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EFFECT OF THREE DIFFERENT SOILS ON THE GROWTH PARAMETERS OF CASSAVA (MANIHOT ESCULENTA CRANTZ) TMS 419

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ABSTRACT

This study was carried out at The Ecological center (Green House), Department of Plant Science and Biotechnology, Faculty of Science, University of Port Harcourt, Rivers State to investigate the impact of three different soils with known physicochemical characteristics and textural class, on the growth parameters of Manihot esculenta Crantz (TMS 419). The selection of the soils for use was done based on soil color and physical textural feel. Physicochemical analysis was carried out to determine the physicochemical characteristics of the different soils. The soils were labeled as Soil A, Soil B and Soil C, having pH levels of 4.09,5.24, and 6.04 respectively. The soils also had varying nutrient content and Total Organic Nitrogen (%). Over a period of three months, various growth parameters, including plant height, petiole length, leaf length, leaf width, leaf area, and the number of leaves, were monitored to unravel the intricate relationship between the different soils and the developmental outcomes of Manihot esculenta. The experimental setup included three replicates of each of the different soils with each soil weighing 10kg, arranged in a Randomized Complete Block Design(RCBD). Plant data were taken at monthly intervals. Results indicate that soils with lower pH levels between 4-5 supports greater vertical height, particularly evident in the consecutive months after planting. Also, soil A having higher Total Organic Nitrogen (TOC %) showed better leaf development compared to Soil B and Soil C. Soil A and B had higher potassium and phosphorus contents and showed better overall growth of Manihot esculenta Crantz (TMS 419).

Key words: Growth Parameters, Cassava, Soil, Total Organic Nitrogen

1. INTRODUCTION

The importance of soil in agriculture cannot be overstated. Soil serves as the foundation for plant growth and is critical in sustaining agricultural productivity. Soil is the basis of farming, it delivers water and nutrient to crops, physically supports plant, help control pest and protects the quality of drinking water and wild life habitat (Griffing et al,2008)

The development and production of cassava are significantly affected by soil characteristics, like soil type, texture, pH levels and moisture retention despite its versatility. These elements differ greatly in different areas and directly affect the productivity and quality of cassava. Soils with adequate nutrient levels, ideal pH values and effective water retention capabilities are linked to enhanced cassava growth.

Understanding the impact of distinct soil types on the growth of Manihot esculenta is essential for developing effective agricultural practices aimed at maximizing yields and ensuring food security.

2. MATERIALS AND METHODS

2.1 STUDY SITE

The experiment was carried out at the Ecological center (Green House), Department of Plant Science and Biotechnology, Faculty of Science, University of Port Harcourt, Rivers State.

2.2 SOURCE OF MATERIALS

The different soils were sourced from the Faculty of Agricultural Science demonstration farm behind the water bottling plant, University of Port Harcourt. The stem cuttings of TMS 419 were sourced also from the same location.

2.3 PREPARATION OF EXPERIMENT MATERIALS

The soils used for this experiment were selected based on their distinct physical color and particle texture. The collected soils were filled into 10kg soil capacity plastic buckets. Each soil type had three replicates and were arranged in a Randomized Complete Block design(RCBD). The planting buckets were perforated to allow for proper aeration and drainage.

2.4 PLANTING OF CASSAVA STEM CUTTINGS

The cassava plant stems were cut into planting sizes of about 20-25cm using a machete and planted in a slightly vertical orientation with about 3 nodes beneath the soil and 3 nodes above the soil. After which the soil were watered adequately. Each planting bucket had only one planting cutting at the center.

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2.5 Determination of Soil pH and available Phosphorus

The soil pH and available Phosphorus were determined using the method of Bray and Kurtz, 1945

2.6 Measurement of Growth Parameters: The growth parameters measured weekly were plant height (cm), leaf length (cm), Petiole length(cm) and the number of leaves

2.7 Statistical Analysis: To ascertain whether the results were significant or not, statistical analysis were performed on the values obtained from measuring the growth parameters

3. RESULTS

3.1 SOIL ANALYSIS

Table 1.1: Summary for result of soil samples

S/N	Parameters(s)	Soil A	Soil B	Soil C
1	pH	4.09	5.24	6.04
2	Phosphorus(mg/kg)	0.19	0.38	0.24
3	Potassium(mg/kg)	59.0	20.04	14.78
4	Sand (%)	73.24	75.28	74.15
5	Silt (%)	15.39	9.36	8.66
6	Clay (%)	11.37	15.36	17.19
7	Texture Class	Sand Clay Loam	Sandy Loam	Sandy clay
8	Total organic Nitrogen,TOC (%)	0.104	0.078	0.061

