

REVIEWER'S REPORT

Manuscript No.: IJAR- 59145

Title: Land Suitability and Sustainable Management Options for Cotton Production in Bafime and Larazourou, Korhogo Department, Côte d'Ivoire.

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: Dr. ANAPANA GOPAL

Reviewer's Comment for Publication.

General Comments

The manuscript presents a site-level assessment of **soil properties, climatic suitability, land suitability and sustainable management options for cotton production** in Bafime and Larazourou, two cotton-producing villages in the Korhogo Department of northern Côte d'Ivoire. The study combines six composite topsoil samples, two soil profiles, soil physicochemical analyses, climatic data, and the FAO/Sys land-evaluation framework to classify cotton suitability.

The study addresses an important agricultural issue because cotton production in northern Côte d'Ivoire is affected by soil fertility constraints, water stress, degradation and climatic variability. The site-specific approach is potentially useful for identifying locally relevant management interventions.

The manuscript reports that the soils are generally sandy, slightly acidic to near-neutral, low in organic carbon and nitrogen, and characterized by low absolute CEC and exchangeable bases. Bafime is classified as **S3** based on soil characteristics, whereas Larazourou is **S2**. When climate and soil are combined, both villages are classified as **N1**, primarily because of the reported 79% mean relative humidity during the growing season.

The manuscript has a useful practical orientation and provides detailed methodological information. However, **minor revision is required** before the study can be considered for publication. The principal concerns involve the limited spatial sampling, the representativeness of the climate data, the interpretation of the relative-humidity limitation, inconsistencies in the description of the climatic dataset,

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application of the FAO/Sys classification, insufficient quantitative presentation of variability, and some recommendations that were not experimentally evaluated.

1. Originality and Scientific Contribution

The manuscript's principal contribution is its attempt to move from regional cotton-suitability assessments toward a more detailed assessment of **two specific villages**, combining soil profiles, laboratory measurements and climatic suitability criteria. The authors explicitly position the work as a site-level extension of previous regional suitability research.

This is a reasonable contribution.

However, the novelty should be stated more precisely. The authors should explain clearly:

- what is newly contributed compared with Kouakou et al. (2023);
- whether the novelty is the village-scale soil characterization;
- whether the integration of soil and climate suitability is new;
- whether the proposed management recommendations are specifically derived from the measured constraints.

The Introduction should avoid presenting the study as broadly representative of the Korhogo cotton basin because only two villages were examined.

2. Minor Concern: Limited Sampling and Representativeness

The study uses only **six composite topsoil samples: four from Bafime and two from Larazourou**, together with one soil profile from each village.

The authors appropriately acknowledge this limitation in the final section and state that the results should not be generalized to the wider Korhogo cotton basin.

Nevertheless, the manuscript occasionally uses broad statements such as “the soils of the Korhogo cotton-producing area” or “the study area” that could imply wider representativeness.

The authors should consistently distinguish among:

- the six sampled plots;
- Bafime village;
- Larazourou village;
- Korhogo Department;
- the wider northern Côte d'Ivoire cotton basin.

The conclusions should remain explicitly restricted to the sampled villages.

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3. Composite Sampling Design Needs Clarification

The sampling methodology states that **17 elementary samples were collected at each sampling point**, and that up to five sampling points were used depending on plot size. These were subsequently combined into composite samples.

This is potentially appropriate for reconnaissance-level soil characterization, but the description is difficult to follow.

The authors should clarify:

- the exact number of plots sampled;
- the exact number of sampling points per plot;
- how the 17 elementary increments were spatially distributed;
- whether all 17 increments were combined at each sampling point or across the entire plot;
- how the four Bafime and two Larazourou composite samples were geographically distributed;
- whether the six composites are considered independent sampling units.

A schematic diagram of the sampling design would substantially improve reproducibility.

4. Lack of Replicated Soil Profiles

Only **one complete 0–100 cm profile was described in each village**.

This is adequate for preliminary morphological characterization but insufficient to characterize within-village variability in effective soil depth, gravel content, drainage or horizon development.

This becomes particularly important because effective depth is one of the factors contributing to the S3 classification of Bafime.

The authors should therefore clearly describe these profiles as **representative profiles**, rather than implying that they characterize all soils in each village.

Future work should include multiple profiles per village or soil-mapping units.

5. Soil Variability Should Be Presented More Completely

Table 4 reports mean physicochemical values for Bafime, Larazourou and the overall dataset.

However, because Bafime is represented by four composite samples and Larazourou by only two, means alone do not adequately demonstrate variability.

Where possible, the authors should provide:

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- minimum and maximum;
- standard deviation;
- coefficient of variation;
- individual sample values.

This would help readers understand whether the reported differences between villages are consistent or driven by individual plots.

