Reponse to reviewer RC2

Major Revisions

1- Title and Abstract

The title and abstract should be revised to accurately reflect the main findings of the study. As currently written, they partially present the experimental results, lacking emphasis on pedological information and crop suitability.

Title

Answer: Thank you very much for your suggestion. The title has been revised as follows: "Soil characteristics, land suitability and effect of trachyte and basalt rock powders on maize (Zea mays L.) growth and yield on Fluvisols in Cameroon's Sudano-Sahelian zone (Central Africa)".

Abstract

Answer: The sentence "These soil characteristics are moderately suitable for maize cultivation" was replaced with the following sentence " The study area has very favourable climatic conditions for maize growth (suitability index of 91.4), with a land suitability index of 62.4, classifying it as S2sf, indicating moderate suitability for maize cultivation " in lines 25-26.

2- Introduction

The introduction should be restructured to better reflect the reality of soil fertility management in Africa, where fertilizer use remains low and nutrient depletion is the dominant challenge. To structure the introduction around "intensive agriculture" does not align with the general conditions of sub-Saharan smallholder systems.

Answer: Thank you very much for your comment. We have taken your recommendation into account and restructured the introduction as follows at the beginning of the introduction in lines 16–50 " In Sub-Saharan Africa, soil degradation represents a major obstacle to food security and the sustainability of agricultural production systems. Increasing population pressure on arable land, combined with extensive farming practices and low input, leads to the gradual depletion of essential soil nutrients (Jhariya et al., 2021; Khatri et al., 2024). In most rural areas, agriculture remains predominantly subsistence-based, relying on traditional techniques and limited mineral inputs due to the high cost and restricted accessibility of synthetic fertilizers (Sinha et al., 2022). These conditions result in declining yields, deteriorating soil structure, and loss of organic matter (Nanganoa et al., 2019; Rajwar et al., 2021).

In recent decades, population growth and food insecurity have led to an intensification of extensive farming practices and increased of soil overexploitation (Pham et al., 2018; Jhariya et al., 2021; Khatri et al., 2024). This situation is further exacerbated in addition to limited access to inputs, by logistical constraints and institutional challenges, causing a continuous decline in soil fertility and crop productivity (Kuria et al., 2018; Nanganoa et al., 2019). As a limited resource, soil takes between 200 to 1000 years to form a layer of 2.5 cm in thickness, making its exploitation for agricultural purposes fragile due to the increase in the world population and climate change (Moges and Taye, 2016). Soil degradation thus represents a major environmental and socio-economic challenge, impacting biodiversity, ecosystem services, and food security. Sustainable management requires integrated strategies aimed at restoring or maintaining nutrient balance and enhancing agroecosystem resilience (Nkouathio et al., 2008; Mekuriaw et al., 2017; Hossain et al., 2020; Garai et al., 2021)."

3- Integration of Pedological Information / crop suitability

The manuscript includes a detailed pedological study and soil and crop suitability assessment, but this information was not integrated into the experimental design or discussion (example: treatment based on soil organic amendment to improve the water retention in sandy soils). The authors should link the soil information gener8ated in the first section to treatment responses, explaining how these factors may have influenced maize growth and yield.

Answer: Dear Sir, thank you very much for your comment. The soil information contained in the first section is indeed linked to the treatment responses. It had influenced the growth and yield of maize in the control plot. This control plot had the lowest growth parameters and yields primarily due to constraints related to the soil's physical properties (texture) and fertility (base saturation and organic carbon) as the soil was classified as S2sf, indicating moderate suitability for maize cultivation. It was demonstrated that clay fraction (13 to 18%) and the presence of smectite improve for example the water retention in the study sandy soil in the first section of the discussion. Also, in the introduction, it is clearly stated that numerous studies have explored the use of silicate rock powders for soil fertilization and remineralization. In the Americas for example, several studies have demonstrated that these mineral powders enhance water retention and soil fertility while contributing to carbon sequestration (Beerling et al., 2018; Theodoro et al., 2021; Lewis et al., 2021; Ramos et al., 2022; Medeiros et al., 2023).

4- Section on Nutrient Release Kinetics

The section discussing the kinetics of nutrient release from trachyte and basalt powders lacks supporting experimental data. Since no direct measurements of nutrient release dynamics or plant uptake were conducted, this section should be removed or significantly shortened to avoid overinterpretation.

Answer: **Thank you very much for the suggestion. Please Sir, this section was recommended by some reviewer in the first round of interactive discussion. Nevertheless, the following three sentences (59 words) which are not directly linked to silicate dissolution and nutrient release were deleted:**

- **Meena and Biswas (2014) demonstrated that rock phosphate and mica release cations more rapidly when finely ground and combined with compost.**
- ***Bacillus mucilaginosus*** **produces organic acids that enhance nutrient solubilization (Yang et al., 2016).**
- **Root exudates and mycorrhizal associations further improve K and Mg bioavailability, facilitating plant uptake (Ma and Yamaji, 2006; Menna and Biswas, 2014).**

Specific Comments

5- Lines 20–25: Improve this section by summarizing the dominant soil clay minerals and overall texture and remove overly descriptive details that are not directly relevant to the main results.