3.2 PLANT HEIGHT

In the first month after planting, Soil B exhibited a mean plant height of 4.13 cm, while Soil A showed a slightly lower mean value of 3.82 cm. On the other hand, Soil C showed a considerably lower mean value of 1.3 cm. As the study progressed to the second month, the disparity in plant height became a little more pronounced, with Soil A and B yielding a mean value of 9.3cm and 10.93 cm respectively while Soil C remained considerably lower increasing to 3.45 cm. This trend persisted into the third month, where Soil A and B recorded a mean height of 16.9 cm and 18.18 cm respectively and soil C displayed a notably lower mean value of 8.33 cm.

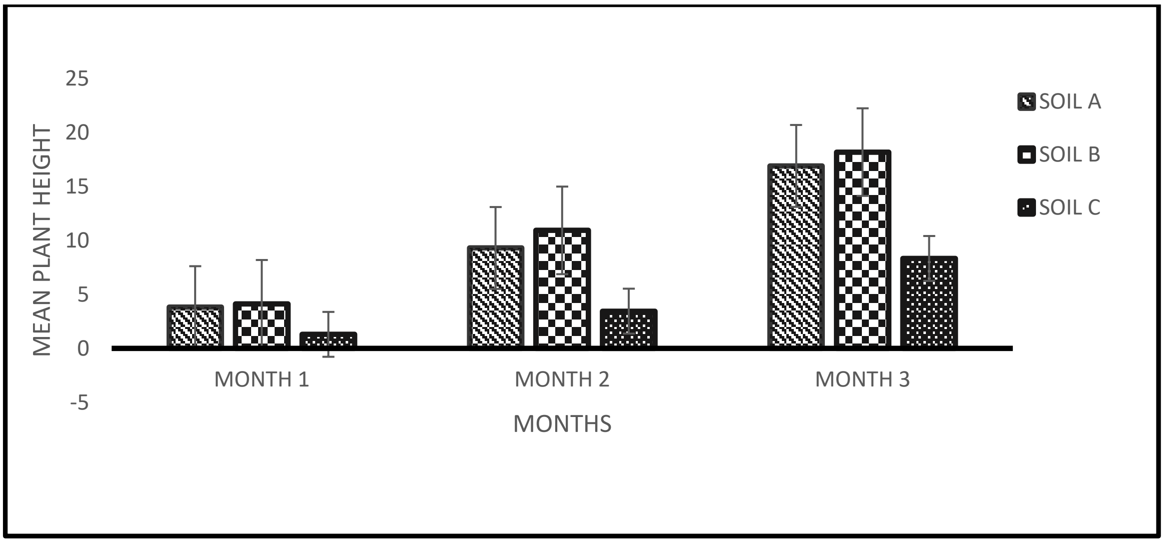

Fig 3.1: Effect of three different soils on plant height of Manihot esculenta

3.3 PETIOLE LENGTH

The examination of the impact of three different soils, specifically Soil A, Soil B, Soil C, on the establishment of Manihot esculenta as presented in Fig 3.2, demonstrated variations in petiole length over a three-month period. In the initial month after planting, Soil A exhibited a mean petiole length of 5.3 cm, while Soil B and Soil C showed mean values of 5.15 cm and 2.65 cm respectively. As the study progressed to the second month, the disparity in petiole length of Soil A and Soil B remained minimal, but obvious for Soil C which showed a lower mean value of 4.95 cm. This trend persisted into the third month, where Soil A and Soil C recorded a mean value of 8.35cm and 8.95 cm respectively, and Soil C displayed a lower mean value of 5.25 cm.

