials. Biofertilizers contribute to increased biological activity and root surface area. Furthermore, organic matter acts as a natural soil conditioner, playing a vital and effective role in improving soil properties.

Organic fertilizers are characterized by their rapid action, natural origin, and reduced need for chemicals, thus limiting environmental pollution. They are also cost-effective, making them a cost-efficient solution for agriculture. Furthermore, they improve the soil by increasing organic matter, which stimulates biological growth by providing essential nutrients without the need for chemical fertilizers.

Bio fertilizers can be used on various crops and are particularly beneficial in organic farming. They can be used primarily in poor soils in arid and semi-arid regions, along with rationalizing irrigation practices. As the world moves towards sustainable agriculture, biofertilizers offer a natural solution to ensure good production and improve soil quality for sustainable farming.

Keywords: **Biofertilizers, Arid ,Semi-Arid Soils.**

Introduction:

Dry and Poor soils are characterized by rapid water drainage, poor in nutrients, and dry out quickly. Their fertility can be improved by adding organic matter and chemical fertilizers as a result of the widespread use of chemical and organic fertilize for the purpose of improving agricultural production to improve agricultural production it has led to environmental pollution of water, soil, and air, Abdel Fattah. 1987

In addition, desert lands suffer from many problems that hinder the agricultural production process, due to their coarse, sandy texture, lack of stable soil structure, severe deficiency in most nutrients, and scarcity of organic matter.

Bio-fertilizers are natural, containing living microorganisms—such as fungi, or algae—that enhance soil fertility and promote plant growth. They work by fixing atmospheric nitrogen and stimulating plant growth through natural hormones, ultimately reducing reliance on chemical fertilizers.

Soil problems that require biofertilizers:

In arid and semi-arid lands, reddish-brown, arid, slightly differentiated crust soils are most frequently found in arid and semi-arid climates; these soils are most

common in the plains. The parent material is basically made up of alluvial, alluvial-proluvial and proluvial-deluvial deposits. The reddish brown, arid, slightly differentiated crust soils are subdivided into the following genera: carbonate, carbonate saline, carbonate gypsic, and leached (Khalid, 1999). Tables 1 and 2 show some of the morphological, natural, and chemical properties of the dry soil of the change horizon.

Table 1: Morphological and natural characteristics of arid soil

Depth-cm	Mud%0	Silt%	Sand %
0-30	3.3	13.2	83.5
30-63	1.3	4.1	94.5

Source: Agriculture Centre, 2010.

Table 2: Chemical properties of arid soil

Depth cm	Electrical conductivity ml Siemens / cm at 25	Mutual ratio of sodium	Calcium carbonate% 0-30	Gypsum %
0-30	0.26	5.53	3.8	Remains
30-63	0.29	7.19	6.8	Remains
63-85	1.60	4.74	9.1	3.44

Source: Source: Agriculture Centre, 2010

Dry soils are formed on carbonate deposits resulting from fluvial and primary fluvial deposition processes. The formation of dry soils is attributed to the predominance of desert soil formations (Karim, 2001). The morphological characteristics of dry brown soils can be summarized as follows: brown or light brown color; stratified structure of the upper horizon; and low humus content. Table 3 illustrates some of the morphological characteristics.

Table 3 Chemical properties of dry calcareous soil

Horizon depth – cm	Electrical conductivity ml Siemens / 25m	Calcium carbonate%	Organic matter%	Exchange capacity for cations ml / 100 g soil	Ratio of sodium
0-30	0.74	21.9	0.56	3.1	7.6
30-60	0.42	20.9	0.72	7.7	8.9
60-180	0.63	18.8	0.64	7.6	3.2

Source: Agriculture Centre, 2010.