Importantly, inferential statistical testing between the villages should not be attempted or overinterpreted with only **n = 4 versus n = 2**.

6. Minor Concern: Climate Dataset Description Is Inconsistent

The Methods state that rainfall data were obtained from **SODEXAM and the CNRA/LCSEP database**, whereas temperature and relative humidity were obtained from ERA5.

However, the caption of Figure 4 states that the climate trends were aggregated from **ERA5 and SODEXAM/CNRA station records**, apparently including rainfall.

This needs clarification.

The authors should explicitly state, variable by variable:

Variable	Dataset/source	Spatial resolution	Temporal resolution	Period
Rainfall	?	?	?	1980–2020
Temperature	ERA5	?	Monthly	1980–2020
Relative humidity	ERA5	?	Monthly	1980–2020

The exact data-processing procedure should also be described.

7. ERA5 Spatial Resolution Requires Verification

The manuscript states that ERA5 temperature and relative humidity were obtained at a **native spatial resolution of 0.05°** through Google Earth Engine.

This description should be carefully verified and corrected if necessary.

The authors need to distinguish between:

- the native resolution of the underlying ERA5 product;
- the resolution at which the Google Earth Engine dataset is provided;
- any resampling or aggregation performed by the authors.

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This is important because the spatial resolution directly affects the credibility of a village-level climatic suitability assessment.

8. Relative Humidity as the Principal Limiting Factor Needs Stronger Justification

The central conclusion of the manuscript is that both villages are **N1 because mean growing-season relative humidity is 79%**, despite otherwise favourable rainfall and temperature conditions.

According to Table 2, 70–80% relative humidity corresponds to a degree-3 limitation under the adopted Sys et al. (1993) criteria.

The classification therefore follows the supplied framework.

However, the authors should discuss more carefully whether **a seasonal mean relative humidity of 79% is sufficient to characterize the climatic suitability of cotton at the village scale**, particularly because relative humidity varies strongly diurnally and seasonally.

The manuscript should explain:

- whether the 79% value is an arithmetic mean of monthly means;
- whether daytime and nighttime humidity were treated equally;
- whether the threshold in Sys et al. (1993) refers to the same type of humidity metric;
- whether the criterion was developed for the same cotton production system and climatic context.

Without this clarification, the conclusion that excessive relative humidity is the **principal determinant of N1 status** may appear stronger than the underlying climatic analysis supports.

9. Climatic Suitability Should Consider Temporal Variability

Table 5 provides a single mean value for the climatic variables for 1980–2020.

However, cotton production is affected not only by long-term means but also by:

- onset and cessation of rainfall;
- dry spells;
- rainfall distribution;
- extreme rainfall;
- temperature extremes;
- humidity during critical growth stages.

The manuscript briefly mentions intra-seasonal rainfall descriptors in the Methods, but these are not actually presented in the Results.

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The authors should either provide these analyses or remove/reduce the implication that they were fully assessed.

10. Figure 4 Needs Substantial Improvement

Figure 4 presents rainfall and temperature trends for 1980–2020.

The figure would be more informative if it included:

- clearly defined time axis;
- separate precipitation and temperature scales where appropriate;
- explanation of whether values are monthly or annual;
- statistical trend information;
- confidence intervals where applicable;
- source for each variable.

At present, the figure is primarily descriptive and does not demonstrate whether the apparent trends are statistically significant.

11. No Formal Climate Trend Analysis

The manuscript refers to climate trends and temporal evolution but does not appear to provide:

- Mann–Kendall trend statistics;
- Sen's slope;
- p-values;
- confidence intervals.

If the objective is simply to characterize climatic suitability using long-term means, the wording “climate trends” should be moderated.

If actual trends are intended to be part of the study, statistical trend analysis should be added.

12. Land-Suitability Classification Methodology Needs More Transparency

The manuscript uses the **Simple Limitation Method (SLM)** and the FAO/Sys suitability classes S1–N2.

The general framework is understandable.

However, the authors should explain more explicitly:

1. how each raw soil measurement was converted to a limitation degree;
2. how multiple moderate limitations were combined;
3. how climate and soil classes were integrated;
4. whether the most limiting factor always determined the final overall class;
5. whether any weighting was applied.

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The manuscript eventually explains that the overall class is determined by the most limiting component, but this procedure should be stated clearly in the Methods rather than reconstructed from the Results.

13. Potential Terminological Issue: Land Capability vs Land Suitability

The Introduction states that land capability refers to suitability of a piece of land for specific uses.

The terminology should be corrected or clarified.

Land capability and **land suitability** are related but distinct concepts in land evaluation.

Because the manuscript specifically applies the FAO/Sys framework to cotton production, terminology should consistently use **land suitability** unless capability is actually being evaluated.

