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STUDY ON PADDY SOIL AND CROP PRODUCTIVITY

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ABSTRACT

Fertilizers that are based on inorganic chemicals have been around for a long time and are still actively used in the soil management practices of today, which poses a significant risk to human health and the environment. In sustainable agriculture, the use of biofertilizer has been acknowledged as a viable option for increasing crop yield and enhancing the fertility of the soil. The use of beneficial microorganisms as biofertilizers has become more significant in the agricultural business as a result of the potential relevance it may have in ensuring the safety of food and ensuring the production of crops in a sustainable manner. A comprehensive plan for the management of nutrients may benefit from the use of biofertilizers in various capacities. In general, biofertilizers include of nitrogen fixers (N-fixers), potassium and phosphorus solubilizers, growth-promoting rhizobacteria (PGPR), endo and ectomycorrhizal fungi, cyanobacteria, and several other advantageous microscopic creatures. By using bio- fertilizers, you may increase the plant's ability to absorb nutrients and water, as well as the plant's resistance to the effects of biotic and a biotic stress. These potential biological fertilizers would play a significant role in the development and sustainability of soil, as well as in the conservation of the environment; they would be inputs for farmers that were both environmentally benign and cost-effective.

Keywords:- *Bio-fertilizers, crop productivity.*

INTRODUCTION

Biofertilizers provide a potentially safer option to chemical inputs. Furthermore, they will assist in the process of lowering the pace at which ecological disturbance occurs. A substance that contains living microorganisms and, when applied to seeds, plants, or soil, colonizes the biosphere or the interior of the plants and promotes plant growth by increasing the supply of nutrients to the host plant is referred to as a biofertilizer (Vessey, 2003; Bardi and Malusa, 2012; Malusa and Vassilev 2014). Biofertilizers can be applied to seeds, plants, or soil. Under optimal circumstances, the fixation of biofertilizers may provide up to 30–300 kg of nitrogen per hectare, and they can also solubilize immobilized 30–50 kg of phosphorus–2–5 per hectare. They do this by releasing chemicals and vitamins that encourage development and by contributing to the continued fertility of the soil. The occurrence of pathogens that cause plant illnesses may be reduced by using biofertilizers, which results in an increase of 10–35% in crop field. The majority of the nitrogen that is fixed on a global scale is done so via biological processes. The symbiosis between legumes and rhizobia is the most promising since it provides around 80–90% of the entire amount of nitrogen that legumes need. The ensuing cereal crop benefits from the symbiotic relationship's residual nitrogen. Thecontinuous application of biofertilizers improves the fertility level of the soil (Mahdi et al., 2010; Singh et al., 2011). Biofertilizers are cost efficient and environmentally beneficial in their natural state. According to Gaur (2010), they are the most cost-effective source of plant nutrients, as well as highly major providers of micronutrients and organic matter, secretors of growth hormones, and contributors to mitigating the adverse effects of the use of artificial fertilizers.