Sediment is a naturally occurring material that is broken down by processes of weathering and erosion, and is subsequently transported by the action of wind, water, or by the force of gravity acting on the particle itself. Sediments are most often transported by water. This type of soil occupies a large area of land in arid and semi-arid land (Balba, 1979). The morphological features of brown arid soils

can be summarized into: a brown to light brown colour, a layered structure of the upper horizon, and a low humus content. photo 1,2

Photo 1 dry soil of the change horizon
Source: Field study, 2026

Photo 2 brown arid soils
Source: Field study, 2026

In conclusion, soil poverty is the deterioration of soil fertility and the loss of essential nutrients (such as nitrogen, phosphorus, and potassium) and organic matter, rendering it unproductive or unsuitable for agriculture. This degradation results from harmful practices such as over-farming, overgrazing, deforestation,

and erosion, and can be remedied by adding organic fertilizers, bio char, and adopting crop rotation.

Effecting of bio-fertilizers on dry soil:

Dry soils are characterized by more developed plant growth and higher and more uniform primary productivity than fine-textured soils. Thus, profitably and commercially cultivated rain-fed olive orchards are grown on deep sandy soils under as little precipitation as 200 mm/year in the dry areas, although this is not possible without additional runoff to complement silt soils (ACR, 2006).

Importance of using bio-fertilizers:

Bio-fertilizer application has a positive effect on the plant, increasing final yield in both quantity and quality. Bio-fertilizers are very important for improving long-term soil health, enhancing structure, and promoting sustainable, nutrient-rich plants. Bio-fertilizers improve root water absorption and restore microbial balance in the soil. It also represents natural biological antibodies against fungal bacteria microbes. In addition to reducing environmental pollution and lowering the toxicity of food products, this translates to better production at lower prices, thus providing healthier food (Ismail, 1996).

Types of bio-fertilizers:

Agricultural fertilizers vary in their role in plant growth and in supplying it with the necessary elements. They also differ in their degrees of absorption and other factors that make each fertilizer important in plant life (sabaa 2020). Some of the most popular fertilizers currently in use are:

Nitrogen-fixing bacteria: For example, Rhizobium bacteria form a symbiotic relationship with legume plants, fixing atmospheric nitrogen and making it available to the plant.

Phosphate-soluble bacteria: These bacteria break down unnecessary phosphorus in the soil. This fertilizer helps to improve the overall function of natural moisture and also leads to increased vegetative growth of plants.

Using a microbial fertilizer helps reduce the problem of environmental pollution that harms the soil, and this damage then extends significantly to the plant.

Biofertilizer preparation process:

Preparing a biofertilizer involves fermenting organic materials with beneficial microorganisms to enhance soil fertility and plant nutrition. A basic method consists of mixing organic ingredients in specific proportions to ensure successful fermentation. For example, 100 kg of fresh cow dung is mixed with 2 kg of brown sugar, 2 kg of chickpea flour, and 2 liters of cow urine, and the mixture is then fermented for a specified period.

Preparation of Solid Biofertilizer (Quick Compost):

1. Spread 100 kg of fresh cow dung in the shade.
2. Add 2 kg of brown sugar (as a carbon source) and 2 kg of chickpea flour (as a protein source).
3. Add 2 liters of cow urine and a handful of fertile soil to stimulate microbial growth.
4. Mix the ingredients thoroughly with a shovel and cover with a burlap sack for at least 24 hours.

Preparation of Liquid Biofertilizer (EM1):

1. Purchase the original active microorganism solution (EM1).

2. Mix the EM1 with fresh (non-chlorinated) water and molasses in the specified proportions. 3. Leave the mixture in sealed containers, away from sunlight, for 7-10 days to activate the microorganisms Photo 3.

Photo3 Liquid Bio fertilizer
Source: Field study, 2026

The biofertilizer is typically ready for use within 50 days to 3 months, depending on weather conditions and the ingredients used. It is recommended to apply the biofertilizer at planting or during the active growth stage of plants to improve growth and increase yield photo 3. 4.

Photo 3.4 Bio fertilizer
Source: Field study, 2026

Biofertilizer can also be prepared through solarization by spreading animal waste on a level surface and exposing it to sunlight for more than four months. This process is important because it helps prevent plant damage caused by excessive heat and reduces the risk of raising soil temperature to harmful levels photo 5

Photo 5 Bio fertilizer added to dry soils
Source: Field study, 2026

Fertilizer should be applied in appropriate amounts. For example, an olive or orange tree typically requires 3–4 kilograms of fertilizer. The fertilizer should be mixed thoroughly with the soil and then watered well (see photo 6 .7).

