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A review on the types of fertilizer

Research Project

Submitted to the Department of (Biology) in partial fulfillment of the requirements for the degree of **BSc. in Biology**

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CERTIFICATE

This research project has been written under my supervision and has been submitted for the award of the **BSc.** degree in **Biology** with my approval as a supervisor.

Signature

Name:

Date: **April , 2023**

DEDICATION

This effort I dedicate to **Allah** Almighty, my lord, my powerful foundation, my source of inspiration, wisdom, knowledge, and understanding. Throughout this project, he was the source of my energy.

Student Name

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To begin with, I thank (**Allah**) for His blessing, which made me able to complete and perform this study with success, the lord of the universe, blessing, and peace be on **Muhammad** (Allah's peace and prayers be upon him).

Finally, I want to say thanks to all those I forgot them here to mention his/her name, who assisted me even by one useful scientific word directly or indirectly.

SUMMARY

Fertilizer is any material or mixture used to supply one or more of the essential plant nutrient elements. Use of mineral fertilizer seems to be a very quick and efficient method. The farmers implement fertilization often in an excessive amount. It leads to physical, chemical, and biological damage of soil and decrease soil fertility. Application of organic fertilizers or biofertilizers or the combination of organic, biofertilizers and inorganic fertilizers, can be an alternative option to reduce the utilization of inorganic fertilizers. Organic fertilizers and biofertilizers, compared to inorganic fertilizers, maintain soil quality, increase soil fertility and enhance soil nutrients. The present review is an attempt to summarize the types of fertilizers. Numbers of research articles have been included in this review to describe different types of fertilizers and their importance for plant growth and development.

Keywords: Inorganic fertilizer, Organic fertilizer, Biofertilizer

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1. INTRODUCTION

For optimum plant growth, nutrients must be available in sufficient and balanced quantities. Soil contain natural reserves of plant nutrients, but these reserves are largely in forms unavailable to plants, and only a minor portion is released each year through biological activity or chemical processes. This release is too slow to compensate for the removal of nutrients by agricultural production and to meet crop requirements. Therefore, fertilizers are designed to supplement the nutrients already present in the soil. Use of mineral fertilizer seems to be a very quick and efficient method(Al-Shamma and Al-Shahwany, 2014). Chemical fertilizers are materials, containing nutrients essential for the normal growth and development of plants. Three plant nutrients have to be applied in large quantities, nitrogen, phosphorus and potassium. These materials are required by plants in relatively large amounts(Isherwood, 2000). Excessive use of these fertilizers is negatively impacting human and environmental health, including soil acidification, soil infertility as well as soil, water and atmospheric contamination (Rosenblueth et al., 2018). To overcome the problem of nutrient deficiency and helping the nature rather than destroying it, Organic sources of nutrients are the best option maintain the health of soil, plant and animal and provide the equal opportunity for all living existence to live and use from their beneficial activities (Fazily and Hunshal, 2019). On the other hand, one potential way to decrease negative environmental impacts resulting from continued use of chemical fertilizers is inoculation with plant growth-promoting rhizobacteria (PGPR). These bacteria exert beneficial effects on plant growth and development, and many different genera have been commercialized for use in agriculture (Adesemoye et al., 2009). The present article reviews the importance of biofertilizers, organic and inorganic fertilizers on varied aspects of plants.

2. LITERATURE REVIEWS

Fertilizers

Less soil fertility is one of the most vital constraints on improved agricultural production. Fertilizers are used to improve soil fertility but intensive inorganic fertilizer usage in agriculture causes so many health problems and unrecoverable environmental pollution(Adekiya et al., 2020). Thus, to reduce and eliminate the adverse effects of Synthetic fertilizers on human health and environment, now-a-days a new agricultural practice have been developed which includes organic fertilizers and biofertilizers(Begom et al., 2021). Organic fertilizers are primarily cost effective, easily available from locality products than chemical fertilizers(Sofyan et al., 2019). Organic matter is the basis of soil fertility. Biofertilizers are distinctly environment friendly, cost effective which plays a significant role in plant nutrition. On the other hand, inorganic fertilizers are known for their high cost and their negative environmental effects if managed poorly(Subhan et al., 2017). All these give rise to reduced crop yields as a result of soil degradation and nutrients imbalance. Also, inorganic fertilizer differs from organic fertilizer in the way that they consist of simple chemical compounds of known composition. Because of this issue, farmers create a “mix” of both organic and inorganic fertilizers for their crop. The choices of suitable fertilizer are usually governed by multi factors like climate, locality, natural conditions and soil variation with regard to their suitability for crops cultivation(Jan et al., 2018).

