Effect of rubber effluent and urea fertilizer on the growth, yield and leaf quality of fluted pumpkin (telfairia occidentalis)

Dunsin O.[1*], Aboyeji C.M[1], Agbaje G.O[1] and Ehi-eromosele S.[1]

Department of Crop & Soil Sciences, Landmark University, PMB 1001, Omu-Aran, Kwara-State. Nigeria
*Corresponding author's e-mail: dunsin.oluwagbenga@lmu.edu.ng

Abstract: The utilization of agro-processing by-products as a veritable source of nitrogen for vegetable production is being popularized. An experiment to determine the effect of rubber effluent as an inorganic fertilizer on the growth, yield and nutritional composition of fluted pumpkin (*Telfairia occidentalis* Hook. F) was conducted at Landmark University Teaching and Research Farm between 2014. The experiment consisted of four treatments which are: control, rubber effluent, urea, and rubber effluent + urea laid out in a randomized complete block design (RCBD) with three replicates. Data on the response of the morphological traits such as vine length, number of leaf/plant, and leaf area recorded fortnightly 2 weeks after transplanting while proximate composition on leaf were determined after harvest. Parameters assessed were significantly ($p<0.05$) increased by the applied fertilizer types. Rubber effluent + urea had the highest vine length at 4, 6, 8, and 10 WAT, urea fertilizer, had the highest leaf number at 8 & 10 WAT, while the leaf area was highest at 8 & 10 WAT with rubber effluent + urea treatment. The crude protein (41.76 %) was highest at rubber effluent + urea treatment, while treatment with rubber effluent had the highest % ether extract (13.33%) and crude fibre (7.5 %).

[Dunsin O., Aboyeji C.M, Agbaje G.O., and Ehi-eromosele S. **Effect of rubber effluent and urea fertilizer on the growth, yield and leaf quality of fluted pumpkin (telfairia occidentalis).** *N Y Sci J* 2015; 8(9):70-73].(ISSN:1554-0200). http://www.sciencepub.net/newyork. 13

Keywords: *Telfairia occidentalis,* rubber effluent, yield, leaf quality

Introduction

Vegetable cultivation is one of the dynamic branches of agriculture, and from the point of view of the economic value of its produce, it is one of the most important. Its production and consumption dates far back in Africa history. Attention to vegetables as a vital component in our daily diets has helped in reinforcing the significant roles that leafy vegetables plays as an important components in the African diets (Smith and Eyzaguirre, 2007). Vegetables are of great importance in human diets and they will continue to remain as the primary cheapest source of protein, energy, lipids, and carbohydrates, including fibres, vitamins and minerals in developing countries (Oyolu, 1980; Lima *et al*., 2009). One of such vegetable of great economic importance is *Telfairia occidentalis* popularly known as fluted pumpkin. It is among the major leafy vegetables grown that is indigenous to West Africa (Nkang *et al*., 2003). Fluted pumpkin is known to be currently gaining popularity as the most important and extensively cultivated food and income generating crops in many parts of Africa (Adebisi-Adelani *et al.*, 2011) because of its undeniable contribution to human diets. One of its major health benefit is that it is used for treatment of anaemia, chronic fatigue, diabetes (Dina, *et al*., 2006) and also used for treatment of oxidative damage condition such as cancer, liver and liver diseases because it is high in antioxidant and free radical scavenger properties (Janet, 2012).

Despite the great nutritional and economic importance of vegetables especially fluted pumpkin in many African diets, farmers are facing lots of problem concerning its production. Fashina *et al*. (2002) reported lower yield and quality of leaves and seeds. This lower yield and leaf quality can be due to factors such as use of local varieties, low fertility status of soils especially in Nitrogen, Potassium and Phosphorus, The low fertility status of some of our Nigerian soils hinders the proper growth and performance of vegetable crops. As a result, its production is encouraged through better improved farming practices to increase yield. For yield expansion of *T. occidentalis* in Nigeria there is a great need to augment the production of the crop by improving the fertility status of the soil in order to meet up with the nutrients requirement of the soil. One of the requisites for improving the soil fertility is thus through the use of organic fertilizers. The particular significance of organic fertilizer for soil fertility is that it influences so many different soil properties (Awodun, 2007). It has been reported that the rate of application of organic manure showed a significant increase on growth and yield of plants (Offiong et al., 2010). With the recent increasing demand for fluted pumpkin in the country, there is limited information on the type of fertilizer and nutrient requirement for optimal nutrient uptake, leaf quality and yield. Hence, the project will help to know the effect of rubber effluent on the growth, yield and quality of leaf of *Telferia occidentalis*.

