

 <p>ISSN NO. 2320-5407</p>	<p>wJournal Homepage: - www.journalijar.com</p> <h2>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)</h2> <p>Article DOI: 10.21474/IJAR01/6250 DOI URL: http://dx.doi.org/10.21474/IJAR01/6250</p>	
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RESEARCH ARTICLE

NUTRITIONAL AND PHYTOCHEMICAL STUDIES OF *Jatropha tanjorensis* Ellis & Saroja UNDER VARIED SOIL CONDITIONS.

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Manuscript Info

Manuscript History

Received: 08 November 2017
Final Accepted: 10 December 2017
Published: January 2018

Keywords:-

Nutritional, phytochemical, *Jatropha tanjorensis*, soil.

Abstract

Introduction: This present study was carried out to assess the mineral nutrient and phytochemical properties in leaves of the test plant and the influence of soil properties on them.

Methods: Leaves of *J. tanyorensis* obtained from two sampling locations (Akwa Ibom State-L1 and Bayelsa State-L2), were analysed for phytochemical and mineral nutrient contents using standard procedures. The physico-chemical properties of soils in the sampling locations were also assessed.

Results: There were variations in soil physico-chemical properties between the two sampling locations. There were marked variations ($P < 0.05$) in elemental nutrient and phytochemical compositions in leaves of *J. tanyorensis* between the two sampling locations.

Conclusion: This study suggests that the soil conditions in L1 sampling location enhanced the phytochemical and mineral nutrient contents in leaves of *J. tanyorensis* than that of L2 location. Therefore, appropriate soil improvement practices are required in L2 sampling location in order to improve the biochemical properties of this important species.

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Introduction:-

In some areas, rapid industrialization has generated changes in soil physico-chemical properties due to pollution and climatic changes [1, 2]. Environmental disturbances resulting from mining and road construction activities also contribute to changes in soil quality [3], and in consequence affect the elemental composition in plants [4]. Climatic change has been reported to have a great influence on the life cycle, distribution and phytochemical composition of the world's vegetation [5]. Phytochemical composition of medicinal plants is known to be affected by a number of environmental factors such as altitude, soil type and change of season [6, 7, 8].

The medicinal value of plants like antimicrobial, anti-inflammatory, antidiabetic, antioxidant, antidiuretic among others mainly depend on the secondary metabolites, and the most important bioactive compounds are alkaloids, saponins, flavonoids, tannins, sterols and phenolic compounds [9, 10]. *Jatropha tanjorensis* (family Euphorbiaceae) is an important species usually utilized for medicinal and nutritional purposes, and exhibit intermediacy in phenotypic characters between *J. gossypifolia* and *J. curcas* [11]. It has common names such as hospital too far, Catholic vegetable, Iyana-ipaja, lapalapa [12]. It is utilized majorly for fencing while its other uses are as a source of edible leafy vegetable and as medicine [13]. Research on toxicity and histopathological studies of the leaf

extract on rats showed no significant abnormalities in the tissues, but has a mild effects on the lungs and liver [14]. The herbal medicine from this species is prepared by squeezing the leaves to obtain a juice [11]. It is a good dietary source of mineral elements, since it compares favorably with other food substances in contents of trace elements such as zinc, iron and selenium [15, 16]. The antimicrobial properties of the leaf extract has been shown to inhibit the growth of *S. aureus* and *E.coli* [16].

It is important to note that natural food and food ingredients from plants have been proven to be safer and healthier than their synthetic ones [17], therefore studies on this species becomes a worthwhile pursuit. Understanding how declining soil fertility influence the growth, and production of mineral nutrients and secondary metabolites have attracted considerable attention to evaluate the influence of soil status on the mineral nutrients and phytochemical contents of the test plants.

Materials and methods:-

Study Area: The research was carried out in Abak in Akwa Ibom State (L1) and Yenagoa in Bayelsa State (L2), both in Nigeria. Abak has coordinates of 4°33'N and 7°33'E. Akwa Ibom State is located within the humid tropical rainforest Zone of South eastern Nigeria with a mean annual rainfall of about 2000mm, while the mean annual minimum and maximum temperature are 23°C and 31.7°C, respectively [18, 19]. Yenagoa is located at coordinates of 4° 55' 33.51"N and 6° 15' 33.58"E. Bayelsa State lies in the heaviest rainfall area of Nigeria with a mean minimum monthly temperature ranging from 25°C to 31°C [20].

