

REVIEWER'S REPORT

Manuscript No.: IJAR- 58555

Title: EFFECT OF CO-INOCULATION WITH *Rhizobium tropici* AND *Azospirillum brasilense* IN OFF-SEASON COWPEA CULTIVATION IN WESTERN BAHIA.

Recommendation:

Accept as it is

Accept after minor revision.....

Accept after major revision

Do not accept (*Reasons below*)

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity			✓	
Significance			✓	

Reviewer Name: **ANAPANA GOPAL**

Reviewer's Comment for Publication.

General Comments

This manuscript evaluates the effect of co-inoculation with *Rhizobium tropici* and *Azospirillum brasilense* on growth, nodulation, nutrient uptake, and grain yield of cowpea cultivated during the off-season in Western Bahia, Brazil. The topic is relevant because biological nitrogen fixation and plant growth-promoting bacteria represent sustainable alternatives to chemical fertilizers. The study demonstrates that co-inoculation improves nodulation, plant growth, nutrient accumulation, and yield compared with single inoculation and the uninoculated control. Overall, the study has practical importance for sustainable agriculture. However, the manuscript requires substantial improvements in scientific presentation, methodology, statistical interpretation, language, and discussion before it can be considered for publication.

Minor Comments

1. Novelty should be better justified

The introduction explains the importance of biological nitrogen fixation but does not clearly explain how this work differs from previous studies on cowpea co-inoculation. Several similar studies are already cited, yet the novelty of conducting this experiment in Western Bahia during the off-season is not sufficiently emphasized. The authors should explicitly state the research gap addressed by this study.

2. Experimental methodology requires additional details

The Materials and Methods section lacks several important details, including:

- Soil physicochemical properties before sowing.
- Fertilizer management during the experiment.
- Irrigation practices.
- Seed inoculation procedure (application rate, inoculant concentration, storage conditions).
- Plot size and harvested area.

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- Weather data during crop growth.

These details are necessary for reproducibility.

3. Statistical analysis should be strengthened

Although ANOVA followed by Tukey's test is appropriate, the manuscript should additionally report:

- ANOVA assumptions (normality and homogeneity tests).
- F-values and degrees of freedom.
- Exact p-values where appropriate.
- Effect sizes or confidence intervals.

Including these statistics would improve the scientific rigor of the manuscript.

4. Discussion needs greater scientific depth

The discussion mainly repeats the results rather than explaining the biological mechanisms responsible for improved plant performance.

The authors should discuss:

- Synergistic interactions between *Rhizobium* and *Azospirillum*.
- Mechanisms of enhanced phosphorus uptake.
- Hormonal effects (IAA production, root stimulation).
- Root architecture modification.
- Improved nitrogen fixation efficiency.

A broader comparison with recent international literature (2023–2026) would strengthen the discussion.

5. Conclusions should acknowledge limitations

The conclusion summarizes the findings but does not mention limitations such as:

- Single location experiment.
- Single growing season.
- Single cowpea variety.
- Lack of economic analysis.

Suggestions for future multi-location and long-term experiments should be included.

Specific Comments

Abstract

- The abstract is generally clear.
- Include numerical improvements in grain yield, nodulation, and nutrient uptake.
- Mention statistical significance ($P < 0.05$).
- Reduce repetitive wording.

Introduction

- The literature review should include more recent publications (2024–2026).
- Clearly define the scientific hypothesis.
- Explain why off-season cultivation was specifically selected.

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Materials and Methods

Clarify:

- Soil fertility status.
- Initial microbial population.
- Inoculant formulation.
- Number of plants sampled per treatment.
- Environmental conditions during crop growth.

The experimental procedures should be sufficiently detailed for replication.

Results

The tables are informative, but several improvements are recommended:

- Add sample size (n) to all tables.
- Report standard deviation or standard error together with mean values.
- Present exact p-values instead of only significance letters.
- Include confidence intervals where possible.

Some figures have relatively low resolution and should be improved for publication quality.

Discussion

Avoid simply restating numerical results.

Instead,

- explain why co-inoculation improved nodulation,
- explain nutrient uptake mechanisms,
- discuss agronomic implications,
- compare results with similar studies conducted in tropical agriculture.

The discussion should focus more on biological interpretation than numerical repetition.

References

The reference list is generally appropriate.

However,

- several citations are local Brazilian reports,
- additional international peer-reviewed publications from recent years would improve the manuscript,
- reference formatting should be checked for consistency according to journal style.

Language and Editorial Issues

The manuscript requires careful English language editing.

Examples include:

- Missing spaces between scientific names (*Azospirillum brasilense* appears joined in several places).
- Inconsistent formatting of species names.
- Minor grammatical errors throughout the manuscript.
- Inconsistent capitalization of section headings.
- Uniform formatting of units (g kg⁻¹, mg kg⁻¹, cm, etc.) should be ensured.

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Strengths of the Study

- Relevant topic for sustainable agriculture.
- Appropriate randomized complete block design.
- Practical field experiment.
- Multiple plant growth and nutrient parameters evaluated.
- Useful findings for improving cowpea production.
- Clear presentation of treatment comparisons.

Weaknesses

- Novelty is insufficiently highlighted.
- Discussion lacks mechanistic interpretation.
- Methodological details are incomplete.
- Statistical reporting can be improved.
- English language requires revision.
- Economic feasibility of co-inoculation is not discussed.
- No limitations or future research directions are included.

Overall Recommendation

The manuscript presents useful agronomic findings demonstrating that co-inoculation with *Rhizobium tropici* and *Azospirillum brasilense* significantly improves nodulation, nutrient uptake, plant growth, and grain yield of cowpea under off-season conditions. The experimental design is appropriate, and the results are promising for sustainable crop production. However, improvements in methodology, statistical reporting, discussion, language, and presentation are necessary before publication.

Final Recommendation: Minor Revision