Materials and Methods

The field experiment was conducted at the Teaching and Research Farm of Landmark University, Omu-Aran, Kwara state (Latitude 8 ° 9 ° 0"N and Longitude 5° 61° 0"E) located at the southern Guinea savannah zone of Nigeria. The experimental site is composed of a texturally laterite soil type which contains high proportion of iron and aluminium as residue. Soil samples were randomly taken with auger at a depth of 0-15cm from the site after it had been prepared for cultivation. The samples was collected and packaged into sub-samples and taken for laboratory analysis to determine the physical and chemical properties of the soil.

Rubber effluent was obtained from Odia rubber factory, Benin City, left to ferment for 28 days before the effluent was analysed for N, P, K Mg and Ca following the methods outlined by AOAC (1980). Fluted pumpkin pods were purchased from Omu-Aran market in Kwara state. The seeds were extracted from the pods and one seed was placed in a polythene bag filled with top soil. The bags were covered with grasses to prevent them from direct sunlight and also to enhance warmth, air and moisture (conditions necessary for germination). Water was sprinkled on the bed at least once daily. Sprouted seeds were transplanted after two weeks. Treatments include Control (T_1), Rubber effluent (T_2), Urea fertilizer (T_3) and Urea + rubber effluent (T_4). The rubber effluent was passed through a 2mm sieve to remove suspended particles of various sizes before they were uniformly spread on the plots using a knapsack sprayer two weeks before transplanting and the fertilizer was applied at an equivalent rate of 60 kgN/ha at a weeks after transplanting. The treatments were laid out in a Randomized Complete Block Design (RCBD) with three replicates. The experimental field of 24m by 10m was divided into three blocks each containing 5 beds giving a total of 15 beds in the site. Each bed size constructed was 4m by 3m (12m) containing 12 plant stands and a total of 180 plant stands grown in the site. Alley of 1m apart was created as a form of demarcation between beds and which can also help to prevent runoff of nutrients from one bed to another. The blocks were spaced at 0.6m apart for easy movement during cultural operations. Sprouted vigorous fluted pumpkin seeds were transplanted to the experimental site at a spacing of 1m by 1m. The seedlings were watered manually twice daily (morning and evening) and weeding at sight was done regularly to ensure maximum growth of crop. The experimental area and the surroundings were kept clean to prevent harboring of pest. Staking vertically and horizontally was done immediately at vine initiation. Insects were controlled using insecticide at a rate of 100ml per 100l of water. The leaves of the fluted pumpkin were harvested at 10 weeks after seedling transplant. Data on growth parameters (vine length, number of leaves and leaf area) were collected at 4, 6, 8 and 10 weeks after transplanting (WAT), fresh leaf samples of fluted pumpkin were collected and proximate analysis for its nutrients were determined based on the official methods of analysis of the AOAC (1980). The data collected on various parameters were subjected to analysis of variance using SAS software programme. The means were separated using Duncan Multiple Range Test (DMRT) at 5% level of probability.

Result and Discussion

Physical and Chemical Properties of Soil and Rubber effluent

The laboratory result of the rubber effluent used for the study revealed that the effluent is slightly acidic and contained N, P, K, Mg, Ca and organic carbon (Table 1), which could be utilized by crops for its growth and development and these results was in accordance with the findings of Orhue *et al.*, (2007) and Augusthy and Mani (2001) who stated that high significantly amounts of total suspended and dissolved solids, phosphates and total nitrogen in rubber effluent. Waizah *et al*., (2011) has opined that the application of urea and rubber effluent improved the general soil chemical properties and indicated that this change can be attributed to the increase in the soil nutrient level and a more conducive environment for the activities of microorganisms to proliferate thereby increasing the fertility status of the soil.