14. Soil Fertility Interpretation Requires Greater Precision

The manuscript reports:

- OC: 0.24–0.42%;
- total N: 0.050–0.090%;
- CEC: 4.90–8.99 cmol⁺/kg;
- SEB: mean 4.21 cmol⁺/kg;
- BS: mean 55.6%.

These data clearly indicate low organic carbon and nitrogen and relatively low exchange capacity.

However, the manuscript sometimes moves from measured soil properties to direct statements about crop performance without actual yield measurements.

For example, statements that these properties “limit cotton productivity” should preferably be phrased as **potential limitations** unless supported by yield or crop-response data.

15. CEC Interpretation Needs Clarification

An interesting point is that the manuscript describes CEC values as low in absolute terms but assigns **degree 0/no additional limitation** under the Sys criteria because thresholds are adjusted for coarse-textured soils.

This is scientifically important and should be explained more clearly.

The authors should distinguish between:

low absolute CEC

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and

no CEC limitation under the adopted land-suitability classification system.

Otherwise, readers may perceive an apparent contradiction between the Results and Table 7.

16. Organic Carbon Interpretation Should Be More Consistent

The manuscript states that OC values are below an average threshold of 2%, while Table 7 assigns Bafime degree 1 and Larazourou degree 0 for OC.

The authors should explain that **the general soil-fertility threshold and the crop-specific Sys suitability thresholds are not necessarily identical.**

This would prevent readers from interpreting “low OC” as automatically equivalent to a formal S3/N1 limitation.

17. Bafime Soil Suitability Classification Should Be Explained Clearly

Bafime is classified as S3 because it has five moderate limitations:

- drainage;
- texture;
- coarse fragments;
- effective depth;
- sum of basic cations.

Table 7 provides the individual limitation scores.

This is one of the stronger aspects of the manuscript.

However, the text should consistently identify **five** moderate limitations. In some earlier statements, the description emphasizes four physical limitations and then separately discusses fertility. This can create ambiguity.

18. Soil Profile Information Is Valuable but Underused

Figure 2 provides detailed morphological information for Bafime and Larazourou, including colour, texture, roots, drainage, gravel/coarse fragments and profile depth.

The Bafime profile terminates at approximately 65 cm because of rocks and concretions, whereas the Larazourou profile extends to at least 100 cm.

This is important evidence for the different soil-suitability classes.

The authors should integrate the profile observations more systematically into the Results rather than relying mainly on the discussion to explain their importance.

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19. Recommendations Were Not Experimentally Tested

The manuscript recommends:

- organic amendments;
- mineral fertilizers based on soil analysis;
- crop-residue retention;
- mulching;
- contour tillage;
- vegetative strips;
- wider spacing;
- row orientation;
- pruning;
- weed control;
- disease-tolerant varieties;
- integrated pest/disease monitoring.

These recommendations are reasonable as **management options derived from identified constraints.**

However, they were not tested in the present study. The manuscript appropriately acknowledges this.

The wording should therefore consistently use:

“recommended,”

“potential management option,” or
“should be evaluated in future field trials”

rather than implying demonstrated effectiveness.

20. Humidity, Disease and Pest Pressure Were Not Directly Measured

The manuscript connects high relative humidity with potential disease and pest pressure. It later correctly acknowledges that the study did not directly measure disease incidence, pest pressure or yield losses.

This qualification is important and should be retained.

The authors should avoid statements suggesting that high humidity **caused** disease or yield loss in the sampled cotton fields.

The strongest defensible interpretation is that high humidity represents a **potential agronomic risk factor based on the adopted suitability criteria and previous literature**.

21. Need for Actual Cotton Production/Yield Data

The study evaluates land suitability but does not appear to include:

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- cotton yield;
- biomass;
- boll number;
- fibre quality;
- disease incidence;
- farmer management practices;
- fertilizer application rates.

Therefore, the manuscript cannot directly validate whether the S2/S3/N1 classes correspond to actual cotton productivity in the two villages.

If yield data are unavailable, the authors should explicitly state that the study provides a **resource-based suitability assessment**, rather than a yield-based validation.

A future study could compare predicted suitability classes with actual field productivity.

22. Water Availability Is Not Adequately Evaluated

The Introduction and discussion mention water stress and drainage, but the actual land evaluation focuses mainly on rainfall, soil texture, depth and drainage.

The authors should clarify whether:

- groundwater availability;
- irrigation access;
- soil available water capacity;
- seasonal water deficit;
- drought frequency

were considered.

For a crop suitability study, especially in a region characterized by a pronounced dry season, these factors could be relevant.

If they were not evaluated, this should be acknowledged explicitly.

23. Sustainable Management Section Should Be More Site-Specific

The recommendations are useful, but the manuscript could distinguish more clearly between the two villages.