Answer: **Dear Sir, thank you for your suggestion. The section has been reformulated as follows in lines 21-24: " The soil is sand-dominated with a neutral pH, and its clay fraction is composed of kaolinite, smectites, and sepiolite. It exhibits low levels of organic matter (2.6%) and nitrogen (0.1%) but has a moderate-to-high cation exchange capacity (22.1 $cmol_c$ kg^{-1}) and an available phosphorus content (19 mg kg^{-1}). This soil is classified as Ochric Dystric Fluvisols according to the WRB ".**

6- Lines 35–40: The general statement does not accurately reflect the current reality of African agriculture. Please rephrase to reflect context-specific challenges, such as low fertilizer use, limited access to inputs, political issues, logistics constraints, and soil nutrient depletion.

Answer: **Thank you, Sir, for this remark. Revision was done also at the following of your above recommendation concerning the introduction as follows:**

" In recent decades, population growth and food insecurity have led to an intensification of extensive farming practices and increased of soil overexploitation (Pham *et al*., 2018; Jhariya *et al*., 2021; Khatri *et al*., 2024). This situation is further exacerbated in addition to limited access to inputs, by logistical constraints and institutional challenges, causing a continuous decline in soil fertility and crop productivity (Kuria *et al*., 2018; Nanganoa *et al*., 2019). As a limited resource, soil takes between 200 to 1000 years to form a layer of 2.5 cm in thickness, making its exploitation for agricultural purposes fragile due to the increase in the world population and climate change (Moges and Taye, 2016). Soil degradation thus represents a major environmental and socio-economic challenge, impacting biodiversity, ecosystem services, and food security. Sustainable management requires integrated strategies aimed at restoring or maintaining nutrient balance and enhancing agroecosystem resilience (Nkouathio *et al*., 2008; Mekuriaw *et al*., 2017; Hossain *et al*., 2020; Garai *et al*., 2021)."

7- Lines 45–50: Clarify the conceptual difference between *soil health* and *soil quality*.

Answer: Thank you very much for this important remark. Dear Sir, soil quality refers to the inherent, measurable physical and chemical properties of a soil, whereas soil health is the dynamic, holistic capacity of a soil to function as a vital living ecosystem. Soil quality is a component of soil health. The following sentence (lines 45-47) " Soil health, also known as soil quality, is a key factor in sustainable agriculture, influencing ecosystem quality, such as air and water quality" was revised as follows:

" Soil health is a key factor in sustainable agriculture, influencing ecosystem quality, such as air and water quality"

8- Lines 50–55: The statement suggesting that intensive agriculture is a major problem in Africa is misleading. In most African systems, the challenge is low agricultural intensification rather than overuse of inputs.

Answer: Thank you very much. Sir, the expression "intensive agriculture" was replaced by "Intensification of extensive farming practices"

9- Line 121: Remove the duplicated reference to “(Table 1)”.

Answer: The duplicated reference to "(Table 1)" was removed

10- Line 135: Avoid using abbreviations such as “IRAD” at their first occurrence; write the full name before introducing the acronym.

Answer: Thank you for this remark. The first occurrence of the acronym *“IRAD”* appears at line 112, where it is properly defined as: "Agricultural Research Institute for Development (IRAD)"

11- Line 290: Add in Table 4, the international regulatory limits for trace elements in soil amendments and fertilizers, for proper environmental assessment.

Answer: Thank you for this suggestion. We add standard limits according to FAO/WHO for the following trace elements in agricultural soils: V (50 mg/kg), Cr (100 mg/kg), Co (20 mg/kg), Ni (50 mg/kg), Zn (200 mg/kg), Pb (50 mg/kg), U (20 mg/kg). We also add Standard limits according to Environment protection agency United State (EPA) for major elements in agricultural soils: Si (40%), Al (8%), Fe (5%), Mn (0.3%), Mg (1.5%), Ca (3%), Na (1.5%), K (3%), P (0.2%).

12- Line 327: In Table 6, avoid introducing abbreviations such as “TEB” before defining them.

Answer: Thank you, Sir, for this observation. The term "TEB" was defined at its first occurrence in line 195, as "Total exchangeable bases" before being used again in the table 6.

13- Line 480: The section titled *“4.3 Kinetics of nutrient element release from trachyte and basalt powders”* is overstated. The experimental design does not allow evaluation of release kinetics, plant uptake, or nutrient dynamics. This section should be removed.

Answer: Thank you very much for your suggestion. As already stated above in the Major revision section, this section was recommended by some reviewer in the first round of interactive discussion. Nevertheless, the following three sentences (59 words) which are not directly linked to silicate dissolution and nutrient release were deleted:

- **Meena and Biswas (2014) demonstrated that rock phosphate and mica release cations more rapidly when finely ground and combined with compost;**

- ***Bacillus mucilaginosus*** **produces organic acids that enhance nutrient solubilization (Yang et al., 2016).**
- **Root exudates and mycorrhizal associations further improve K and Mg bioavailability, facilitating plant uptake (Ma and Yamaji, 2006; Menna and Biswas, 2014).**

14- Line 508: The suggestion to use amendments based on clay materials is not cost-effective for smallholder farmers. Given the applied nature of the research, the socio-economic feasibility of proposed solutions should be considered in the recommendations.

Answer: Dear Sir, thank you for this comment. We deleted the suggestion to use amendments based on clay materials. The sentence was revised with an addition of one reference as follows: " Adding biochar with and without additional compost and manure, identified by Hussain et al. (2021) and Seyedsadr et al. (2022) as an effective solution, enhances water retention and cation exchange capacity, both of which are fundamental properties for the fertility of sandy soils "