Since the 12th century, agriculture has seen a string of advancements, and it is now widely practiced over the whole of the planet. In the year 2007, it was estimated that one third of the working population of the globe was engaged in the field of agriculture. The Food and Agricultural Development report states that agriculture provides a viable source of income for 55 percent of the population in Africa (Ref). Agriculture is the primary means of subsistence for people in the majority of locations in Nigeria, particularly in the rural areas, and people are completely reliant on farmers for their food supply (Ifokwe, 1988). As a result of the recent decline in the price of crude oil, which is currently Nigeria's primary source of income, the President of Nigeria, Muhammadu Buhari GCFR, has emphasized that the nation must return to agriculture, particularly crop farming, which was the country's source of income prior to the discovery of crude oil (Daily Trust; September 9th, 2016). This was the source of income for the country before the discovery of crude oil. In order to provide food for Nigeria's bustling population, which the Nigerian population census from 2006 estimates will reach 221 million by the year 2020, there is a need for very rich soils as well as for the cultivation of crops in a manner that does not deplete natural resources. According to Khosro and Yousef (2012), the lack of fertility in the soil is the most significant factor that reduces agricultural output in underdeveloped countries across the globe, particularly among farmers who have limited access to resources. Therefore, preserving the quality of the soil may help alleviate the issues of land degradation, falling soil fertility, and fast falling output levels in huge portions of the globe that need the fundamental principles of sound agricultural management. According to Mfilinge et al. (2014), poor crop yield is a widespread issue that affects the majority of agricultural systems in Sub-Saharan Africa (SSA).These poor yields are especially noticeable in legumes and are often connected to a decrease in the fertility of the soil and a diminished capacity for nitrogen fixation as a result of both biological and environmental variables. One of the possible solutions is known as biological nitrogen fixation (BNF), which is also known as a vital source of nitrogen for farmers who use minimal fertilizer. Biological nitrogen fixation is also known as a critical role in the sustainable production of legumes and even non-legume crops. Because of a rise in population, one area of land has been continuously farmed over the years, which has led to a loss in the fertility of the soil to the point that, despite the use of chemical and inorganic fertilizer, very little is gained in return.

Conventional agriculture plays a significant part in satisfying the dietary requirements of a rising human population; yet, this has resulted in an increasing reliance on the use of chemical fertilizers and pesticides in order to achieve improved crop yields (Santos et al., 2012). Chemical fertilizers are compounds that are created in an industrial setting and are 6 comprised of known proportions of nitrogen, phosphorus, and potassium. According to Yourself and Eissa (2014), the usage of chemical fertilizers contributes to the eutrophication of water bodies, which in turn results in air and ground water pollution. According to Chun- Li (2014), the use of chemical fertilizers and pesticides in agricultural practices not only has the potential to speed up the process of soil acidification, but it also carries the danger of polluting ground water and the atmosphere. In addition to this, it makes plants more vulnerable to a wide variety of unwelcome diseases by weakening their root systems. In this context, efforts have lately been made toward the creation of nutrient-rich, high-quality fertilizer, also known as biofertilizer, in order to guarantee bio-safety. In order to boost soil fertility and crop output while maintaining a sustainable agricultural practice, bio-fertilizer has been recognized as a viable alternative to chemical fertilizer. According to Khosro and Yousef (2012), these prospective biological fertilizers would play a vital role in the productivity and sustainability of soil in addition to protecting the environment by providing environmentally friendly and cost efficient inputs for farmers. According to Raja (2013), organic farming is one of these ways that not only assures the safety of food but also contributes to the biodiversity of soil. The use of bio-fertilizer on soil results in an increase in its biodiversity, which includes many different types of beneficial bacteria and fungus. These organisms include arbuscular mycorrhiza fungi (AMF), also known as plant growth promoting rhizobacteria (PGPR), and nitrogen fixers. There are a great number of different kinds of microorganisms that may be found growing in the soil, particularly in the rhizosphere of plants. A significant number of these microorganisms have a functional link with plants and together they make up a holistic system. They contribute to the overall health and well-being of the plant (Vessey, 2003). It has been around sixty years since the use of helpful microorganisms in agricultural techniques. It is now obvious that these beneficial microbes may also boost plant tolerance to unfavorable environmental conditions such as a lack of water and nutrients as well as heavy metal pollution.

OBJECTIVES

1. To the study of biotechnological application.
2. To the study of biofertilizer for problem.

BIOFERTILIZERS

A significant contribution has been made by chemical pesticides and fertilizers to the advancement of agricultural productivity for a very long time. In spite of the fact that they have a very brief history in contemporary agriculture, they have managed to swiftly become the focus of attention thanks to their immediate effect and inexpensive cost. As a result of this, their negative impacts on the environment, as well as plant, animal, and human life, have caused ecofriendly plant conservation to become less of a priority (Patel et al., 2014). According to Aggani (2013), the word "biofertilizer" may refer to a wide variety of substances, from manures to plant extracts.