Photos 6.7 Adding fertilizer to the olive tree
Source: Field study, 2026

Discussion:

Farmers add organic matter to the soil with the aim of building up its levels, so that it serves as a reservoir of nutrients. In addition, it helps prevent soil erosion and improves soil aeration and moisture retention. The direct use of plant residues in the field requires a long decomposition period; therefore, the application of processed organic fertilizers enhances the process within the same growing season. It also increases microbial activity, improves the diversity of microbial communities and their role in nutrient cycling within the soil, and enhances seedbed quality.

The production and preparation of these fertilizers are essential because they promote the optimal use of natural resources and protect the soil from the spread of soil-borne diseases.

Microorganisms secrete sugary substances that act as a "glue," binding loose sandy soil particles together, thus increasing their cohesion and reducing water loss. Increasing fertility and nutrient availability: Bacteria (such as nitrogen-fixing and phosphate-solubilizing bacteria) break down organic matter and convert it into readily available nutrients, compensating for the poor quality of sandy soil, photos (8.9) adding bio fertilizers to dry soils improves agricultural production.

photos (8.9) applying biofertilizers to dry soils
Source: Field study, 2026

Conclusion:

Biofertilizers utilize beneficial microorganisms to improve soil fertility and support plant development. When introduced to seeds, plant tissues, or soil, these microorganisms establish themselves in the root zone or within the plant, enhancing nutrient availability and uptake. They are an important component of sustainable agriculture, contributing to healthier plants and more fertile soils through natural mechanisms such as nitrogen fixation, phosphorus solubilization, and the synthesis of plant growth-promoting compounds.

It can be concluded from the above that a study of the groundwater quality in the area will provide more appropriate information for the detection of the salinization and Calcification process in the dry area. In addition, the gravity of the seawater intrusion in coastal areas has led to the formation of salt soil in the dry area. This phenomenon should be the main focus of future studies. There is a need for a study to determine any relationship between the configuration of poor soils and natural conditions in arid and semi-arid lands.

REFERENCE

1- Abdel Fattah ,A. 1987.Soil conservation. Higher Education Press, Baghdad.253.

2- Agriculture Center . 2010.Office of Studies Stage Atlantic to exploit the Great Manmade River. Tripoli, 1,13.
3- Agricultural Research Center. 2004.2006. Agricultural Development Achievements: In A. D. Achievement. Ministry of Agriculture: Tripoli. Agricultural Situation Report.2010. Tripoli. Libya. 2 4- Balba, A,. 1979. Salt-affected soil. Agriculture Organization. UN, Rome.480 . 59.
4- Barkha, A. A. S., Jalboub, F. A. M., Alkhammas, I. O. A., & Madi, M. S. A. (2026). The Effect of Dietary Aflatoxin on Local Domestic Turkey (Meleagris gallopavo) in Libya. *Al-Farooq Journal of Sciences*, *2*(1), 1400-1407.
5- Hussein, G. 1998.Natural geography in the deserts of the Arab world. knowledge Alexandria House 'Egypt.
Ismail , J. 1996.The basics of soil science. Arab Thought. Nasr. Egypt.
6- Karim, B. (2001). Soils Libyan coast.University Journal,Center for Scientific Research , 2(3), 210-212.
7- Tantoush, J. A. M. (2025). Environmental Pollution Assessment of Some Heavy Metals in the Western Coast of Tripoli, Libya. *Al-Farooq Journal of Sciences*, *1*(1), 161-175.
8- Khalid ,A. 1989.Soil morphological. The Ministry of Higher Education. University of Baghdad, Iraq.692.
9- Sabaa Jawad Abdulkadhim,Al-Furat 2020 Al-Awsat Technical University, DOI:10.13140/RG.2.2.13848.14089