

FOLIAR MINERAL CONTENT OF FLUTED PUMPKIN (*Telfairia occidentalis* F.Hook) GROWN SOLE OR INTERCROPPED WITH MAIZE, CASSAVA OR THEIR MIXTURE.

Orji, J.O¹., Ibeawuchi, I. I¹., Obilo, O. P¹., Obiefuna, J.C¹., Peter-Onoh, C.A¹., Harriman, J.C²., Nze, E.O¹ and Abana, P.C¹.

¹. Department of Crop Science and Technology, Federal University of Technology Owerri, Imo State, Nigeria.

². Micheal Okpara University of Agriculture, Umudike, Abia State, Nigeria. ukpanken@yahoo.com

ABSTRACT

Telfairia occidentalis is a tropical vegetable predominantly grown in mixtures with food crops in Southeastern Nigeria. This study investigated the effect of different rates of poultry manure on the mineral content of *Telfairia occidentalis* when grown in *Telfairia* / cassava /maize mixtures. The field was laid out in a 4 x 5 factorial arrangement fitted into a randomized complete block design and replicated three times. The treatments consisted of five levels of organic manure (0, 2.5, 5, 7.5, 10 t/ha) were applied on four cropping systems (*Telfairia*-sole, *Telfairia* and cassava, *Telfairia* and maize and *Telfairia*, cassava and maize). Mineral content (N, P, K, Ca, and Mg) were determined at four, eight and twelve weeks after emergence (WAE). The result showed that increasing levels of poultry manure application resulted to increase in the mineral content as, at 4, 8 and 12 WAE. The highest nitrogen content (5.24, 4.80, 4.08) of *Telfairia* leaves was recorded at Poultry manure rate of 10.0t/ha. The highest, phosphorus content (53.90, 49.30, 47.40); potassium (1.18, 1.08, 1.00) and calcium content (1.05, 0.9) at 8 and 12 WAE were recorded at manure rate of 7.5 t/ha. *Telfairia* in the mixture recorded the highest nutrient content. The highest quality was recorded when 7.5 t/ha of poultry manure was applied to *Telfairia*, cassava and maize followed by *Telfairia* and maize then *Telfairia* and cassava. *Telfairia*-sole had poor quality irrespective of manure rate.

Keywords: *Poultry, Manure, Telfairia, Intercropping, Mineral*

1. Introduction

In the agro ecology of southeastern Nigeria, the most common cropping system consists of growing several crops in association or in mixtures (Edje, 1979). The simultaneous cultivation of different crops on the same piece of land has been described interchangeably as mixed cropping or intercropping which are all classified as multiple cropping, (Ruthenberg,1976). According to

Ibeawuchi, (2007), intercropping is the growing of two or more crops in proximity to promote interaction between them. Dalal (1974) reported that most scientist have proved that crops extract

more nutrients from the soil when grown in mixture than when grown in pure stands. Intercropping has evolved in different areas and is so deeply established among peasant farmers that a complete change of the system may not be acceptable to most farmers (Nnko and Doto, 1980).

Intercropping has been reported to have yield advantage over sole cropping; this could as a result of complementary use of growth resources such as nutrients, water and light by the component crops (Enyi, 1973). Irrespective of all the advantages of intercropping, there is still the problem of reduced yield of the component crops (Agboola and Fayemi, 1971); which could be due to competition for light, nutrients, water (Dalal, 1974; Willey, 1979); and allelopathic effects due to excretion of toxic substances by one or more crop component in the mixture (Dalal, 1974). Hence, it is necessary to improve intercropping in order to attain maximum yield.

Poultry manure as soil amendment to sustain adequate crop yields has been found effective for cereals and vegetable crops in south-western Nigeria (Adeleye *et. al.*, 2010). Also reported it has long been recognized as perhaps the most desirable of organic fertilizers because it supplies essentially nitrogen, phosphorus, potassium and many other essential plant nutrients. Generally, poultry manure application improves the physical properties of the soil. It significantly decreases bulk density and increases total porosity, infiltration capacity and water holding capacity (Amanullah *et. al.*, 2010). Poultry manure showed better performance in producing maize, vegetables and tubers (cassava) yield (Akande *et. al.*, 2005; Amanullah *et. al.*, 2007).