A substance that incorporates live creatures into its composition is referred to as biofertilizer. When they are applied to the surfaces of plants, they stimulate the development of plants by increasing the amount of primary nutrients that are supplied to the host plant. The addition of nutrients to the soil is accomplished by bio-fertilizers via the use of naturally occurring processes such as nitrogen fixation, the dissolution of phosphorus, the stimulation of plant development, and the production of chemicals that encourage plant expansion. Bio-fertilizer is theoretically considered to be alive, and when used in conjunction with plant roots, it may be mutually beneficial. Microorganisms were able to transform complicated organic material into chemicals that were easier for plants to absorb, and this was made possible by the microorganisms involved. The natural habitat of the soil is preserved as a result of this. The plant's development is enhanced, and the chemical nitrogen and phosphorus content of the replacement are increased by twenty to thirty percent. It has the ability to guard against drought as well as some illnesses that are carried by the soil. When applied to seed, roots, or soil, biofertilizers stimulate the availability and usefulness of helpful microorganisms, which in turn improves the health of the soil (Bhattacharjee and Dey, 2014). Biofertilizers are ready- to-use live compositions of beneficial microorganisms.

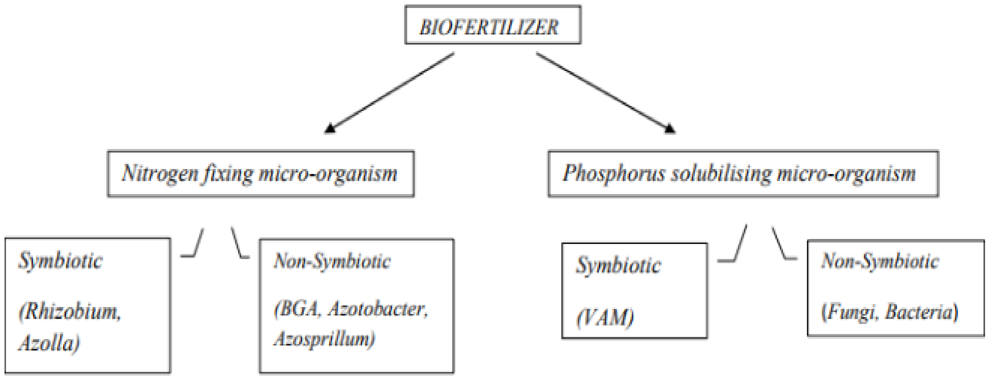

Figure 1.1: categories of biofertilizers (Jahangir et al., 2017)

The use of chemical fertilizers on their own is not enough to give plants with all of the necessary nutrients they need. This leads to a decrease in the organic content of the soil, which in turn has a negative impact on the biological and physical characteristics of the soil. An growing interest in the use of organic manures has generally been brought about as a result of all of these considerations. Not only does the use of organic manure involve the management of crop yields, but it also plays a significant role in exhibiting both direct and indirect influence on the accessibility of nutrients in soil. This is accomplished through the enhancement of the soil's physical, chemical, and biological properties, and it also improves the utilization efficiency of fertilizers that have been applied (Kapoor and Pandit, 2015). In addition to these benefits, the use of organic manure helps to manage crop yields.