Importance of fertilizer

Fertilizer is any material or mixture used to supply one or more of the essential plant nutrient elements. The basic purpose of fertilizer application in soil is to improve the nutrient status and quality of soil by enriching it with nutrients which it lacks. Crop plants require nitrogen, phosphorous and potassium to maintain normal physiological function of the cell. Fertilizers have all the ingredients that are needed by plants to grow, so they are added to the soil in order to improve the physical, biological and chemical properties of the soil (Mia and Shamsuddin, 2010). A physical property includes soil friability, porosity and absorption. Biological properties are associated with the microorganisms living in the soil. The chemical properties are related to the soil pH (acidity level) and the availability of nutrient to the plants. It has been reported earlier that both organic and inorganic fertilizer which has been used by the farmers increases yield and sustain soil productivity. The use of several organic materials especially cows dung, poultry droppings and farm yard manure as soil amendments are suitable for increasing crop production. So fertilizers are required and thus applied to replenish nutrients taken away from the soil by crop harvest and so they are applied to supplement more nutrients to boost crop yield (Jan et al., 2018).

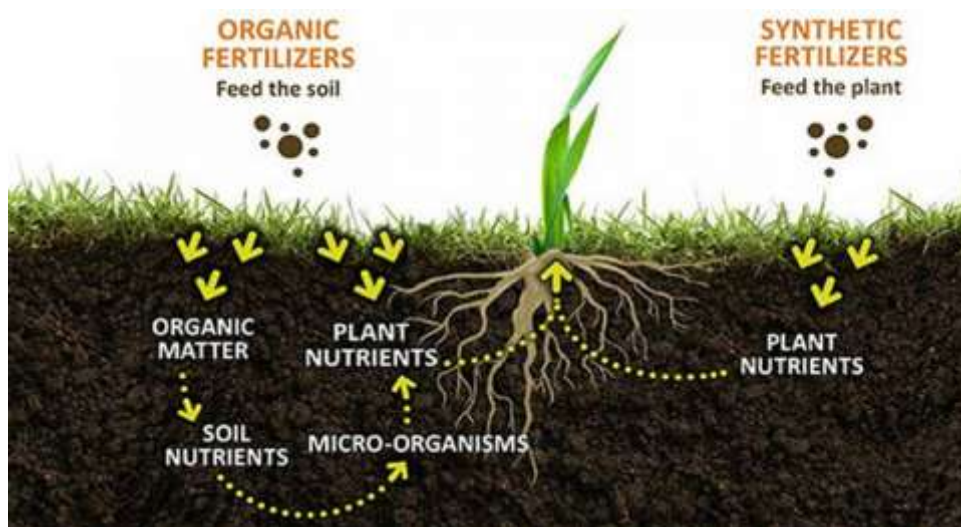


Figure 1 importance of fertilizers

Types of fertilizer:

1. Inorganic fertilizers

Inorganic fertilizer contains a combination of chemicals and minerals that were produced in a refinery, and it offers gardeners and farmers a more reliable form of plant nourishment because its nutrient levels are calculated to be consistent. The three major ingredients of a plant food are nitrogen (N), phosphorus (P) and potassium (K) (Sofyan et al., 2019). Nitrogen (N) is a key component of amino acids and proteins. It is also a part of the chlorophyll molecule, which controls photosynthesis. Adequate supplies of N are needed to support photosynthesis and to produce proteins in harvested crops. Phosphorus (P) also plays a vital role in photosynthesis, functioning in the capture and transfer of energy into chemical bonds. New, rapidly growing plant meristematic tissues have a high concentration of P. The genetic materials, DNA and RNA, are built around a backbone of P atoms, and P plays a major role in the metabolism of sugars and starches, all critical to cell division and growth processes. Phosphorus usually occurs in large quantities in the soil minerals and organic matter, and must be converted to inorganic phosphate ions (H_2PO_4^- or HPO_4^{2-}) to be used by plants. Potassium (K) exists in large quantities in the soil minerals and adsorbed in the ionic form K^+ to soil particles and organic matter. It enters the plant roots as a K^+ ion. K regulates the flow of water and other materials across cell membranes, and helps regulate a wide variety of chemical and enzymatic processes. K is essential to nutrient uptake and movement throughout the plant, and in maintaining water balance in the plant (Reetz, 2016). Malghani et al. (2012) found that NPK treatments resulted in significant increases of grain number.spike⁻¹, 1000 grain weight (cm) and grain yield (kg.ha⁻¹) of wheat plants. The farmers implement fertilization often in an excessive amount. It leads to physical, chemical, and biological damage of soil and decrease soil fertility. Efforts can be made to reduce the negative impact of inorganic

