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

occidentalis)

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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 %).

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Introduction Despite the great nutritional and economic

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).

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

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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 (T1), Rubber effluent (T2), Urea fertilizer (T3)

and Urea + rubber effluent (T4). 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

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

Mean Rubber

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

Parameters

pH ( O)

Organic carbon (%)

Nitrogen (%)

Sodium mg/l

Potassium mg/l

Calcium mg/l

Available Phosphorus

(mg/kg)

Magnesium (mg/l)

Growth Character

value effluent

5.60 5.40

1.02 2.086

0.157 2.43

0.021 1.04

0.108 3.95

0.004 4.52

12.50 38.1

0.13 0.35

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

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

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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

Treatme

NO OF LEAVES/PLANT WAT

LEAF AREA INDEX WAT

nts

Control

Rubber

effluent

Urea

Rubber

effluent

+ urea

4 6 8

51.50 68.47 85.70

86.00 104.80 123.17

99.73 114.57 131.07

97.14 116.63 136.03

10 4 6

138.57 33.9 48.93

175.90 51.67 67.97

178.57 58.77 79.47

200.90 53.53 83.83

8 10 4 6 8 10

78.30 123.5 16.77 25.6 33.03 40.77

90.87 173.43 30.17 41.13 53.20 67.93

108.63 214.03 32.97 46.90 60.53 71.30

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

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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.

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