Soil fertility

According to Purves et al. (2000), soil is defined as the component of the earth in which plant life may thrive. It includes the top soil, the sub- soil, and the parent material as its constituent layers. However, the top soil is of primary significance to us since it is the layer that provides optimal conditions for plant development. To be considered fertile, a soil must have a pH of at least 7.0, include live organisms, minerals, air, water, and inorganic and organic materials, and have a certain ratio of each of these components. A healthy soil has 45% mineral content 10 (including sand, silt, and clay), 25% air content, 25% water content, and 5% organic and living stuff, as stated by Purves et al. (2000). The mineral component of soil, which accounts for almost half of its volume, is composed of approximately 93% silica, Al, and Fe oxides; 4% Ca, K, and Mg oxides; 3% Ti, Na; and very minute amounts of N, S, P, B, Mn, Zn, Cu, Cl, Mo, and a wide variety of other elements. According to Purves et al. (2000), only 14 of these minerals are considered to be needed for plant growth, and these minerals are referred to as essential elements. Barak (1999) suggests that the basic nutrients may be broken down into two categories: micronutrients and macronutrients. Micronutrients are needed in very tiny amounts, while macronutrients are required in relatively high amounts by plants. The first six components displayed in are considered to be macronutrients, whereas the other components are considered to be micronutrients. The macronutrients are further subdivided into primary macronutrients, which are defined as those that are perpetually deficient in the soil, and secondary macronutrients, which are defined as those that are only seldom deficient. Nitrogen, phosphorus, and potassium are the major nutrients.

Nitrogen

Nitrogen is one of the key macronutrients that plants need in big quantities. Plants can't survive without it. Its functions include: formation of base pair for Ribonucleic acid (RNA) and Deoxyribonucleic acid (DNA), formation of phosphate group of protein (example hemp group of chlorophyll) and hormones such as cytokines, metal uptake, transport in xylem and phloem (example copper with amines), as osmoregulation (example in lettuce and spinach), alkaloids, miscobiochemicals e.g. mescaline, quinine (Barak,1999). Nitrogen is taken up by plants in the form of nitrates, ammonium, and sometimes urea (Ifokwe, 1988). Nitrogen is provided to the soil via the use of fertilizer, biological N fixation, precipitation and thunder, and the breakdown of organic debris. According to Barak (1999), the indications of nitrogen deficiency in plants include stunted development and leaves that are either pale green or yellow. Necrosis that begins at the tips of the older leaves and develops into a 'v' pattern is one of the most severe indications of nutrient shortage.

Phosphorus

Phosphorus is required in very substantial proportions, however the required amount is far less than that of nitrogen and potassium. It encourages the development of legumes as well as the yield, as well as the number and mass of nodules. Phospholipids in the membrane, phosphor proteins necessary for life processes, and an enhancement in crop productivity and quality are all tasks that it serves. It plays a crucial role in the development of the seed. According to research carried out by Scalenghe et al. (2012), it is a significant component of both the seeds and the fruits of the plant. Phosphorus is taken up by plants in the form of phosphates, and it is provided to the soil in the form of fertilizers, bone meal, and super phosphates. Phosphates are the most common type of phosphate. According to Barak (1999), phosphorus is mobile across the phloem of the plant, and the symptoms of phosphorus deprivation are distributed uniformly throughout the plant. On the other hand, a lack of it is often connected with delayed maturation and a slowed development rate. When the condition is severe, grassy plant species like maize will display a reddening of their leaves. The vast majority of phosphorus exists in its inorganic form, which makes it difficult for plants to adequately digest, as stated by Scalenghe et al. (2012). An excess of phosphorus should be avoided. Early plant maturity and decreased crop production are two symptoms that may be caused by an excess of phosphorus in plant soil.

Potassium

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CONCLUSION

Paddy straw disposal has become a significant issue in rice-growing regions, which has led to an increase in the number of fires started by farmers as a means of reducing their workload. According to the findings of our research, paddy straw could be successfully managed with the addition of additional microbial inoculants. This would result in an improvement in crop productivity, soil fertility, available nutrients, nutrient use efficiency, nutrient balance, net returns, and BC ratio as compared to the alternative of removing or burning residues. It is possible to attain sustainable yields by increasing the fertility status of the soil via a combination of residue incorporation and compost culture with an SSNM targeted yield of 80 q ha-1 (M3T5). This is the greatest choice to pursue since it does not have any negative impact on the surrounding ecosystem.

