INTEGRATION OF ACTIVATED PHOSPHATE ROCK AND MYCORRHIZA TO IMPROVE MAIZE PRODUCTION AND LOWER PRODUCTION COSTS IN SUB-SAHARAN AFRICA

PHOSPHORUS: THE DYING NUTRIENT, THE FINITE RESOURCE

Phosphorus (P) is the main limiting macronutrient for most fertilized crops like maize in Sub-Saharan Africa (SSA). The finite nature of phosphate reserves and low soil P is a big constraint and its depletion is receiving much interest. Low levels of soil P can lead to extreme losses in the yield of staple crops like maize. Worldwide, maize (*Zea mays* L.) is the third most commonly grown cereal after wheat and rice. In Africa, it is an important food security crop. For example, maize production represents 40% of Kenya's crop area. Maize produces a high biomass and therefore has a high nutrient requirement. A typical 5 metric ton (mt) per ha maize yield will remove approximately 20 kg P/ha, and P deficiencies are a primary cause of maize yield loss.

To compensate for P deficiency, expensive phosphate fertilizers are applied in agriculture to improve crop yield. The continuous application of these fertilizers however can lead to soil acidity and alteration of the microbial diversity. Low P availability due to its poor mobility and high P sorption is a critical problem in many sub-Saharan Africa soils. These challenges have led to the search for environment-friendly and economically feasible alternative strategies for improving crop production in low or P-deficient soils.

MICROBIAL INTEGRATION, INNOVATIVE AND COST CUTTING STRATEGIES FOR EFFICIENT USE OF PHOSPHORUS

Direct application of phosphate rock (PR) to soil provides a valuable source of P. However, PR dissolves gradually to release P and the rate of dissolution may be too slow to support plant immediate needs. Activating PR with soluble sources such as DAP has proven to viable. Arbuscular mycorrhizal fungi intensively aid in P uptake by forming symbiotic relationship with plants. The purpose of this research was to explore the possibilities of using activated PR, with and without arbuscular mycorrhizal fungi, to address widespread P deficiencies, reduce P fertilizer production costs, and minimize phosphogypsum by-product waste streams inherent in the production of traditional inorganic P fertilizers.

RESULTS AND IMPACT

Greenhouse investigation in which PR has been activated by granulating it with DAP has shown to be effective. Even though the PR source was of low solubility, the activation process made the P in the PR almost as bioavailable as the P in DAP. Activating PR has shown to provide a means for use of smaller PR sources to produce a viable phosphate fertilizer and thereby lower the cost of production and reducing the environmental footprint resulting from PG as a byproduct of raw material for producing P fertilizers. Other research has reported that activating PR with DAP reduces leaching of P, thereby indirectly tackling the issue of eutrophication in the long run. They further argue that activated PR reduces the leaching of trace metals by 30 to 60% as compared to soluble P sources such as DAP, for they act as slow release fertilizers. These results indicate that activated PR is more environmentally friendly than soluble P sources.

Plant growth parameters (height, girth, leaf surface area and number of leaves) showed that there were significant differences in interactions between treatments (fertilizer applied) and mycorrhiza inoculation, with the activated PR outperforming both the PR without activation and control. Overall, the inoculated treatments outperformed the non-inoculated ones. In conclusion, the benefits of combined application of activated PR and commercial mycorrhizal inoculant enhanced plant growth and was deemed promising in increasing the effectiveness of plant P uptake. Further research would focus on identifying the right species of mycorrhiza to be applied to activated PR in the right dosages and tested on different crops.

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