Telfairia occidentalis Hook f. known as fluted pumpkin is a member of cucurbitaceae family. It is one of the commonly consumed leafy and seed vegetables in Nigeria and is distributed around the tropics, (Renner *et. al.*, 2007). It has been suggested that it originated in south-east Nigeria and was distributed by the Ibos, who have cultivated this crop since time immemorial, (Kayode and Kayode, 2011). The largest diversity in plant populations can currently be found in Imo state and surroundings areas in South-eastern Nigeria (Olaniyi and Odere, 2009).

Telfairia leaves are rich in iron and play a key role in the cure of anaemia; they are also noted for lactating properties and are in high demand for nursing mothers (Okoli and Mgbeku, 1983). The seeds are very rich in oil, especially unsaturated fatty acids which form 61% of the oil (Odoemena and Onyeneke, 1998; Okoli and Nyanaya, 1988). The purpose of this research is to evaluate the yield and some mineral content of the leaves of *Telfairia occidentalis* intercropped with cassava, maize and their mixture.

2. Materials and Methods

The experiment was conducted at the Teaching and Research Farm, School of Agriculture and Agricultural Technology, Federal University of Technology Owerri, Imo state. Owerri is in the humid forest zone of Southeastern Nigeria and it is located on latitude 5° 27' 50.23" North and longitude 7° 02' 49.33" (Nwosu and Adeniyi, 1980).

2.1 Land Preparation

The land measuring 42 x 42 meters was cleared manually and tilled to make seed bed. The bed 4m long and 2m wide constitutes a treatment plot. The distance between each plot was 0.5m while the distance between the blocks was 1.0m. Cured poultry manure was measured and applied according to treatment. The soil samples randomly collected from the experimental site were analysed before the experiment.

2.2 Treatments and Experimental Design

Total of 20 treatments were laid out in a 4 x 5 factorial arrangement fitted into a randomized complete block design. Treatments consisted of four production systems (*Telfairia* sole, *Telfairia* and cassava, *Telfairia* and maize, and *Telfairia*, cassava and maize) and five levels of poultry manure; 0, 2.5, 5.0, 7.5 and 10t/ha respectively and replicated three times.

2.3 Planting and planting materials

The seeds of *Telfairia*, maize (Oba 2) and cassava cuttings (NR 8082) were collected from the genetic resource unit of Department of Crop Science and Technology, Federal University of Technology, Owerri. The healthy *Telfairia* pods were processed

for seeds which were shade dried for 2 days to reduce moisture and prevent decay. In both sole and intercrops, *Telfairia* was spaced 2.0 x 2.0m, cassava cuttings 20cm long were planted at 1.0x1.0 and maize was sown at 0.75x0.25m respectively. Weeding was done manually at 5 and 12 weeks after planting using hoe.

2.4 Mineral Analysis

After each harvest at 4, 8 and 12 WAE, yield samples were analysed for N, P, K, Ca and Mg in the Crop Science laboratory, Federal University of Technology, Owerri. *Telfairia* leaf samples collected at each harvest were air-dried and milled. The N was determined using micro-kjeldahl approach. For P, K, Ca and Mg samples were digested using nitric-perchloric-sulphuric acid mixture (Tel and Hagarty, 1984).

2.5 Statistical Analysis

Statistical analyses of the data were carried out using GENSTAT and SPSS (Genstat, 2012). The means were statistically separated using F-LSD at a significance level of $p \leq 0.05$.

3. Results and Discussion

The result of the mineral content (N,P,K,Ca,Mg) analysis of *Telfairia* leaves from different harvest intervals (4, 8 and 12 WAE) showed that as the levels of poultry manure increased the mineral content also increased (Tables 1 – 3). Poultry manure rate of 7.5 t/ha at 4, 8 and 12 WAE recorded the highest Nitrogen content (5.24, 4.80, 4.08); highest phosphorus content (53.90, 49.30, 47.40); highest potassium content (1.18, 1.08, 1.00). Calcium content was highest (1.05, 0.99) at poultry manure rate of 7.5 t/ha only at 8 and 12 WAE. Magnesium content of *Telfairia* leaves at 4, 8 and 12 WAE was highest (0.79, 0.60, 0.44) at poultry manure rate of 5.0 t/ha. These findings are in line with the work of Amanullah *et al.* (2007) who reported that the application of organic manure registered higher uptake of NPK than control. It also corresponds with the findings of Ano and Agwu, (2005) who stated that animal manure increased soil pH and macronutrients of the soil in southern Nigeria. Thus, this revealed that manure is known to have positive influence on soil.