Table 1: Physical and Chemical Properties of the Soil (0-15cm) before Experiment

Parameters	Mean value	Rubber effluent
pH (O)	5.60	5.40
Organic carbon (%)	1.02	2.086
Nitrogen (%)	0.157	2.43
Sodium mg/l	0.021	1.04
Potassium mg/l	0.108	3.95
Calcium mg/l	0.004	4.52
Available Phosphorus (mg/kg)	12.50	38.1
Magnesium (mg/l)	0.13	0.35

Growth Character

The vine length of Fluted pumpkin increased significantly ($p<0.05$) by the application of rubber effluent and inorganic fertilizer across the four sampling period of 4, 6, 8 and 10 weeks after transplanting (WAT), with rubber effluent + urea fertilizer showing the superiority in vines among the treatment (Table 2). The number of leaves were significantly influenced (p<0.05) by application of the rubber influence and urea. There was a constant increase in number of fluted pumpkin leaves for 4-10 week after transplanting in all treatments except the control. Plants resulting from rubber effluent + urea application constantly had highest number of leaves at 6, 8 and 10WAT while treatment with Urea application has the highest number of leaves at 4WAT and 12WAT. The leaf area was significantly influenced by fertilizer applied on the treatment. Treatment with rubber effluent + urea had the highest leaf area index, followed by Urea and rubber effluent respectively as compared to the control treatment. The increase experienced in vine length, number of leaves and leaf area may be imputed to the presence of plant nutrient in rubber effluent applied assist in promoting an early growth and subsequently development leading to greater yield in fluted pumpkin. This increase in the vegetative growth and yield is similar to earlier reports of Orhue *et al*. (2005) in *Dialium guineense* seedlings and Orhue and Osaigbovo (2013) in maize. It was reported that this increase could be attributed to the presence of high level soil nutrient provided by the effluent which is readily utilized by the crop for its growth and development.

Table 2. Effect of rubber effluent on the vegetative traits of fluted pumpkin at 4, 6, 8 and 10 weeks after transplanting (WAT).

VINE LENGTH (CM) WAT					NO OF LEAVES/PLANT WAT				LEAF AREA INDEX WAT			
Treatments	4	6	8	10	4	6	8	10	4	6	8	10
Control	51.50	68.47	85.70	138.57	33.9	48.93	78.30	123.5	16.77	25.6	33.03	40.77
Rubber effluent	86.00	104.80	123.17	175.90	51.67	67.97	90.87	173.43	30.17	41.13	53.20	67.93
Urea	99.73	114.57	131.07	178.57	58.77	79.47	108.63	214.03	32.97	46.90	60.53	71.30
Rubber effluent + urea	97.14	116.63	136.03	200.90	53.53	83.83	112.80	191.1	34.4	45.57	54.90	79.97

Mean values with the same letter in the column are not significantly different from one another at P< .05.

Proximate Composition

This study revealed that nutrient content of fluted pumpkin was significantly affected by the application of rubber effluent and urea (Table 3). Treatment with rubber effluent + urea had the highest percentage of crude protein, closely followed by urea. This result is in affirmation with the fact that addition of nitrogen in form of fertilizer could increase uptake thereby resulting in higher protein content (Stephen et al., 2014), hence improved quality of the vegetable crop. Although the % ether extract and crude fibre was found to be highest in treatment with rubber effluent followed by rubber effluent + urea. Total ash content was higher in treatment with Urea which is in agreement with result obtained by Stephen *et al*. (2014).

Table 3: Effect of fertilizers on the proximate composition of fluted pumpkin

TREATMENTS	%Crude Protein	% Crude Fat	%Crude Fibre	% Ash
Control	36.11	11.67	2.5	9
R.E	40.72	13.33	7.5	8.33
Urea	40.91	6.67	5	10
R.E + Urea	41.76	8.33	6	8.33

Conclusion

The study revealed that the application of rubber effluent had a positive impact on the vegetative growth, yield and nutrient content of fluted pumpkin. Rubber effluent improved the soil physical characteristics by increasing the organic matter and nutrient content of the soil. The application of rubber effluent combined with urea gave the highest vegetative and yield attributes of fluted pumpkin. The study also revealed that rubber effluent significantly improves the nutritional quality of fluted pumping leaves. Therefore, it could be concluded that rubber effluent could be gainfully harnessed as a soil conditioner in combination with Urea fertilizer.