fertilizer that can improve soil properties and increase the nutrient content of the soil(Isherwood, 2000).

2. Organic fertilizers

Organic fertilizer is organic material added to soil to supply essential nutrients to the growth of the plant. The use of organic inputs such as crop residues, manures and compost has great potential to improve soil productivity and crop yield through the improvement of the physical, chemical and microbiological properties of the soil as well as nutrient supply(Ghanbari et al., 2012). Research has shown that using organic-inorganic compound fertilizers can not only decrease the use of chemical fertilizer but also promote the efficiency and sustainability of agricultural ecosystems over long period of time(Geng et al., 2019). Organic fertilizers are derived from biological or living materials. These fertilizers take longer time to release the nutrient in the soil. . In years to come, utilization of organic manure to meet crop nutrient requirement will be an unavoidable practice to enhance sustainable agriculture, this is because, the fertility of soil is generally improved by the addition of organic manures which in turn enhances crop productivity and maintains the quality of crop produce(Adekiya et al., 2020). Organic fertilizers come in the different forms such as: Manure derived from livestock such as cows, chickens, goats and others. Green manure which are obtained from young plants, especially different type of legumes. Compost derived from agricultural that is waste organic material such as straw, corn stalks or decomposed waste. Jala-Abadi et al. (2012) reported that organic manure application to wheat plant led to significant increases in the grain number and grain weight. Farhad et al. (2009) concluded that organic manure application to maize plant led to significant increases in the plant height.



Figure 2 Organic fertilizers

3. Biofertilizers:

Biofertilizers are substances that contains living microorganisms and applied to plant surface, seeds, or soil (Al-Shamma and Al-Shahwany, 2014). Biofertilizer is a special type of compound that enhances soil nutrient by using microorganisms that establish symbiotic relationships with the plants. Moreover, soil contains a wide range of microbes that can act in symbiosis or non-symbiosis association with their host plant (Begom et al., 2021). By utilizing biofertilizers, it is expected that there will be a remarkable decrease in the use of chemical fertilizer and pesticides. It is stated that natural nutrient cycle of the soil can be restored and the soil organic matter can be built through the microorganisms in biofertilizers. One potential way to decrease negative environmental impacts resulting from continued use of chemical fertilizers is inoculation with plant growth-promoting rhizobacteria (PGPR). These bacteria exert beneficial effect on plant growth and development, and many different genera have been commercialized for use in agriculture (Shameer and Prasad, 2018). Biofertilizers are directly or indirectly induce beneficial effects on plant growth and development. Direct mechanisms include production of phytohormones, phosphorous solubilization, and siderophore production. Some indirect mechanisms are that they act as biocontrol agents and induce systemic resistance in plants (Singh et al., 2013). Afzal and Bano

(2008) showed that combination between biofertilizers and chemical fertilizer caused significant increases in root weight, shoot weight and plant height of the wheat plants.

3. CONCLUSIONS

The present review focuses on the effect of types of fertilizers on the performance of crop plant. It is expected that organic and chemical fertilizers both effects morphological, physiological and biochemical performance of different crop plants. This review suggests that the use of organic fertilizers and amendments are eco-friendly and has got an upper edge as compared to inorganic synthetic fertilizers which causes environment pollution and also might get accumulated in the soil leading to human health hazards. Micro- organism based fertilizers can be applied to plants globally as now the deleterious effects of excessive use of chemical fertilizers are known to us. The many research results showed that the integrated application of organic or biofertilizers with inorganic fertilizers improved productivity of yield as well as the fertility status of the soil.

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