International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 5 May 2022, pp: 1875-1881 www.ijaem.net ISSN: 2395-5252

Can Use Microbial Ameliorators as a Consistent Phosphorus Source for Sri Lankan Rice Soils?

J.P.H.U. Jayaneththi
Faculty of Agriculture, Rajarata University of Sri Lanka, Sri Lanka

Submitted: 15-05-2022 Revised: 20-05-2022 Accepted: 25-05-2022

ABSTRACT
Phosphorus (P) is one of the main plant nutrients that lead to optimum crop growth and production. Despite soil contains substantial reserves of P, most soil P remains insoluble, out of which only less than 10 % is available for plants. The high P fixation in soils is the main reason leading to P deficiency in most Sri Lankan soils. Thus, the farmers tend to use large quantities of P fertilizers to achieve the desired plant productivity and their long-term applications can lead to sever hazards to soil. At present, the microbial interventions for P fertilizers aregoing to be developed. In this regard, microbial biofilms are effective P solubilizers and enhance the soil microbial biomass involved in biological functions to increase mineralization and solubilization of nutrients.Hence, developingof the microbial amended P fertilizers for rice cultivation in Sri Lanka thus paving the path to develop sustainable agro-ecosystems that have both economic and ecological benefits.

Keyword: Microbial biofilms, Phosphorus, Rice, Solubilization

I. INTRODUCTION

Soil acts as a store house for all the plant nutrients. Different plant nutrients are stored in different sites of the soil system. Those storage sites in the soil system are known as reserves. Soil solution, exchangeable sites, and inorganic and organic substances act as major reserves (Kertesz and Frossard, 2015). Phosphorus in soils exists in various chemical forms mainly as inorganic and organic P. These P forms differ in their behavior and fate in soils (Turner et al, 2007). Inorganic P usually accounts for 35 % to 70 % of total P (Harrison, 1987), whereas organic P forms generally account for 30 % to 65 % of the total P in soils (Harrison, 1987). The organic phosphate can be released through mineralization processes mediated by soil organismsand plant roots in association with phosphatase enzyme secretion. These processes are highly influenced by soil moisture, temperature, surface physical and chemical properties, and soil pH and Eh (redox potential). Organic P transformation has a great influence on the overall bioavailability of P in soil (Turner et al., 2007).Available Phosphorus in soil is fixed via different mechanisms. According to many researches, P fixation is mainly caused by the linkage of PO_4^{3-} through replacement or displacement of structural OH^- groups. Chelation and complexes formation are two different ways of fixing P (Hansen et al., 2004). Moreover, this type of mechanism is more abundant in 1:1 type clay than 2:1 clays due to high availability of exposed Al-OH groups. In acidic and basic soils, P fixation occurs due to precipitation of PO_4^{3-} with different cations. In acidic soil, PO_4^{3-} is fixed through precipitating as $AlPO_4$, $FePO_4$ and $Mn_3(PO_4)_2$. In basic soil, it takes place via $Ca_3(PO_4)_2$ and $Mg_3(PO_4)_2$. Thus, P fixation leads to fix many cations useful in terms of plant nutrition (Hinsinger,2001). Another part of P can be removed from surface soils by water moving rapidly downwards through cracks and large channels in the soil (Stammet al., 1998).

Phosphorus can be added to soils either as chemical or organic fertilizers. These added P undergo different mechanisms. Formation of crystalline products and reduction of water solubility can be caused by fixation (Sharpley, 2000). Over application of P fertilizers causes the leaching and runoff losses, which tend to enhance the P contamination in water resources and groundwater bodies. Eutrophication can be caused by P accumulation in water bodies through runoff losses, and it has been regarded as the most important environmental hazard of P losses (Smith et al., 2006).The availability of P in soil depends on several factors such as soil pH, Al and Fe oxides,