MIKAILALSYS
Journal of Multidisciplinary Sciences

e-ISSN : 2987-2286
p-ISSN : 2987-3924

Index : Dimensions, Scilit, Crossref, Garuda, Semantic, Lens,Google Scholar,Base, etc

https://doi.org/10.58578/mikailalsys.v3i1.4365

Assessment of Mineral and Vitamin Constituents of SAMPEA-11 and SAMPEA 20T Cowpea Cultivars

Stephen D. Titus[1], Samuel G. Ishaya[2], Allahnanan Emmanuel[3], Clever E. Bariya[4], Ebwaseh D. Bulus[5], Sarah B. Gurama[6], Ejembi O. Daniel[7]
Taraba State University, Nigeria
titus.stephendio@gmail.com1

Article Info:

Submitted:	Revised:	Accepted:	Published:
Nov 17, 2024	Dec 4, 2024	Dec 14, 2024	Dec 19, 2024

Abstract

This experiment was carried out to Assess mineral, and vitamin constituents of SAMPEA-11 and SAMPEA 20T cowpea cultivars. Plant materials were purchased from the Institute for Agricultural Research, Ahmadu Bello University, Zaria, Nigeria. Minerals were determined using Atomic Absorption Spectrometer while vitamin contents were analyzed using High-Performance Liquid Chromatography. SAMPEA 20T had high potassium concentration of 8.920 ppm, while copper was 0.059 ppm. For SAMPEA-11, potassium also had the highest concentration at 6.760 ppm, followed by phosphorus, 3.626 ppm and calcium, 1.630 ppm. Lower concentrations of iron, zinc, copper, and magnesium were noted in both cultivars. In SAMPEA 20T, two vitamins were detected: Vitamin B1 and Folate with concentrations of 2.123 mg and 11.060 mg, respectively. In SAMPEA-11, three vitamins were detected: Thiamine, Folate, and Vitamin E with concentrations of 12.450 mg, 23.459 mg and 3.047 mg respectively. The analysis of SAMPEA-11 and SAMPEA 20T cowpea cultivars shows a significant presence of potassium among the minerals, and a predominant presence of Folate, with notable concentrations of Thiamine and Vitamin E. The variety of nutrients highlight the nutritional value and potential health benefits of these cowpea cultivars.

Mikailalsys is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License

Keywords: SAMPEA-11; SAMPEA 20T; Vitamins; Minerals; Folate Thiamine

INTRODUCTION

SAMPEA-11 is an inproved cowpea (Tolorunju *et al.,* 2023), while SAMPEA 20T, is a newly introduced genetically modified crop (Malik and Roy, 2021; Andam *et al.,* 2024) that have garnered attention due to their unique characteristics and potential as a nutritional powerhouse (Titus *et al.,* 2024). They are cultivar released by the Institute of Agricultural research (IAR) Ahmadu Bello University, Zaria as an important variety of cowpea that has a high resistance against boring insects (Smith *et al.,* 2019; Titus *et al.,* 2024). SAMPEA11 and SAMPEA 20T belongs to the *Vigna unguiculata* (L.) Walp. species, and it are known for their adaptability to various environmental conditions and ability to thrive in marginal soils (Singh, 2005; Weru, 2016; FAO, 2021). This adaptability makes them attractive candidates for improving food security and nutrition in regions where resources are scarce (Nwagboso *et al*., 2024; Ragasa *et al.,* 2024).

The continent of Africa is not yet on the path to eliminate hunger by 2030 while the prevalence of malnutrition in Africa has risen from 17.6% in 2014 to 19.1% in 2019 (FAO, 2019; Wudil *et al*., 2023). Over the years, the question of appropriate food security has remained a critical subject for consideration by many government administrations in Nigeria (Ejikeme, Osabohien *et al*., 2020).

Minerals, and vitamins are fundamental components of human nutrition, and their presence in our diets is essential for maintaining health and preventing various dietary deficiencies (Godswill *et al.,* 2020).

The nutritional content of SAMPEA-11 and SAMPEA 20T remains an area of interest and significance, particularly in regions where it is a dietary staple. Moreover, as dietary preferences shift and global nutrition challenges evolve, it is essential to continuously assess the nutritional composition of food sources like SAMPEA-11 and SAMPEA 20T to adapt to changing dietary patterns and address emerging nutritional concerns (Bailey *et al.,* 2019). This study was carried out to assess the mineral, and vitamin constituents of SAMPEA-11 and SAMPEA 20T.

METHODS

Plant materials collected and how to get it

SAMPEA-11 and SAMPEA 20T were purchased from Institute for Agricultural Research, Ahmadu Bello University, Zaria Kaduna State Nigeria. The collected samples were cleaned, dried, and ground into a fine powder to ensure homogeneity.

Analysis of Mineral and Vitamin Constituents

Mineral constituents (Na, K, Ca, Cu, P and mg) were analyzed using atomic absorbance spectrometer (AAS - Shimadzu AA 7000) according to standard operation instructions. Whilwe, vitamins were analysed using HPLC with methanol as mobile phase and C-18 column, and standard vitamins were used to calibrate (Agilent 1200 series, Agilent Technologies, USA).

