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REVIEWER'S REPORT

Manuscript No.: IJAR- 58898

Title: ***Combined microdosing of NPK and Urea: Effects on productivity and economic profitability of sesame (Sesamum indicum L.) in Semi-Arid Burkina Faso.***

Recommendation:
Accept as it is .....
Accept after Major revision.....
Accept after minor 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
The manuscript, titled **"Combined microdosing of NPK and Urea: Effects on productivity and economic profitability of sesame (Sesamum indicum L.) in Semi-Arid Burkina Faso,"** addresses an important and practical topic for sustainable intensification of sesame production in semi-arid West Africa. The study evaluates five fertilizer treatments over two cropping seasons at the Saria Research Station using a randomized complete block design with four replications.
The manuscript has practical relevance because fertilizer microdosing can potentially increase crop productivity while reducing the financial burden associated with conventional fertilizer application. The inclusion of both agronomic and economic performance is a strength.
However, the manuscript requires **Minor revision** before publication. There are concerns regarding the experimental design description, statistical analysis, economic calculations, interpretation of fertilizer-use efficiency, consistency of numerical statements, and quality of language and references. Some claims, particularly those concerning sustainability and fertilizer-use efficiency, are stronger than what is directly demonstrated by the experiment.

Content and Originality
The subject is relevant and potentially valuable, particularly because the study combines **NPK microdosing with supplemental urea** and evaluates both yield and profitability. The authors clearly state the hypothesis that combined and fractional application of NPK and urea would improve productivity and profitability compared with NPK alone.
The main contribution of the study is the comparison of:

- unfertilized control;
- 1 g NPK/hill;
- 1.5 g NPK/hill;

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- 1 g NPK + 1 g urea/hill;
- 1.5 g NPK + 1 g urea/hill.

Nevertheless, the manuscript should better establish its **novelty relative to previous work**, especially the authors' own previous studies on NPK microdosing and sesame.
The Introduction already acknowledges that previous research demonstrated the effectiveness of NPK microdosing in sesame. Therefore, the authors should clearly explain what new scientific knowledge is generated by adding urea and applying it fractionally.
It would also be useful to distinguish between:

- **agronomic effectiveness**;
- **economic profitability**;
- **fertilizer-use efficiency**; and
- **sustainability**.

These concepts are not interchangeable.

Technical Quality

1. Experimental design needs clarification

The experiment is described as a randomized complete block design with four replications. This is appropriate in principle.
However, the manuscript should clarify whether the experiment was conducted at the **same experimental site and with the same plots in both years**, or whether the experiment was independently established in 2019 and 2020.
The statistical treatment of the two years also needs clarification. The Results present each year separately, but the manuscript refers to an "average" yield in several places. A factorial analysis incorporating **year × treatment interaction** would be more informative if the experimental design permits it.

2. Fertilizer rates should be converted to kg ha^{-1}

The treatments are expressed as grams per hill, but the practical fertilizer recommendation is ultimately intended for farmers on a hectare basis.
Given the spacing of **60 cm × 20 cm and two plants per hill**, the manuscript should explicitly calculate the corresponding NPK and urea rates in kg ha^{-1}.
This is particularly important because the conclusion recommends **1.5 g NPK + 1 g urea per hill**. Farmers and extension personnel need to know the equivalent hectare-level application.

3. Nutrient quantities should be reported

The manuscript identifies NPK as **14-23-14** and urea as **46% N**.
The authors should report the actual quantities of:

- N;
- P_2O_5;
- K_2O; and
- additional N supplied by urea

for each treatment.
This would make the scientific comparison between treatments much clearer.

4. Soil characterization is useful but incomplete

Table 1 provides texture, organic matter, total N, total P, available P, and total K. The soil is described as a lixisol with sandy-silty texture.
However, important variables such as:

- soil pH;

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- exchangeable bases;
- CEC;
- available K;
- soil organic carbon;
- micronutrients

are not reported.

Since fertilizer response is strongly dependent on baseline fertility, additional soil information would strengthen interpretation.