Table 1: Effect of poultry manure rate and intercropping on nitrogen content (mg/100g) of harvested telfairia leaves at 4, 8 and 12WAE

Intercrop	MANURE RATE t/ha					Mean
	0.00	2.50	5.00	7.50	10.00	
4 WAE						
Telfairia (sole)	3.98	4.57	4.75	5.07	4.84	4.65
Telfairia + Cassava	4.08	4.68	5.03	5.34	6.05	5.03
Telfairia + Maize	3.79	4.04	4.77	4.97	4.88	4.48
Telfairia+Cassava+maize	4.51	4.47	4.68	5.00	5.20	4.77
Mean	4.09	4.44	4.81	5.09	5.24	
LSD (0.05) for manure rate		=	0.39			
LSD (0.05) for intercrop		=	0.35			
LSD (0.05) for manure rate X intercrop		=	N.S			
8 WAE						
Telfairia (sole)	3.03	4.03	4.07	4.27	4.83	4.05
Telfairia + Cassava	3.80	3.94	4.13	4.57	5.03	4.29
Telfairia + Maize	3.77	3.82	4.13	4.30	4.80	4.16
Telfairia+Cassava+maize	3.87	3.83	4.03	4.20	4.53	4.09
Mean	3.62	3.91	4.09	4.33	4.80	
LSD (0.05) for manure rate		=	0.26			
LSD (0.05) for intercrop		=	N.S			
LSD (0.05) for manure rate X intercrop		=	N.S			
12 WAE						
Telfairia (sole)	2.33	3.10	3.60	3.53	3.90	3.29
Telfairia + Cassava	3.13	3.00	3.20	3.67	4.20	3.44
Telfairia + Maize	3.27	2.83	3.67	3.40	4.23	3.42
Telfairia+Cassava+maize	3.00	2.97	3.30	3.33	3.97	3.31
Mean	2.93	2.98	3.37	3.48	4.08	
LSD (0.05) for manure rate		=	0.32			
LSD (0.05) for intercrop		=	N.S			
LSD (0.05) for manure rate X intercrop		=	N.S			

Table 2: Effect of poultry manure rate and intercropping on phosphorous (ppm) content of harvested telfairia leaves at 4, 8 and 12WAE

Intercrop	MANURE RATE t/ha					Mean
	0.00	2.50	5.00	7.50	10.00	
4 WAE						
Telfairia (sole)	33.70	44.80	35.70	34.50	38.70	37.50
Telfairia + Cassava	33.70	34.00	42.50	46.90	41.00	39.60
Telfairia + Maize	23.70	45.90	25.60	48.60	38.30	36.40
Telfairia+Cassava+maize	58.60	64.90	67.50	85.60	76.90	70.70
Mean	37.40	47.40	42.80	53.90	48.70	
LSD (0.05) for manure rate		=	N.S			
LSD (0.05) for intercrop		=	12.26			
LSD (0.05) for manure rate X intercrop		=	N.S			

8 WAE

Telfairia (sole)	27.00	35.30	29.00	29.30	33.70	30.90
Telfairia + Cassava	28.30	32.30	37.00	41.70	35.00	34.90
Telfairia + Maize	18.70	38.80	19.80	43.60	33.00	30.80
Telfairia+Cassava+maize	53.30	58.70	64.70	82.70	70.70	65.80
Mean	31.60	41.30	37.60	49.30	43.10	
LSD (0.05) for manure rate	=		N.S			
LSD (0.05) for intercrop	=		11.73			
LSD (0.05) for manure rate X intercrop	=		N.S			

