

Comparison of important micronutrients profile among collections of *Irvingia gabonensis* and *Irvingia wombolu* at NACGRAB, Nigeria

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ABSTRACT

Tree species *Irvingia gabonensis* and *Irvingia wombolu* are highly valuable and extensively utilised tropical African tree, sometimes known by the common names wild mango, African mango, bush mango, dika or ogbono. They bear edible mango-like fruits and their occurrences in sub – Saharan Africa are mostly in south-western Nigeria and southern Cameroon, and also in Côte d'Ivoire, Ghana, Togo and Benin. The fruits are sold, but by far the most important product is the kernels, which fetch a price several times higher than the fruits, hence the need to analyse the micronutrients content of our collections at the National Centre for Genetic Resources and Biotechnology (NACGRAB), Ibadan, Nigeria for better utilisation of its genetic resources. The results of the micronutrients analysis done using Atomic absorption spectrometer (AAS) revealed that *Irvingia gabonensis* has the highest mean Nitrogen value with $(1.63 \pm 0.01)\%$, while *Irvingia wombolu* has a mean Nitrogen value of $(1.32 \pm 0.07)\%$. Phosphorus mean values are *Irvingia gabonensis* $(0.22 \pm 0.005)\%$ and *Irvingia wombolu* $(0.26 \pm 0.05)\%$. Others are Calcium, *Irvingia gabonensis* $(0.32 \pm 0.00)\%$ and *Irvingia wombolu* $(0.29 \pm 0.00)\%$ Magnesium, *Irvingia gabonensis* $(0.09 \pm 0.00)\%$ and *Irvingia wombolu* $(0.12 \pm 0.00)\%$, Potassium, *Irvingia gabonensis* $(1.24 \pm 0.03)\%$ and *Irvingia wombolu* $(1.85 \pm 0.005)\%$. Other mean values includes Sodium *Irvingia gabonensis* $(0.18 \pm 0.00)\text{ppm}$ and *Irvingia wombolu* $(0.17 \pm 0.00)\text{ppm}$; Iron, *Irvingia gabonensis* $(76.40 \pm 1.50)\text{ppm}$ and *Irvingia wombolu* $(134.0 \pm 2.63)\text{ppm}$; Manganese, *Irvingia gabonensis* $(33.65 \pm 0.82)\text{ppm}$ and *Irvingia wombolu* $(121.15 \pm 1.064)\text{ppm}$; Copper, *Irvingia gabonensis* $(4.92 \pm 0.28)\text{ppm}$ and *Irvingia wombolu* $(7.82 \pm 0.29)\text{ppm}$ and Zinc, *Irvingia gabonensis* $(16.24 \pm 0.14)\text{ppm}$ and *Irvingia wombolu* $(20.24 \pm 0.19)\text{ppm}$.

Keywords

Irvingia gabonensis, *Irvingia wombolu*, Utilisation, Micronutrients.

Introduction

Irvingia gabonensis and *Irvingia wombolu* are highly valuable and extensively utilised tropical African trees, which were identified as high priority species. The *Irvingia* trees occur naturally on farms in Cameroon [1], but are planted in home gardens in Nigeria (Ukafor 2001). A study by Ayuk et al. [2] in the humid lowlands of Cameroon indicates that most farmers maintain mature bush mango trees that are already growing on their land and also transplant

wild seedlings onto their farm or raise new seedlings. Franzel et al. [3] carried out a priority setting exercise in Nigeria, Cameroon and Ghana, and found out that *Irvingia gabonensis* is the most preferred indigenous tree species in the humid lowlands of Nigeria and Cameroon. Eighty-six percent of respondents mentioned the species in both countries, with an average preference score of 7.8 in Nigeria and 6.0 in Cameroon. In a study of under-exploited tree crops, Moss concluded that *I. gabonensis*, also called bush mango, was one of two species that presented the best opportunities for development intervention. Leakey [4] lists *I. gabonensis* among the 'Cinderella' species that are ideal agroforestry trees because

they are already recognized by local people and found in local markets. Since they are indigenous, they are well adapted to the region.



Figure 1: Distribution of *Irvingia* species in Africa.

Materials and Methods

Collection of *Irvingia* species Fruits

Mature fruits of *Irvingia gabonensis* and *Irvingia wombolu* were collected from the field plots at the National Centre for Genetic Resources and Biotechnology, (NACGRAB), Ibadan, Nigeria at their respective fruiting seasons of the year respectively. The *Irvingia gabonensis* fruits between May to September while the *Irvingia wombolu* fruits between October and January.