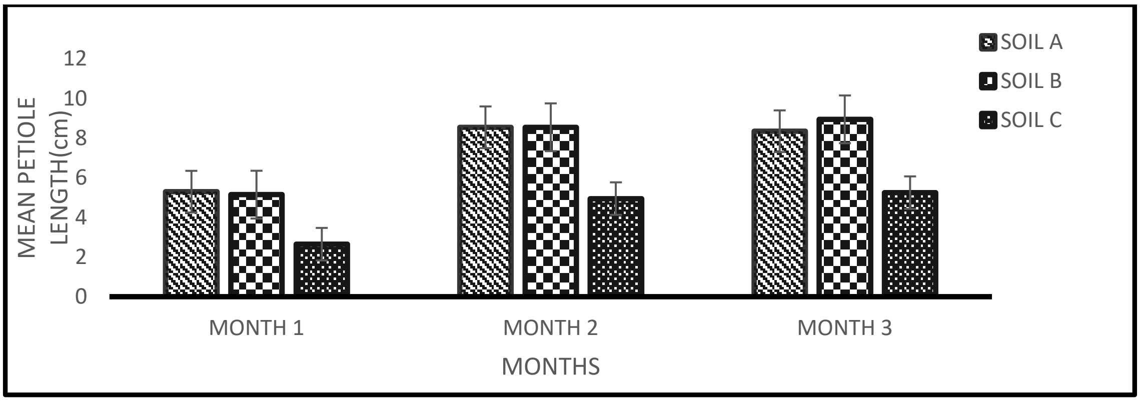

Fig 3.2 : Effect of three different soils on Petiole length of Manihot esculenta

3.4 NUMBER OF LEAVES

The results of the number of leaves as presented in Fig 3.3, showed a progressive increase in number of leaves with months. Although there were no significant difference in the number of leaves between the plants in Soil A and Soil B and plants in Soil C had slightly lower number of leaves.

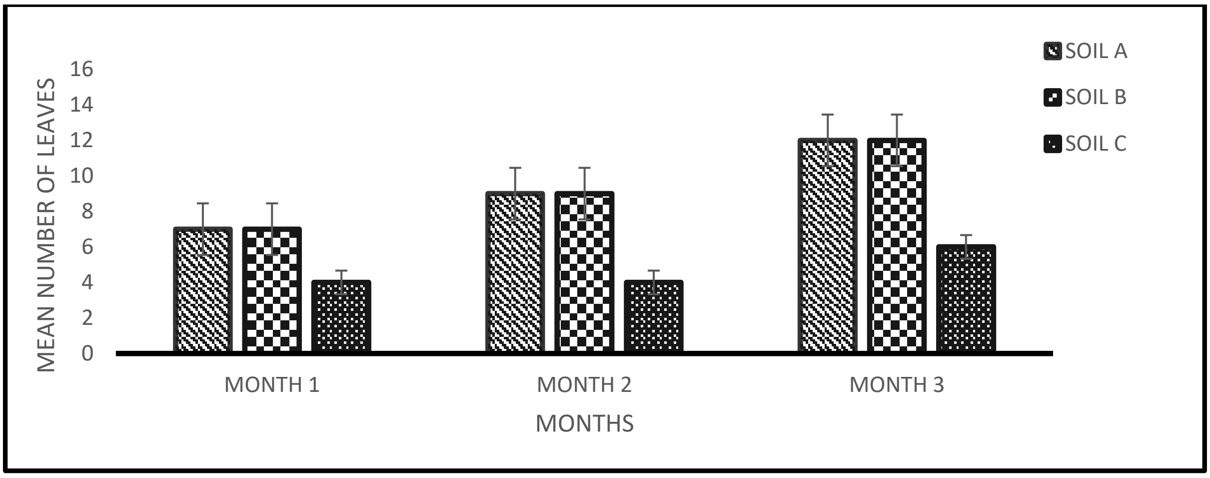

Fig 3.3: Effect of three different soils on Number of leaves of Manihot esculenta

3.5 LEAF AREA

In the first month after planting, Soil A exhibited a higher mean leaf area than the one observed in Soil B and Soil C. This trend continued in the second month as Soil A exhibited a mean leaf area increase from 70.09 cm² in the first month to 136 cm², while Soil B and Soil C increased from 64.05cm² to 121.19 cm2, and 21.41 cm² respectively. In the third month however, for Soil A, the mean leaf area reduced to 134.95 cm² which was however still larger than that of Soil B and Soil C which had mean leaf area values of 126.99 cm² and 41.14 cm² respectively.