Data obtained from the analysis were statistically analyzed to determine difference in mean. The results were expressed as mean ± standard deviations, and other relevant statistical parameters.

RESULTS

Table 1 presents the mineral composition of SAMPEA-11 and SAMPEA 20T. Among the minerals analyzed, potassium (K) has the highest mean concentration at 6.760 ppm, indicating its substantial presence in the sample. Calcium (Ca) and phosphorus (P) displayed notable concentrations at 1.630 ppm and 3.626 ppm, respectively. Conversely, the analysis revealed relatively lower concentrations of iron (Fe), zinc (Zn), copper (Cu), and magnesium (Mg) in SAMPEA-11. While the mineral composition of SAMPEA 20T showed significant variations in the concentrations of the minerals with potassium (K) having the highest mean concentration at 8.920 ppm, indicating its substantial presence in the sample. Conversely, copper (Cu) displayed the lowest mean concentration at 0.059 ppm, suggesting a comparatively lower abundance.

Table 2 presents the vitamin contents of SAMPEA-11 and SAMPEA 20T analyzed using High-Performance Liquid Chromatography (HPLC). Five vitamin compounds were detected: Vitamin B1 (Thiamine), Folate (Vitamin B9), and Vitamin E. Thiamine was detected at a retention time of 2.505 minutes with a concentration of 12.450 mg, contributing to approximately 32.0% of the total vitamin content. Folate, identified at a

retention time of 2.910 minutes, exhibited a significantly higher concentration of 23.459 mg, constituting 60.2% of the total vitamin content. Additionally, Vitamin E was detected at a retention time of 5.655 minutes, with a concentration of 3.047 mg, contributing to 7.8% of the total vitamin content. The analysis indicates a predominant presence of Folate, followed by Thiamine and Vitamin E, in SAMPEA-11.

While Vitamin B1 (Thiamine) and Folate (Vitamin B9) were detected in SAMPEA 20T. Thiamine, detected at a retention time of 2.507 minutes, and a concentration of 2.123 mg, constituting approximately 16.1% of the total vitamin content while, folate, identified at a retention time of 2.912 minutes, with higher concentration of 11.060 mg, contributing to 83.9% of the total vitamin content.

Table 1: Mineral Composition of SAMPEA-11 AND SAMPEA 20T 20T

Minerals	**Concentration (ppm)**	
	SAMPEA-11	**SAMPEA 20T**
Fe	0.200±0.001	0.300±0.002
Zn	0.500±0.001	0.500±0.002
Cu	0.133±0.002	0.059±0.001
Mg	0.052±0.001	0.072±0.002
K	6.760±0.001	8.920±0.002
Ca	1.630±0.001	1.680±0.002
P	3.626±0.001	3.765±0.002

Table 2: Vitamin Contents of SAMPEA-11 and SAMPEA 20T using HPLC

Compound	**Retention Time**	**Response**	**Amount**	
	(min)		**(mg)**	**(%)**
SAMPEA-11				
Vitamin B1	2.505	18.401	12.450	32.0
Folate(B9)	2.910	95.017	23.459	60.2
Vitamin E	5.655	146.700	3.047	7.8
SAMPEA 20T				
VitaminB1	2.507	3.138	2.123	16.1
Folate(B9)	2.912	44.796	11.06	83.9

DISCUSSION

The findings revealed a significant amount of potassium, phosphorus and calcium as well as moderate quantity of Fe, Zn, cu and mg. This work agrees with the report of Owolabi *et al.* (2012) who reported similar findings when they compared the proximate and mineral composition of five cowpea varieties in Nigeria. Considering the levels of micronutrient present in SAMPEA-11 and SAMPEA 20T, it can be considered as an important component for human meal and can be used to supplement for essential nutrient in low-income populations.

These findings are consistent with previous studies (Fairweather-Tait *et al.,* 2011; Titus *et al.,* 2024) highlighting the importance of potassium in plant growth and metabolism, while the lower concentration of copper may warrant further investigation into potential implications for nutritional balance and plant health. Additionally, the relatively high concentrations of calcium (Ca) and phosphorus (P) at 1.680 ppm and 3.765 ppm, respectively, suggest their significant contributions to the overall nutrient profile of SAMPEA-11 and SAMPEA 20T, On the other hand, the result indicates presence of Folate in the plant varieties, highlighting their potential nutritional significance in the sample.

The results of this analysis offer valuable insights into the vitamin profile of SAMPEA-11 and SAMPEA 20T, essential for understanding its nutritional properties and potential health benefits. The significant presence of Folate, a vital B-vitamin crucial for various physiological functions, suggests that SAMPEA 20T could serve as a valuable dietary source of this nutrient. Folate plays a crucial role in DNA synthesis, cell division, and red blood cell formation, making it essential for overall health and development. Moreover, the detection of Thiamine, at a lower concentration compared to Folate, further enhances the nutritional value of SAMPEA 20T, as Thiamine is essential for energy metabolism and nerve function.