For example:

Bafime

The management strategy should primarily address:

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- shallow effective depth;
- coarse texture;
- coarse fragments;
- drainage;
- low exchangeable bases;
- low organic carbon.

Larazourou

The main emphasis could be:

- fertility management;
- exchangeable bases;
- drainage;
- texture;
- maintaining the favourable deeper soil profile.

The manuscript does make this distinction to some extent, but a concise management matrix would make the practical contribution much stronger.

24. Discussion Is Somewhat Repetitive

The Discussion repeats several findings already presented in the Results, particularly:

- 79% relative humidity;
- N1 climatic suitability;
- Bafime S3;
- Larazourou S2;
- low fertility;
- sandy texture.

The Discussion would be stronger if it focused more on:

- why the findings differ between the two villages;
- comparison with previous cotton-suitability studies;
- implications for local management;
- limitations of the classification approach;
- implications for future research.

25. References and Citations

The manuscript includes references covering FAO land evaluation, soil fertility, cotton production, climate and soil suitability.

However, the reference list should be carefully checked for:

- completeness;
- consistency of formatting;
- DOI accuracy;

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- journal titles;
- author names;
- publication years;
- URLs;
- consistency between in-text citations and reference list.

Some references appear incomplete or unusually formatted. For example, the entries for Dabin (1970), Driessen & Konijn (1992), CIRAD (2006), Oudin (2020) and several institutional documents should be checked for complete bibliographic information.

The authors should also ensure that every important numerical threshold used in the suitability analysis is traceable to the cited source.

26. Language and Editorial Quality

The manuscript is understandable but requires substantial English-language and editorial revision.

Examples include:

- inconsistent spacing after punctuation;
- inconsistent use of “cotton-growing,” “cotton production,” and “cotton cultivation”;
- inconsistent capitalization;
- missing spaces around units and mathematical symbols;
- inconsistent table-title formatting;
- awkward constructions such as “the one that is very suitable for specific crops”;
- occasional overly long sentences;
- unnecessary repetition.

For example, the Methods statement describing the Simple Limitation Method should be rewritten in clear scientific English rather than the current formulation.

Professional language editing is recommended.

27. Tables Require Editorial Correction

Several tables require formatting improvements.

Table 2

The crop-requirement table is information-dense and difficult to read in its current format.

The authors should improve:

- column alignment;
- units;
- superscripts;

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- threshold presentation;
- footnotes;
- explanation of S1–N2 categories.

Table 4

The overall mean should clearly indicate that it is calculated from **six composite samples**, with four from Bafime and two from Larazourou.

Tables 6 and 7

The limitation codes should be defined directly in the table footnotes.

28. Geographic Information and Maps

The manuscript provides coordinates for Bafime and Larazourou within the soil-profile figure.

However, a proper location map would improve the manuscript considerably.

The map should show:

- Côte d'Ivoire;
- Poro Region;
- Korhogo Department;
- Bafime;
- Larazourou;
- major roads or geographic landmarks;
- sampling locations.

This would make the spatial context much clearer.

Strengths of the Manuscript

The study has several positive features:

- Relevant agricultural and environmental research problem.
- Clear focus on two cotton-producing villages.
- Combination of soil and climate suitability assessment.
- Use of recognized FAO/Sys land-evaluation criteria.
- Six composite topsoil samples provide a useful preliminary site characterization.
- Detailed soil laboratory methodology is provided.
- Soil-profile morphology is documented photographically.
- Physical and chemical soil constraints are clearly identified.
- The distinction between soil-only suitability and combined soil-climate suitability is useful.
- The authors appropriately acknowledge the limited sampling design.
- Management recommendations are linked to identified constraints.

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- The manuscript avoids claiming that the proposed interventions were already experimentally validated.

Overall Recommendation

The manuscript addresses an important and practically relevant question concerning **land suitability and sustainable cotton production in northern Côte d'Ivoire**. The soil characterization provides useful evidence of strong sandy-texture conditions, low organic carbon and nitrogen, low exchangeable-base reserves, and contrasting soil constraints between Bafime and Larazourou. The distinction between soil-only suitability (S3 and S2) and combined soil-climate suitability (N1) is potentially valuable.

However, the **N1 classification is driven almost entirely by the reported 79% relative humidity**, making the climatic methodology and interpretation especially important. The climate-data description requires clarification, and the applicability of the relative-humidity threshold to the specific climatic metric used should be demonstrated more rigorously.

In addition, the limited number of composite samples and soil profiles means that the findings should remain restricted to the investigated villages and should not be generalized to the wider Korhogo cotton basin.

The manuscript has a useful foundation, but substantial methodological clarification, more cautious interpretation, improved presentation and stronger methodological transparency are required.

Final Decision: Minor Revision