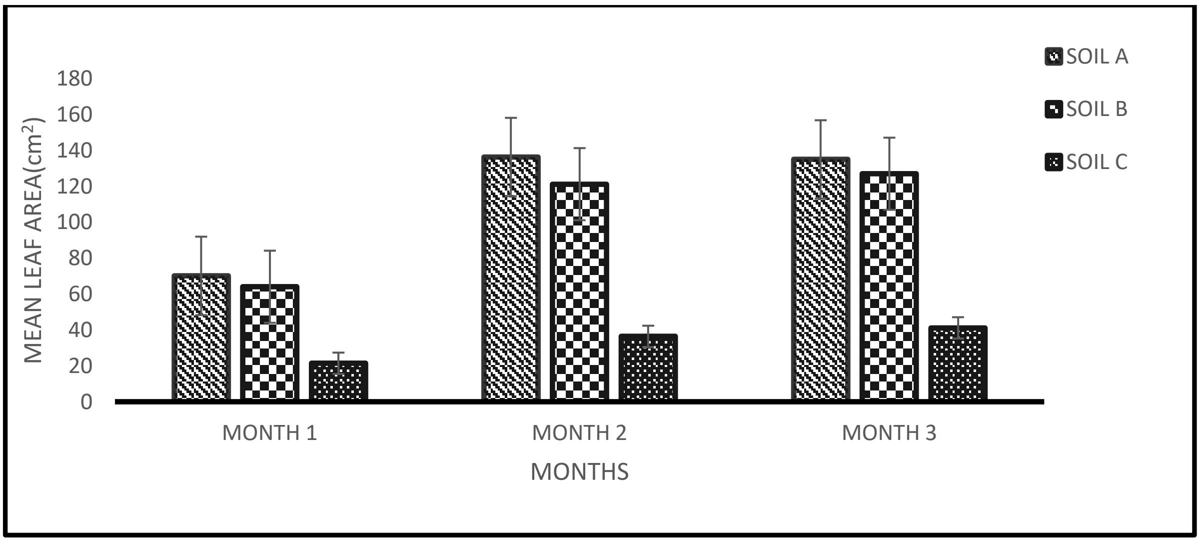

Fig 3.4: Effect of three different soils on Leaf area (cm²) of Manihot esculenta

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3.6 LEAF LENGTH

As presented in Fig 3.5, the impact of the three different soils (Soil A, Soil C and Soil B), revealed variations in leaf length over a three-month period. In the initial month after planting, Soil A demonstrated a mean leaf length of 6.83cm, while soil B showed a slightly similar mean value of 6.48 cm. Soil C showed a slightly shorter mean value of 4.08cm. Moving to the second month, the trend continued, with Soil A and Soil B yielding mean leaf length of 9.85cm and 9.28cm respectively and Soil C showing a lower mean value of 5.0cm. As anticipated, by the third month, Soil A and Soil B recorded further increase in mean leaf length, reaching 10.05cm and 9.68cm, however soil C exhibited a mean value of 5.23cm.

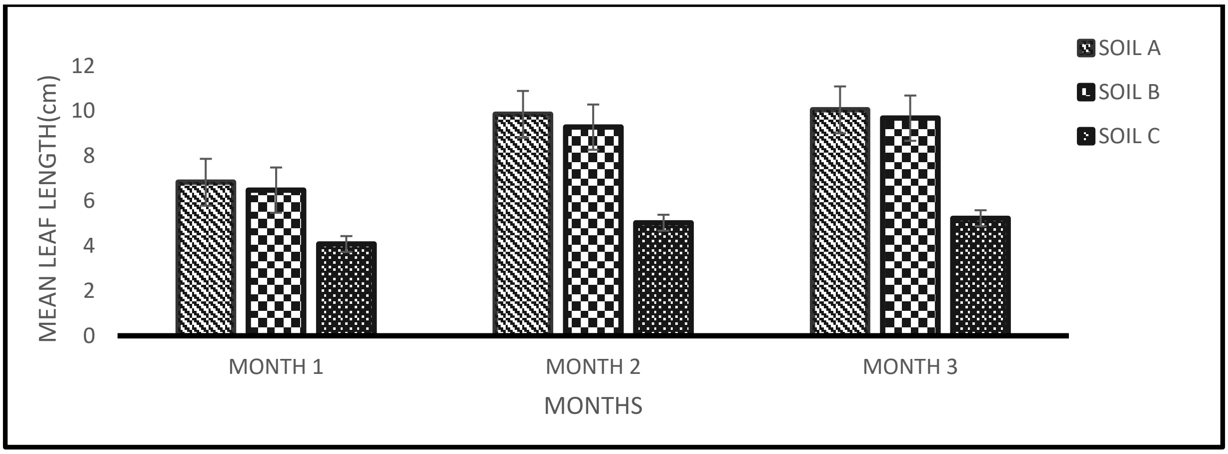

Fig 3.5: Effect of three different soils on Leaf length of Manihot esculenta

4 DISCUSSION

Soil plays a vital role in plant cultivation, as the type of soil in a given environment significantly influences the plants that can thrive there. Soil provides essential nutrients required for normal plant growth and development. A lack of these nutrients can lead to stunted growth, chlorosis, necrosis, and other deficiency symptoms. Results indicates that various growth parameters respond differently to different soil.