Kernel extraction from Fruits

The collected fruits were allowed to stay for three (3) weeks in other to decay or rotten. This is necessary for easy removal of the kernels from the fruits. After 3 weeks, the kernels (cotyledons) are removed from the fruits by manual cracking. They were then air – dried for one (1) week at room temperature and condition.

Kernels Processing into powder

After proper drying, the kernels were made into powder using the laboratory mortar and pestle, until a powder is obtained, before each of the accessions were labelled and kept on the shelf, prior to take it to a standard laboratory for micronutrients analyses.

Micronutrients Analyses

The method described by Association of Official Analytical Chemists [5] was used for the analysis of the minerals. Aqua regia solution was prepared in a 2litre volumetric flask as follows, 1.2 litre of distilled water was added to the flask, followed by the addition of 400ml of Concentrated Hydrochloric acid and 133ml of 70% nitric acid. The solution is diluted to 2 litres. 0.52 g of the powdered *Irvingia gabonensis* and *Irvingia wombolu* samples in clean ceramic crucibles were placed in a cool muffle furnace and ramp temperature to 500°C over a period of 2 hours. They

were allowed to remain at 500°C for an additional 2 hours before cooling down. The samples were later transferred to a desiccator. Each sample was now poured into already labeled 50ml centrifuge tube. The crucibles were first rinsed with 5ml of distilled water into the centrifuge tubes and later with 5ml aqua regia solution. The process was repeated, so as to make a total volume of 20ml. The samples were then vortex for proper mixing before centrifuging for 10mins at 3000rpm. The supernatants were now decanted into clean vials and micronutrient analysis for zinc, iron, copper, magnesium, phosphorous and calcium were determined using flame atomic absorption spectrophotometer, AAS, using model Acusys 211 from Buck Scientific, USA.

Statistical Analysis

The data were analysed using Microsoft excel software, 2010. The mean and standard deviation (SD) of each of the samples were calculated. Also necessary charts were done to depict and draw up comparative inferences about each micronutrients values.

Results and Discussion



Figure 2: *Irvingia gabonensis* and *Irvingia wombolu* trees at NACGRAB.



Figure 3: *Irvingia gabonensis* and *Irvingia wombolu* ripened fruits at NACGRAB.



Figure 4: *Irvingia gabonensis* and *Irvingia wombolu* rotten fruits at NACGRAB.



Figure 5: *Irvingia gabonensis* extracted kernels (ogbono).

Micronutrients	<i>Irvingia Wombolu</i>	<i>Irvingia Gabonensis</i>
Nitrogen (%)	1.32 ± 0.07	1.63 ± 0.01
Phosphorus (%)	0.26 ± 0.005	0.22 ± 0.005
Calcium (%)	0.29 ± 0.00	0.32 ± 0.00
Magnesium (%)	0.12 ± 0.00	0.09 ± 0.00
Potassium (%)	1.85 ± 0.005	1.24 ± 0.03
Sodium (ppm)	0.17 ± 0.00	0.18 ± 0.00
Manganese (ppm)	121.15 ± 1.064	33.65 ± 0.82
Iron (ppm)	134.0 ± 2.63	76.40 ± 1.50
Copper (ppm)	7.82 ± 0.29	4.92 ± 0.28
Zinc (ppm)	20.24 ± 0.19	16.24 ± 0.14

Table 1: Showing the Micronutrients value of NACGRAB *Irvingia* species.

Values represents mean amount of micronutrients ± standard deviation (S.D). The amount of Nitrogen, phosphorus, calcium, magnesium and potassium are in %, while those of sodium, manganese, iron, copper and zinc are in ppm.

From the results shown above, for the micronutrients profile of *Irvingia* species, the mean values obtained for Nitrogen was highest for *Irvingia gabonensis* with (1.63 ± 0.01)% while it was lower in *Irvingia wombolu* with a mean amount of (1.32 ± 0.07)%. As for the amount of Phosphorus, it has a highest mean value of (0.26 ± 0.005)% in *Irvingia wombolu*, and the lowest mean amount of (0.22 ± 0.005)% in *Irvingia gabonensis*. The Calcium mean amount evaluated was highest in *Irvingia gabonensis* (0.32 ± 0.00)% as compared with that of *Irvingia wombolu* (0.29 ± 0.00)%. The mean amount of Magnesium was highest in *Irvingia wombolu* with a value of (0.12 ± 0.00)%, while the least was in *Irvingia gabonensis* stood at (0.09 ± 0.00)%. As for the Potassium level, the mean amount obtained was for *Irvingia wombolu* was highest with (1.85 ± 0.005)%, and lowest in *Irvingia gabonensis* with a mean amount of (1.24 ± 0.03)%. The results obtained for the other micronutrients evaluated showed that Sodium was highest in *Irvingia gabonensis* (0.18 ± 0.00) ppm as compared with that of *Irvingia wombolu* (0.17 ± 0.00) ppm. Moreover, the Manganese mean amount was highest in *Irvingia wombolu* (121.15 ± 1.014)