12 WAE

Telfairia (sole)	25.30	33.30	27.00	27.30	32.00	29.00
Telfairia + Cassava	26.30	30.30	35.00	40.00	32.30	32.80
Telfairia + Maize	17.00	37.30	18.00	41.30	31.00	28.90
Telfairia+Cassava+maize	49.70	55.30	61.00	81.00	67.00	62.80
Mean	29.60	39.10	35.20	47.40	40.60	
LSD (0.05) for manure rate	=		N.S			
LSD (0.05) for intercrop	=		11.51			
LSD (0.05) for manure rate X intercrop	=		N.S			

Table 3: Effect of poultry manure rate and intercropping on potassium content (mg/100g) of harvested telfairia leaves at 4, 8 and 12WAE

Intercrop	MANURE RATE t/ha					Mean
	0.00	2.50	5.00	7.50	10.00	
4 WAE						
Telfairia (sole)	0.98	0.92	1.04	1.08	1.11	1.03
Telfairia + Cassava	0.89	1.96	1.04	1.24	1.09	1.05
Telfairia + Maize	0.85	1.07	1.29	1.17	1.02	1.08
Telfairia+Cassava+maize	0.97	0.98	1.12	1.25	1.00	1.06
Mean	0.92	0.98	1.12	1.18	1.06	
LSD (0.05) for manure rate	=		0.09			
LSD (0.05) for intercrop	=		N.S			
LSD (0.05) for manure rate X intercrop	=		N.S			
8 WAE						
Telfairia (sole)	0.87	0.87	0.93	1.00	1.03	0.94
Telfairia + Cassava	0.77	0.83	0.97	1.03	0.93	0.91
Telfairia + Maize	0.83	1.00	1.10	1.07	0.97	0.99
Telfairia+Cassava+maize	0.83	0.87	1.00	1.20	0.70	0.92
Mean	0.82	0.89	1.00	1.08	0.91	
LSD (0.05) for manure rate	=		0.09			
LSD (0.05) for intercrop	=		N.S			
LSD (0.05) for manure rate X intercrop	=		0.18			
12 WAE						
Telfairia (sole)	0.77	0.77	0.83	0.90	0.93	0.84
Telfairia + Cassava	0.70	0.77	0.87	0.93	0.83	0.82
Telfairia + Maize	0.93	1.10	1.20	1.17	1.07	1.09
Telfairia+Cassava+maize	0.73	0.73	0.90	1.00	0.73	0.82
Mean	0.78	0.84	0.95	1.00	0.89	
LSD (0.05) for manure rate	=		0.11			
LSD (0.05) for intercrop	=		0.10			
LSD (0.05) for manure rate X intercrop	=		N.S			

The intercrop showed that among all the mineral contents analyzed, only calcium at 4, 8 and 12 WAE recorded the highest values (1.15, 1.09, 1.00) at Telfairia – sole while others N, P, K and Mg recorded the highest values where Telfairia was planted in mixtures. At 4, 8 and 12 WAE, the highest values for nitrogen (5.03, 4.29, 3.44) was recorded at Telfairia and cassava; phosphorus (70.70, 65.80, 62.80) was recorded at Telfairia, cassava and maize; potassium (1.08, 0.99, 1.09) at Telfairia and maize; Magnesium (0.88, 0.69, 0.51) at Telfairia, cassava and maize. These findings are in line with the report of Steiner, (1991) that intercropping provided a fast

and good ground cover and also allows the roots to exploit soil nutrients at various depths. The findings are also in line with Kurt, (1984); Gomez and Gomez, (1986) who stated that intercropping prevents run-off and leaching as the soil is not exposed to erosion due to the multi-storey cropping which provides a nearly continuous soil cover thus preventing it from the direct impact of the rains. It has also been observed that the roots of intercrops freely intermingle resulting in complementary interactions between the root systems, such as N transfer or complementary use of different nutrients (Natarajan & Willey, 1980)

Table 4: Effect of poultry manure rate and intercropping on calcium content (mg/100g) of harvested telfairia leaves at 4, 8 and 12WAE