5. Yield measurement needs further explanation

The manuscript states that **two 1 m² quadrats per plot** were harvested and that yield was extrapolated to kg ha^{-1}.

The authors should explain:

- how the quadrats were positioned;
- whether they were randomly selected;
- whether border effects were avoided;
- whether seed moisture was standardized before weighing.

This is important because sesame seed moisture can influence yield estimates.

6. Statistical analysis requires strengthening

The manuscript states that ANOVA was performed at the 5% level and that the Student-Newman-Keuls test was used for mean separation.

However, the statistical model is not described adequately.

The authors should specify:

- experimental unit;
- degrees of freedom;
- error term;
- assumptions of ANOVA;
- whether year was treated as a fixed factor;
- whether treatment × year interaction was tested;
- exact p-values where possible.

The results indicate substantial differences between 2019 and 2020. A formal analysis of year effects and treatment × year interaction would therefore strengthen the paper.

7. Economic analysis requires additional methodological information

The economic analysis is potentially one of the strongest aspects of the paper, but the assumptions need to be presented more transparently.

The manuscript reports NPK at **739 USD t^{-1}** and urea at **601 USD t^{-1}**. It also uses several production-cost estimates from a 2017 source.

The authors should clearly explain:

- the sesame selling price used for each year;
- whether the same price was used in 2019 and 2020;
- whether fertilizer prices were year-specific;
- how labor costs were calculated;
- how depreciation was calculated;
- whether family labor was valued;
- whether inflation or exchange-rate changes were considered.

Without these details, reproducibility of the economic analysis is limited.

8. Important issue with the VCR interpretation

Table 4 reports VCR values and p-values. For example, the VCR p-values are **0.105 in 2019 and 0.397 in 2020**, and these are classified as NS (not significant).

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Nevertheless, the Discussion states that the economic results demonstrate clear superiority and that the VCR was "well above" the profitability threshold.
The authors should distinguish between:

- a treatment having a numerically high VCR; and
- a statistically significant difference among VCRs.

The current wording could overstate the statistical evidence.

9. Numerical consistency should be checked

The Abstract reports an average T5 grain yield of **1,114 kg ha^{-1}**, while the Conclusion reports **1,113.9 kg ha^{-1}**. This is not a major problem, but the manuscript should consistently use one appropriately rounded value.
More importantly, the Abstract states that T5 produced a **114.5% increase** over the control, whereas the year-specific increases are 116.97% in 2019 and 143.20% in 2020. The authors should explain precisely how the 114.5% average increase was calculated.

10. Claims about fertilizer-use efficiency need evidence

The Conclusion states that the treatment "enhances crop productivity and fertilizer use efficiency."
However, the manuscript does not appear to report standard agronomic fertilizer-use-efficiency indicators such as:

- agronomic efficiency;
- partial factor productivity;
- apparent recovery efficiency;
- physiological efficiency.

The VCR is an economic indicator rather than a direct measurement of nutrient-use efficiency. Therefore, this claim should either be supported by additional calculations or modified.

11. Sustainability claims should be moderated

The manuscript repeatedly refers to T5 as a "**sustainable**" intensification strategy.
The experiment demonstrates yield and economic responses, but it does not directly measure:

- nitrogen losses;
- soil fertility changes;
- greenhouse-gas emissions;
- long-term soil health;
- environmental impacts.

Therefore, "promising option for sustainable intensification" may be acceptable as a cautious implication, but the manuscript should avoid implying that sustainability has been experimentally demonstrated.

Language and Presentation

The manuscript requires **substantial English-language and copy-editing revision**.
There are numerous spacing, grammatical, typographical, and formatting problems, for example:

- "West Africa.This study" should have a space after the period.
- "invegetative" and similar words have inconsistent spacing.
- "microdose fertilizer application" and "fertilizer microdosing" should be used consistently.
- "1.5 g NPK + 1 g urea per hill" is sometimes repeated unnecessarily.