CONCLUSION

The findings of this experiment revealed the presence of vitamins (vitamin B1, B9 and vitamin E), minerals (Fe, Zn, Cu, Mg, K, Ca and P). It was established that SAMPEA 20T contain higher amount of folic acid (folate) and thiamine. The minerals on the other hand are also abundant with high amount of potassium. Further research into the

bioavailability and potential synergistic effects of these vitamins is required to provide valuable insights for nutritional interventions and food fortification strategies.

REFERENCES

Andam, K. S., Amare, M., Zambrano, P., Bamiwuye, T., Nwagboso, C., Fasoranti, A., ... & Chambers, J. (2024). *Impact evaluation of the use of PBR cowpea in Nigeria: Baseline report*. Intl Food Policy Res Inst.

Bailey, R. L., Fulgoni, V. L., Keast, D. R., Dwyer, J. T. (2019). Why US Adults Use Dietary Supplements. *Journal of the American Medical Association Internal Medicine*, 179(9):1240-1242.

Ejikeme, J. O., Ojiako, J. C., Onwuzuligbo, C., and Uand Ezeh, F. C. (2017). Enhancing food security in Anambra state, Nigeria using remote sensing data. *Environment Review,* **6**:27–44

Fairweather-Tait, S. J., Bao, Y., Broadley, M. R., Collings, R., Ford, D., and Hesketh, J. E. (2011). Iron Nutrition in the UK: Getting the Balance Right. *Proceedings of the Nutrition Society*, 70(4):456-466.

FAO (2019). The State of Food and Agriculture 2019. Moving Forward on Food Loss and Waste Reduction. Rome. Available online at: www.fao.org/3/ca6030en/ca6030en.pdf.

FAO (2021). The nutritional and economic potential of grain legumes in sub-Saharan Africa: Lessons from Uganda and Zambia. Retrieved from http://www.fao.org/3/n6623e/n6623e.pdf.

Godswill, A. G., Somtochukwu, I. V., Ikechukwu, A. O., & Kate, E. C. (2020). Health benefits of micronutrients (vitamins and minerals) and their associated deficiency diseases: A systematic review. *International Journal of Food Sciences*, *3*(1), 1-32.

Malik, C. P., & Roy, B. (2021). New Horizons of Plant Sciences. *The Journal of Plant Science Research*, *37*(2), 225-236.

Nwagboso, C., Andam, K. S., Amare, M., Bamiwuye, T., & Fasoranti, A. (2024). *The economic importance of cowpea in Nigeria trends and Implications for achieving agri-food system transformation*. Intl Food Policy Res Inst.

Osabohien, R. O., Ohalete, M. P., and Osabuohien, E. (2020a). Population–poverty–inequality nexus and social protection in Africa. *Society Indicative Research*, **151**: 575–598

Ragasa, C., Umar, S., Sani, R. M., Onyibe, J. E., Omoigui, L., Fasoranti, A., ... & Policy, I. (2024). Supply-and Demand-Side Factors Affecting Maize and Cowpea Varietal Turnover and Quality Seed Use.

Singh, B. B. (2005). Cowpea [Vigna unguiculata (L.) Walp.]. *Genetic resources, chromosome engineering and crop improvement*, *1*, 117-162.

Smith, A. F., Johnson, B. C., and Davis, D. E. (2019). Legumes: Health Benefits and Culinary Approaches to Increase Intake. *Clinical Diabetes*, 37(3):292-296.

Titus, S. D., Abershi, A. L., Francis, A., Mafe, A. N., Samuel, K. B., Daniel, E. O., & Ojogbene, E. (2024). Effect of Processing on Nutritional and Antinutritional

Composition of SAMPEA-11 and 20-T Cowpea Cultivars. *Mikailal Sys. Journal*, *2*(3), 479-489. DOI: 10.58578/mikailalsys.v2i3.3867

Tolorunju, E., Ayeni, F., Adeniyi, R., Silwal, P. K., Faleti, O., Archibong, B., ... & Luwa, S. (2023). Investment guide for community-based seed entrepreneurs in cowpea production.(retrieved from: https://cgspace.cgiar.org/items/6dd63fc0-eca3-40e9-9757-f535c722ca72.)

Weru, M. S. (2016). *ADAPTABILITY AND STABILITY OF COWPEA (Vigna unguiculata) LINES IN KENYA COASTAL REGION* (Doctoral dissertation).

Wudil, A. H., Ali, A., Aderinoye-Abdulwahab, S., Raza, H. A., Mehmood, H. Z., & Sannoh, A. B. (2023). Determinants of food security in Nigeria: Empirical evidence from beneficiaries and non-beneficiaries rice farmers of the Kano River Irrigation Project. *Frontiers in Sustainable Food Systems*, *7*, 999932.