Collection of Samples: Plant materials (leaves) of the test species were collected from the two (2) sampling location, Abak in Akwa Ibom State (L1) and Yenagoa in Bayelsa State (L2), both in Nigeria. Similarly, soil samples of L1 and L2 were collected for determination of soil- chemical properties. Three replicates were maintained per treatment using completely randomized design.

Analysis of Soil samples: Top soils of about 0-20cm depth collected from the study areas were analysed for soil-chemical properties (pH, organic carbon, total nitrogen, available Phosphorus, calcium, magnesium, potassium, zinc, copper, cadmium, iron and lead) using standard procedures [21].

Phytochemical analysis in Plant samples:-

The leaves of the test plant were analysed for the amounts of simple alkaloids, tannins, flavonoids, saponins, and glycosides using standard procedures [22, 23, 24, 25].

Mineral nutrient Analysis in Plant Samples:-

The method of [26] was used for mineral elements analysis in plant samples. Leaf samples of *Jatropha tanyorensis* were washed several times with water and rinsed with distilled water. They were placed in polybags, and thereafter dried in an oven maintained at 60°C to a constant weight. The dried plant samples were macerated to powder, and stored in sample bottles for analysis. The powdered plant samples were oven dried at 105°C for 2 hours, 1.0g weighed into a platinum crucible and placed in a muffle furnace maintained at 400°C. The powdered plant materials were ashed for 5 hours and then dissolved with 10cm³ of 1M HCL. The solution obtained was filtered through Whatman No. 1 filter paper into 50cm³ volumetric flask and made up to the required mark with distilled deionized water. Standard reagents for analytical experiment were used, and contents of mineral elements in the solution were determined using Atomic Absorption Spectrophotometer (AAS) of Unicam Model.

Statistical Analysis:-

The data generated from this study were assessed using Analysis of variance (ANOVA) and differences in the means were tested using Least Significant Differences (LSD) at probability level of 5% [27].

Results:-

The pH value of soils in L1 and L2 sampling locations were 5.10 and 5.30, respectively. The contents of total nitrogen, available phosphorus, calcium, magnesium, zinc, cadmium, lead and manganese in soil of L1 were comparatively ($P < 0.05$) higher than those of L2 sampling location, while the organic carbon, potassium, copper and iron contents in soil of L2 sampling location were significantly ($P < 0.05$) higher than those of L1 (Table 1). The alkaloids, tannins, saponins and glycosides contents in leaves of *Jatropha tanyorensis* in L1 sampling location were relatively higher ($P < 0.05$) than those of L2, while the flavonoids contents were higher than those of L1 sampling

location (Table 2). Higher contents of calcium, nitrogen, phosphorus, sodium, manganese, zinc and lead were recorded in leaves of *J. tanyorensis* in L1 relative to those of L2 sampling location. The leaves of *J. tanyorensis* recorded higher contents of magnesium, potassium, iron and copper which were relatively higher ($P < 0.05$) than those of L1 sampling location (Table 3).

Table 1:- Chemical Properties of Experimental Soils

Soil parameters	Sampling locations	
	L1 (Abak)	L2 (Yenagoa)
pH	5.30 \pm 0.92	5.10 \pm 0.24
Organic carbon (%)	1.44 \pm 0.34	2.06 \pm 0.53
Total nitrogen (%)	2.63 \pm 0.55	1.69 \pm 0.70
Avail. Phosphorus (%)	5.07 \pm 0.40	3.21 \pm 0.41
Calcium (mg/100g)	3.37 \pm 0.23	2.67 \pm 0.24
Magnesium (mg/100g)	3.19 \pm 0.21	2.17 \pm 0.19
Potassium (mg/100g)	1.72 \pm 0.32	2.82 \pm 0.58
Zinc (mg/100g)	0.17 \pm 0.01	0.14 \pm 0.06
Copper (mg/100g)	0.35 \pm 0.07	0.40 \pm 0.09
Cadmium (mg/100g)	0.21 \pm 0.02	0.10 \pm 0.02
Iron (mg/100g)	0.17 \pm 0.04	0.21 \pm 0.04
Lead (mg/100g)	0.08 \pm 0.01	0.03 \pm 0.01
Manganese (mg/100g)	0.06 \pm 0.01	0.02 \pm 0.00