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- Several sentences contain duplicated words or incomplete phrases.
- The Abstract contains the problematic phrase: "**114.5% increase compared to the unfertilized controlkg.ha-1**".
- The Conclusion contains a duplicated/incomplete phrase: "**1.5 g NPK + 1 g urea per hill1.5 g NPK +**".

The figures are generally understandable, and the use of letters to indicate significant differences is appropriate. However, figure captions should be edited for grammar and consistency.
The decimal notation is also inconsistent. For example, both **1.5** and **1,5** appear in Table 3.

Structure and Organization
The manuscript follows a conventional structure and is generally easy to navigate: **Introduction → Materials and Methods → Results → Discussion → Conclusion → References.**
However, several improvements are recommended.
Introduction
The Introduction is relatively long and could be more focused. The key knowledge gap and hypothesis should be brought forward more clearly.
Materials and Methods
The following subsections should be expanded:

- experimental design;
- fertilizer calculations;
- plot randomization;
- yield measurement;
- statistical model;
- economic assumptions.

Results
The Results should focus strictly on findings and avoid interpretive language.
For example, statements such as "**confirming that the additional investment... is financially beneficial**" are interpretive and would be better placed in the Discussion.
Discussion
The Discussion provides useful comparisons with previous studies, but it is somewhat repetitive. The authors should focus more on:

- why T5 performed better;
- whether the response is consistent across years;
- the importance of nitrogen timing;
- economic implications;
- limitations of the experiment.

Conclusion
The Conclusion is generally consistent with the main findings, but it should avoid overgeneralization from a two-year experiment at **one research station**.

References and Citations
The manuscript contains a substantial number of references, including studies on sesame nutrition, fertilizer microdosing, soil fertility, and economic analysis.
However, the reference list requires careful technical editing.
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1. **Some references appear unrelated to the claims for which they are cited.**

For example, Muthoni & Shimelis (2023) is cited in the Introduction in relation to sesame yields, but the reference title concerns **potato production in Africa**. This citation should be checked and replaced if incorrect.

2. There are duplicate or near-duplicate entries for **Sermé et al. (2016a, 2016b)** that appear to describe the same publication.
3. The Muhamman et al. (2009) reference is corrupted and contains unrelated/garbled text in the bibliographic entry. This must be corrected.
4. Several DOI formats are inconsistent, for example:
    - https://doi.org/doi:...
    - https://doi.org/https://doi.org/...

These should be standardized.

5. Some references have incomplete bibliographic information, inconsistent capitalization, or missing journal details.
6. The authors should verify that **every in-text citation appears in the reference list and every listed reference is actually cited**.
7. More recent and directly relevant peer-reviewed studies on **sesame N management, microdosing, nitrogen-use efficiency, and fertilizer economics in West Africa** could strengthen the Discussion.

Overall Recommendation

The manuscript presents useful two-year field evidence that combining NPK and urea microdosing can improve sesame yield and, under the economic assumptions used, increase net margins. The experimental concept is relevant and potentially useful for smallholder sesame production in semi-arid Burkina Faso.

The strongest finding is the consistent performance of **T5 (1.5 g NPK + 1 g urea per hill)**, which produced the highest seed and straw yields in both seasons. In 2019 it produced 1,224.6 kg ha^{-1} of grain, and in 2020 it produced 1,003.2 kg ha^{-1}. The economic analysis also identifies T5 as having the highest net margin in both years.

However, the manuscript needs **Minor revision** to establish the statistical robustness and reproducibility of these findings. Particular attention should be given to the statistical treatment of the two years, conversion of microdose rates to kg ha^{-1}, economic assumptions, fertilizer-use-efficiency terminology, sustainability claims, numerical consistency, and reference accuracy.

Final Decision:

Minor Revision

The manuscript has **good practical relevance and potentially publishable results**, but substantial revisions are required before acceptance. The authors should address the methodological and statistical concerns, correct the language and formatting problems, verify the references, and moderate conclusions that extend beyond what was directly measured in the two-year single-location experiment.