In terms of plant height, the findings suggest that Soil A and Soil B consistently supports greater vertical growth compared to soil C. This trend was especially pronounced during the second and third months after planting, highlighting the sustained positive impact of Soil A and Soil B on the height development of Manihot esculenta. Factors contributing to this difference may include variations in nutrient composition, water retention, and soil texture. Although cassava is relatively tolerant to low soil chemical fertility, nutrient deficiencies can significantly impact its productivity, as root yields are closely linked to the availability of nutrients in the soil (Bales et al., 1974).

Leaf characteristics, such as length, width, and number, demonstrated intriguing dynamics. In the first month, Cassava planted in soil A and soil B produced more leaves than those in soil C. This is in line with the study reported by Souza et al. 2007, that the planting of cassava should be carried out, preferably, in deep soils of medium texture, with soil pH within the range from 4.5 to 5.5 and base saturation greater than 50% in order to promote good development. These results Suggests a complex interaction of factors like nutrient availability and soil-specific properties influencing leaf development.

The findings highlight the intricate relationship between soil types and the development of Manihot esculenta. The observed variations in growth parameters emphasize the diverse effects that different soils can have on the early stages of cassava development. This underscores the importance of considering the physical and chemical characteristics of soil, as soils with lower pH levels appears to create conditions more favorable for the growth of Manihot esculenta.

5 CONCLUSION

This research evaluated the effect of three different soils; Sandy loam (Soil A), sandy clay loam (Soil B), and Sandy clay (Soil C) on the growth parameters of cassava. The soils varied in both pH and texture, with Soil A having a pH of 4.09 and a loamy texture, Soil B with a pH of 5.24 and a sandy texture, and Soil C with a pH of 6.04 and a clayey texture. The findings demonstrated that cassava growth was significantly better in Soil A and Soil B compared to Soil C. This suggests that both loamy and sandy soils provide optimal conditions for cassava growth, likely due to their better aeration, drainage, and nutrient availability, which facilitate root development and nutrient uptake.

Conversely, the poor performance of cassava in Soil C highlights the limitations posed by soils with high pH levels, and reduced permeability, waterlogging, and limited root penetration. Additionally, the higher pH of Soil C may have influenced nutrient availability, further affecting cassava growth. These results emphasize the importance of selecting appropriate soil types for cassava cultivation and suggest that improving soils through amendments like organic matter addition or soil conditioning could enhance their suitability for cassava production.

In conclusion, the study underscores the critical role of soil texture and pH in cassava cultivation, with loamy and sandy soils proving more favorable. These findings provide valuable insights for farmers and researchers aiming to optimize cassava yields under varying soil conditions.

6 REFERENCES

[1] Adeyemo, AJ., and Ojo, O. S. (2022). Nutrient deficiencies in Cassava cultivation. Journal of Nutrient Management.8(4),112-119.

[2] Bales R. C. (1954). Electrometric pH Determinations. Cosmochim publications. pp 2281-2288

[3] Brady, N.C., and Weil, R.R. (2017). The nature and Properties of Soils (3rd ed.). ISBN.p.14-62.

[4] Bray R.H. and Kurtz, L.T. (1945). Determination of total, organic and available forms of P in soil. Soil Sci. 59: 39-45.

[5] Eze, O.C., and Akinola, J. A. (2023). The influence of soil texture on Cassava yield in southeastern Nigeria. Journal of Soil Science, 15(1), 15-23.

[6] Griffing, D.O., Hog, U. Yo, and Hominy, E.O. (2008). Soul food from Africa to America. Columbia University Press.2004;1-2.

[7] Nweke, F.1., and kudi, T.M. (2019). Cassava production and its challenges in Nigeria. Journal of Agricultural Science, 11(2), 45-46.

[8] Mbanoso, E.O. and Chukwuma, E.C. (2023). Soil pH and its effects on Cassava's nutrient Absorption. Journal of Agricultural Science and Technology, 14(3), 88-95.

[9] Odebiyi, J.A., and Akintola, J.A. (2020). Soil type and fertility effects On Cassava Plant growth. International Journal of Plant Research, 10(1), 20-27.

[10] Ogunniyi, L.T. (2011). The economic importance of Cassava in Nigeria. Journal of Agricultural Science, 3 (2), 10-15

[11] Souza, D.M., Miranda, L.N., and Oliveira, S.A. (2007). Soil acidity and Its correction. CAP. 5, P.205-274.