References

1. Adebisi-Adelani O, FB Olajide-Taiwo, IB Adeoye, LO Olajide Taiwo (2011). Analysis of Production Constraints facing Fadama Vegetable

Farmers in Oyo State, Nigeria. World J. Agric. Sci., 7(2)189-192.
2. AOAC. 1980. Official methods of analysis.13th Edition. Association Official Analytical Chemistry, Washington DC.
3. Augusthy, P. O. and Mani A. S. 2001. Effect of rubber factory effluent on seed germination` and seedling growth of *Vigna radiata J. Environ. Biol. 22: 137 - 139.*
4. Awodun, M.A, 2007. Effects of poultry manure on the growth, yield and nutrient contents of fluted pumpkin (Telfairia occidentalis). Asian Journal of Agricultural Research 1:67-73.
5. Dina O. A, Adedapo AA, Oyinloye OA, Saba AB (2006). Effect of Telfaria occidentalis extract on experimentally induced anaemia in domestic albino rats. Afr. J. Biomed. Res. 3:181-188.
6. Fashina, A. S, Olatunji, K. A., and Alasiri K. O., (2002). Effect of different plant populations and poultry manure on the yield of Ugu (Telfairia occidentalis) in Lagos State, Nigeria. In: Proceedings of the Annual Conference of Horticultural Society of Nigeria (HORTSON), 14-17th May 2002; NIHORT, Ibadan, Nigeria.
7. Janet O. A. (2012). Production, Marketing, Nutritional Value and Uses of Fluted Pumpkin (Telfairia occidentalis HOOK. F.) in Africa. Journal of Biological Science and Bioconservation, Volume 4, ISSN 2277-0143.
8. Lima, G.P.P., Lopez, T.V.C., Roseto, M.R.M. and Vianello, F. (2009). Nutritional composition, Phenolic compounds, nitrate content in eatable vegetables obtained by conventional and certified organic grown culture subject to thermal treatment. International journal of Food Science and Technology 44: 1118-1124.
9. Nkang, A., D. Omokaro, A. Egbe and G. Amanke, 2003.Variations in Fatty Acid Proportions During Desiccation of Telfairia occidentalis Seeds Harvested at Physiological and Agronomic. Afr. J.Biotechnol., 2: 33-39. 10.

Offiong, M. O., Udofia, S. I., Owoh, P. W. and Ekpenyong, G. O. 2010. Effects of Fertilizer on the Early Growth of Tetrapleura tetraptera (DEL). Nigerian Journal of Agriculture, Food and Environment. 6(1&2):53-59.

11. Orhue, E. R. and Osaigbovo, A. U. (2013). The effect of rubber effluent on some chemical properties ofsoil and early growth of maize (zea mays l). Bayero journal of pure and applied sciences, 6(1): 164 - 168.
12. Orhue, E. R. Osaigbovo, A. U. and Vwioko D. E. 2005. Growth of maize (Zea mays) and changes in some chemical properties of an ultisol amended with brewery effluent. African Journal of Biotech 4 (9) 973-978.
13. Orhue, E. R., Uzu, F. O. and Osaigbovo, U. A. (2007). Effect of combining rubber effluent with single superphosphate on some soil chemical properties and early growth of maize. .Journal of Agronomy 6: 250 - 261.
14. Oyolu, C., 1980. Maximising the contribution of okro (hibiscus esculentus) to the national diet. Proceedings of the National Conference of Chemical Society of Nigeria Held at the University of Ife, Nigeria.
15. Smith F, I. and Eyzaguirre P.; African Leafy Vegetables: Their roles in the World Health's Organisation global fruit and vegetables initiatives. African Journal of Food Agriculture Nutrition and Development, Vol. 7, No. 3, 2007.
16. Stephen Oyedeji, David Adedayo Animasaun, Abdullahi Ajibola Bello, and Oludare Oladipo Agboola, "Effect of NPK and Poultry Manure on Growth, Yield, and Proximate Composition of Three Amaranths," Journal of Botany, vol. 2014, Article ID 828750, 6 pages, 2014. doi:10.1155/2014/828750.
17. Waizah, Y, F. O. Uzu, J. R. Orimoloye, and S. O. Idoko, 2011. Effects of rubber effluent, urea and rock phosphate on soil properties and rubber seedlings in an acid sandy soil. African Journal of Agricultural Research Vol. 6(16), pp. 3733-3739.

9/17/2015