Mean \pm standard error from three replicates

Table 2:- Quantitative analysis of phytochemical constituents in leaves of *Jatropha tanyorensis*

Phytochemicals	Sampling locations	
	L1 (Abak)	L2 (Yenagoa)
Alkaloids (%)	22.20 \pm 0.31	20.40 \pm 0.33
Tannins (%)	34.60 \pm 0.46	30.20 \pm 0.80
Flavonoids (%)	11.20 \pm 0.50	13.50 \pm 0.27
Saponins (%)	20.40 \pm 0.22	18.10 \pm 0.45
Glycosides (%)	10.09 \pm 0.26	8.22 \pm 0.76

Mean \pm standard error from three replicates

Table 3:- Mineral elements in Leaves of *Jatropha tanyorensis*

Mineral elements (mg/100g)	Sampling locations	
	L1 (Abak)	L2 (Yenagoa)
Calcium	16.50 \pm 0.21	14.20 \pm 0.30
Magnesium	10.86 \pm 0.33	11.92 \pm 0.45
Sodium	21.80 \pm 0.72	17.21 \pm 0.67
Potassium	14.90 \pm 0.35	16.07 \pm 0.56
Nitrogen	4.20 \pm 0.54	3.80 \pm 0.31
Phosphorus	0.50 \pm 0.07	0.37 \pm 0.03
Iron	0.14 \pm 0.03	0.18 \pm 0.04
Manganese	0.034 \pm 0.01	0.028 \pm 0.02
Copper	0.012 \pm 0.00	0.016 \pm 0.01
Zinc	0.58 \pm 0.03	0.50 \pm 0.03
Lead	0.002 \pm 0.00	0.00 \pm 0.00

Mean \pm standard error from three replicates

Discussion:-

There were variations in phytochemical contents in leaves of *J. tanyorensis* between the two sampling locations. These differences may be due to variation in the prevailing environmental factors in the two habitats. This result agrees with the work of [28] that bioactive compounds are secondary metabolites, which are affected by both environmental and plant nutrition factors. The production and activity of bioactive compounds are influenced by genetics and the environmental factors surrounding the habitat [7, 8]. Different agro-climatic conditions have been reported to have effects on the alkaloids, phenols, flavonoids, saponins, terpenes, total phenolic contents and antioxidant potential of *Aloe Vera* plant [5]. Improvement in soil fertility through application of organic amendment has been shown to increase the water content and the maturity stage of the leaves, thus contributing to a reduction in the content of total and individual glucosinolates as well as flavonoids and anthocyanins [29]. Soil properties such as

water status can inhibit primary metabolism and energy balance of the plant as well as alter the secondary metabolism of plant, and its sequestration of different plants [30, 31].

There were significant variations in elemental composition in leaves of *J. tanyorensis* between L1 and L2 sampling locations. This low nutrient composition in L2 location relative to L1 may be attributed to poor topography terrains that characterized the soil of L2 sampling location, together with environmental problems such as flooding and intense riverine setting of the habitat [4]. Eco-physiological influenced changes in plants elemental composition have been reported [32, 33]. Several factors such as age, cultural practices, environment, the season and the varieties have been reported to influence the nutrient composition of plants [34]. Factors such as pH, available nutrients, texture, organic matter content, soil water relationship, weather and climate factors among others have been reported to directly or indirectly affect the nutritional quality of plants [5]. In addition, soil pH and organic matter affect plant nutrient availability and soil functions. To a great extent, pH influence solubility, and availability of plant nutrients, and organic matter decomposition [35]. Soil organic matter, which is the key indicator to soil quality affects nutrient retention, water holding capacity and soil aggregation, in consequence influence the nutrient status of plant material [35].

Conclusion:-

This study shows that soil conditions have a strong influence on biochemical constituents of plants. The soil conditions in L1 sampling location enhanced the phytochemical and mineral nutrient contents in leaves of *J. tanyorensis* than that of L2 location. Therefore, appropriate soil improvement practices are required in L2 sampling location in order to improve the biochemical properties of this important species.

Conflict of interest:-

There was no conflict of interest between the two authors.

Acknowledgements:-

We wish to appreciate the contributions from Mr. Sunday Okpata, Department of Biology, and Mr Awolabi Akeem, Department of Biochemistry, Faculty of Science, Federal University Otuoke, Bayelsa State, Nigeria.

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