Intercrop	MANURE RATE t/ha					Mean
	0.00	2.50	5.00	7.50	10.00	
4 WAE						
Telfairia (sole)	1.06	1.60	1.12	1.00	0.94	1.15
Telfairia + Cassava	0.97	1.06	1.15	1.86	0.89	0.99
Telfairia + Maize	1.05	0.96	1.04	1.00	0.83	0.96
Telfairia+Cassava+maize	1.02	1.04	1.07	1.89	0.93	0.99
Mean	1.03	1.17	1.09	0.91	0.90	
LSD (0.05) for manure rate		=	0.14			
LSD (0.05) for intercrop		=	0.13			
LSD (0.05) for manure rate X intercrop		=	N.S			
8 WAE						
Telfairia (sole)	0.85	1.16	1.06	1.53	0.84	1.09
Telfairia + Cassava	0.74	0.72	0.94	0.95	0.66	0.80
Telfairia + Maize	0.76	0.85	0.76	0.83	0.64	0.77
Telfairia+Cassava+maize	0.76	0.76	0.71	0.90	0.82	0.79
Mean	0.78	0.87	0.87	1.05	0.74	
LSD (0.05) for manure rate		=	N.S			
LSD (0.05) for intercrop		=	0.20			
LSD (0.05) for manure rate X intercrop		=	N.S			
12 WAE						
Telfairia (sole)	0.83	1.10	0.93	1.40	0.72	1.00
Telfairia + Cassava	0.63	0.60	0.84	0.83	0.63	0.71
Telfairia + Maize	0.63	0.68	0.57	0.73	0.53	0.63
Telfairia+Cassava+maize	0.67	0.87	0.90	1.00	0.73	0.83
Mean	0.69	0.81	0.81	0.99	0.65	
LSD (0.05) for manure rate		=	N.S			
LSD (0.05) for intercrop		=	0.21			
LSD (0.05) for manure rate X intercrop		=	N.S			

Table 5: Effect of poultry manure rate and intercropping on magnesium content (mg/100g) of harvested telfairia leaves at 4, 8 and 12WAE

Intercrop	MANURE RATE t/ha					Mean
	0.00	2.50	5.00	7.50	10.00	
4 WAE						
Telfairia (sole)	0.51	0.61	0.69	0.65	0.44	0.58
Telfairia + Cassava	0.41	0.51	0.48	0.58	0.49	0.50
Telfairia + Maize	0.46	0.57	0.85	0.64	0.45	0.60
Telfairia+Cassava+maize	0.87	0.92	1.13	0.83	0.64	0.88
Mean	0.56	0.65	0.79	0.68	0.50	
LSD (0.05) for manure rate		=	0.09			
LSD (0.05) for intercrop		=	0.08			
LSD (0.05) for manure rate X intercrop		=	0.17			
8 WAE						
Telfairia (sole)	0.31	0.41	0.49	0.46	0.24	0.38
Telfairia + Cassava	0.22	0.31	0.29	0.38	0.29	0.30
Telfairia + Maize	0.26	0.36	0.65	0.44	0.25	0.40
Telfairia+Cassava+maize	0.67	0.72	0.96	0.63	0.46	0.69
Mean	0.37	0.45	0.60	0.48	0.31	
LSD (0.05) for manure rate		=	0.08			
LSD (0.05) for intercrop		=	0.08			
LSD (0.05) for manure rate X intercrop		=	0.17			
12 WAE						
Telfairia (sole)	0.20	0.23	0.30	0.27	0.13	0.23
Telfairia + Cassava	0.13	0.18	0.17	0.18	0.16	0.17
Telfairia + Maize	0.16	0.16	0.49	0.28	0.13	0.24
Telfairia+Cassava+maize	0.37	0.52	0.80	0.43	0.30	0.51
Mean	0.24	0.27	0.44	0.29	0.18	
LSD (0.05) for manure rate		=	0.07			
LSD (0.05) for intercrop		=	0.06			
LSD (0.05) for manure rate X intercrop		=	0.15			

4. Conclusion

Since increasing levels of poultry manure resulted to an increase in foliar mineral content and Telfairia leaves in the mixture recorded higher mineral content than those grown in sole; one can conclude that poultry manure is an efficient source of mineral (N,P,K,Ca and Mg) and growing Telfairia in intercrop improves quality of Telfairia leaves.

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