ppm and the lowest in *Irvingia gabonensis* (33.65 ± 0.82) ppm. As for the mean amount of Iron, the highest was in *Irvingia wombolu* with (134.05 ± 2.63) ppm and the lowest in *Irvingia gabonensis* with (76.40 ± 1.50) ppm. The highest mean amount of Copper was in *Irvingia wombolu* with (7.82 ± 0.29) ppm and the lowest in *Irvingia gabonensis* with (4.92 ± 0.28) ppm. As for the mean amount of Zinc, the highest was in *Irvingia wombolu* with (20.24 ± 0.19) ppm and the lowest in *Irvingia gabonensis* with (16.24 ± 0.14) ppm.

Micronutrients are important part of our diets that are required in milligram or microgram amounts for our good health. The amount of Manganese here in *Irvingia* species depicts its use as a potential cofactor needed for many enzymatic functions. Manganese enzymes are particularly important and essential in the detoxification of superoxide free radicals in organisms. It also functions in the oxygen – evolving complex of the photosynthetic plants. Also, in copious amount, it can act as a neurotoxin. Moreover, its Iron amount in the diet can serve as a co-factor in the formation of hemoglobin and myoglobin, and by so doing can play a role in vertebrate metabolism by aiding the transport of oxygen by the blood and its storage in the muscles. Also, Zinc will contribute to reduce growth and retardation, especially in children. It can also enhance sexual maturity in adults and generally assist to prevent diarrhea. Potassium amount helps to maintain fluid status in the cells and by so doing help with nerve transmission and muscle function, while Phosphorus can help as part of bone and cell membrane structure.

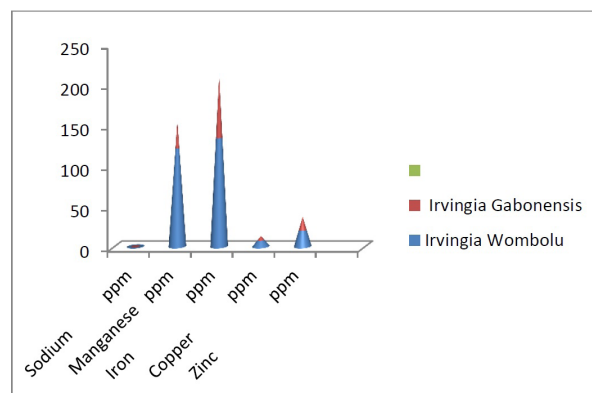


Figure 6: Column chart showing micronutrients values of Na, Mn, Fe, Cu and Zn in *Irvingia* species in ppm.

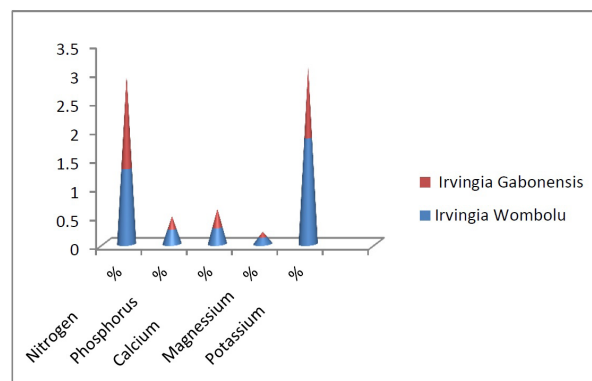


Figure 7: Column chart showing micronutrients values of N, P, Ca, Mg and K in *Irvingia* species in %.

Conclusion

The results obtained showed that *Irvingia* species has immense micronutrients potentials, which if well harnessed can serve to assist developing countries from some of the challenges emanating from hidden hunger. Some of these malnourished conditions include Iron deficient anemia, inflammation, growth retardation, loss of appetite and impaired immune function. Others are impaired glucose tolerance, altered carbohydrate and lipid metabolism; all due to its high amount of Manganese, Iron and Zinc.

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