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REVIEWER'S REPORT

Manuscript No.: IJAR- 57158

Title: Effects of arbuscular mycorrhizal fungal strains on the growth of cowpea [Vigna unguiculata (L.) Walp.] in th presence of Tilemsi natural phosphate (TNP).,

Recommendation:
Accept after minor revision

Rating	Excel.	Good	Fair	Poor
Originality		✔,		
Techn. Quality		✔,		
Clarity	✔,			
Significance	✔,			

Reviewer Name: Dr. Bilqees Hamza

Detailed Reviewer's Report

The research article titled "Effects of arbuscular mycorrhizal fungal strains on the growth of cowpea [Vigna unguiculata (L.) Walp.] in the presence of Tilemsi natural phosphate (TNP)" provides a significant contribution to the field of sustainable agriculture and soil microbiology. By investigating the symbiotic relationship between *Glomus aggregatum* and cowpea plants within the specific context of Mali's natural phosphate resources, the study explores viable alternatives to expensive and environmentally taxing chemical fertilizers. The research successfully demonstrates that bio-fertilization, when paired with local mineral resources, can enhance plant biomass and reproductive potential, even under controlled greenhouse conditions.

The narrative begins by addressing the critical challenge of phosphorus deficiency in sub-Saharan African soils. The author expertly establishes the rationale for using Tilemsi natural phosphate (TNP) as a local, cost-effective phosphorus source, while acknowledging its primary limitation: low solubility. This sets the stage for the introduction of Arbuscular Mycorrhizal Fungi (AMF) as a biological catalyst. The theoretical framework effectively positions AMF not just as a growth enhancer, but as a "solubilizer" that extends the root system's reach and facilitates the uptake of poorly mobile nutrients. This synergy between mineral and biological inputs is the central pillar of the study's academic contribution.

A primary strength of the article is its rigorous experimental methodology conducted at the LaboREM-Biotech facility. The author provides a detailed account of the substrate preparation—using sterilized soil from the IPR/IFRA cultivation plots—and the specific inoculation process. By maintaining a controlled environment on metallic tables in a greenhouse, the study ensures that the observed growth variations are directly attributable to the treatments rather than external environmental variables. The use of parameters

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such as the number of leaves, plant height, number of inflorescences, and both aerial and root biomass provides a comprehensive dataset for evaluating plant vitality.

The results of the study offer a nuanced look at the efficacy of mycorrhization. Interestingly, the author reports a relatively low intensity of root colonization (7.31%), yet the physiological benefits to the plant remained statistically significant. This finding is particularly insightful as it suggests that even a modest fungal presence can profoundly alter the plant's nutrient acquisition strategy. The analysis reveals that the combination of the fungus and natural phosphate significantly outperformed the control groups in terms of biomass and inflorescence production. The author rightly concludes that the presence of TNP provides the necessary mineral substrate that the fungus then makes available to the plant, effectively bypassing the limitations of the phosphate's natural insolubility.

The discussion further evaluates the "mycorrhizal dependency" of the cowpea genotype used in the experiment. The author notes that while the fungus alone increased the frequency of mycorrhization, the maximum benefit to the plant's physical structure and future yield potential (as predicted by biomass) was achieved through the dual treatment. This underscores the importance of a balanced input approach in "agro-bio-technologies." The narrative effectively argues that for smallholder farmers in regions like Mali, the integration of local natural phosphates with AMF strains could represent a transformative shift toward low-cost, high-efficiency crop management.

In summary, this article offers a robust and practical analysis of bio-fertilization strategies for cowpea cultivation. It successfully bridges the gap between laboratory microbiology and field-applicable agricultural solutions. The author's ability to correlate specific fungal strains with the solubilization of regional mineral resources makes this a significant contribution to the study of food security and sustainable soil management in West Africa. It is an essential read for agronomists, soil scientists, and development practitioners interested in leveraging biological symbioses to overcome mineral limitations in tropical agriculture.

Recommendations for Minor Revisions

Methodological and Data Clarity

- **Phosphorus Content Analysis:** While the study measures biomass, it would be academically strengthened by including a brief chemical analysis of the phosphorus content within the plant tissues. This would provide direct evidence that the AMF successfully facilitated the transport of phosphorus from the TNP to the cowpea.

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- **Control Group Specifics:** The author should clarify if there was a treatment group receiving natural phosphate *without* the fungus. Comparing "TNP + Fungus" against "TNP alone" would more precisely isolate the solubilizing effect of *Glomus aggregatum*.

Discussion and Contextualization

- **Colonization Intensity:** The author notes the low intensity of colonization (7.31%). A brief discussion comparing this figure to other studies on cowpea mycorrhization would be helpful. Is this low rate typical for this specific genotype, or could it be a result of the sterilized soil substrate's properties?
- **Long-term Yield Implications:** Since the experiment was conducted over two months, the author should explicitly state that the increase in inflorescences is a proxy for final grain yield. A brief paragraph discussing how these early growth benefits might translate to actual food production in a field setting would add practical value.

Technical and Structural Elements

- **Statistical Presentation:** The paper mentions that results were "more significant," but the inclusion of p-values or specific error bars in the text would allow for a more precise evaluation of the data's reliability.
- **Bibliography Update:** Several of the cited sources are from the 1980s. While these are foundational works, the author should incorporate at least two or three recent studies (from the last 5–10 years) on mycorrhizal-phosphate interactions to demonstrate the paper's engagement with contemporary advancements in bio-fertilizer technology.

Recommendation: Recommend for publication with minor revision.