REFERENCES

1. Parul Chaudhary (2022) Overview of biofertilizers in crop production and stress management for sustainable agriculture Front. Plant Sci., 23 August 2022 Sec. Plant Symbiotic Interactions Volume 13 - 2022 | https://doi.org/10.3389/fpls.2022.930340
2. Malusà, E., Pinzari, F., Canfora, L. (2016). Efficacy of Biofertilizers: Challenges to Improve Crop Production. In: Singh, D., Singh, H., Prabha, R. (eds) Microbial Inoculants in Sustainable Agricultural Productivity. Springer, New Delhi. https://doi.org/10.1007/978-81-322-2644-4_2
3. Kamlesh Kumar Yadav (2019) Biofertilizers, Impact on Soil Fertility and Crop Productivity under Sustainable Agriculture Environment and Ecology 37 (1) : 89—93, January—March 2019 Website: environmentandecology.com ISSN 0970- 0420 Aliyu Ahmad Mahmud (2021) Biofertilizers: A Nexus between soil fertility and crop productivity under abiotic stress Current Research in Environmental Sustainability Volume 3, 2021, 100063
4. Reginawanti Hindersah (2022) Rice yield grown in different fertilizer combination and planting methods: Case study in Buru Island, Indonesia Published by De Gruyter Open Access October 27, 2022
5. E. Malusà (2016) Effi cacy of Biofertilizers: Challenges to Improve Crop Production D.P. Singh et al. (eds.), Microbial Inoculants in Sustainable Agricultural Productivity, DOI 10.1007/978-81-322-2644-4_2
6. Apurav Sharma (2023) Rice straw to biofertilizer formulations: Fostering waste management for circular economy https://assets.researchsquare.com/files/rs- 2797131/v1/dce61333-a84e-4645-9835-8d3db5e5b92d.pdf?c=1686116915
7. Becky N. Aloo (2020) Plant Growth Promoting Rhizobacterial Biofertilizers for Sustainable Crop Production: The Past, Present, and Future Preprints www.preprints.org) NOT PEER-REVIEWED | Posted: 26 September 2020 doi:10.20944/preprints202009.0650.v1
8. Adekunle Raimi (2017) Soil fertility challenges and Biofertiliser as a viable alternative for increasing smallholder farmer crop productivity in sub-Saharan Africa Article: 1400933 | Received 23 Aug 2017, Accepted 30 Oct 2017, Accepted author version posted online: 06 Nov 2017, Published online:17 Nov 2017
9. B.N. Fitriatin (2021) The Impact of Biofertilizers and NPK Fertilizers Application on Soil Phosphorus Availability and Yield of Upland Rice in Tropic Dry Land E3S Web of Conferences 232, 03012 (2021) https://doi.org/10.1051/e3sconf/202123203012 IConARD 2020

10. B. Santhiya and S. Jeeva (2022) Azolla as a source of biofertilizer for sustainable crop production – a review Journal of Xi'an Shiyou University, Natural Science Edition SSN:1673-064X http://xisdxjxsu.asia VOLUME 18 ISSUE 11 November 2022 598-605

11. Tran Thi Ngoc Son (2008) BIOCONVERSION OF PADDY STRAW AND BIOFERTILIZER FOR SUSTAINABLE RICE BASED CROPPING SYSTEMS Omonrice 16: 57-70 (2008) https://www.clrri.org/ver2/uploads/noidung/16-8.pdf

12. K. Sreenivasa Reddy (2021) BIOFERTILIZER FOR CROP PRODUCTION AND SOIL FERTILITY Vol.1 Issue-10, JUNE 2021 (e-ISSN: 2582-8223)

13. Bhardwaj, D., Ansari, M.W., Sahoo, R.K. et al. Biofertilizers function as key player in sustainable agriculture by improving soil fertility, plant tolerance and crop productivity. Microb Cell Fact 13, 66 (2014). https://doi.org/10.1186/1475-2859-13-66

14. Augustine Innalegwu Daniel (2022) Biofertilizer: The Future of Food Security and Food Safety https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9227430/

15. MR Wahane (2020) Biofertilizer and their role in sustainable agriculture-A review The Pharma Innovation Journal 2020; 9(7): 127-130