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Effect of Weed Management and Cutting Frequency on the Leaf Yield and Proximate Composition of Fluted Pumpkin (*Telfairia occidentalis* Hook F.).

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Abstract: Field and laboratory experiments were carried out from April to October 2011 at the Department of Crop Science Research Farm and Laboratory to evaluate the effect of cutting intervals and weed management options on the proximate compositions of fluted pumpkin. In the field, the experiment was laid out as a split plot with three cutting intervals as the main plot and six weed managements as the sub plot. The treatments arranged in a randomized complete block design (RCBD) with three replications. Data on yield attributes of the plant were collected. Air dried leaf samples were analyzed for proximate composition. The results showed that cutting frequency and weed management significantly ($p < 0.05$) affected the proximate composition of the leaves and yield of fluted pumpkin. The highest dry weight, fresh weight, length of vine cut, number of vine cut and leaf yield were obtained on plots mulched by polyethylene irrespective of the cutting intervals employed. Fluted pumpkin leaves harvested at eight weekly intervals in hoe weeded plots had significantly ($p<0.05$) higher ash content (20.34 %) compared to other weed management and cutting frequency options. Plots with no cutting but mulched with polyethylene produced leaves with significantly ($p < 0.05$) higher crude fat content (1.08 %) relative to other treatment combinations. Polyethylene mulched plots harvested at 4 weekly intervals produced higher moisture content (13.50 %) and significantly ($p < 0.05$) higher crude protein (42.12 %). Again the interaction of hoe weeded plots and 8 weekly cutting intervals produced higher carbohydrate content (36.19 %) compared to other treatment combinations. This findings will add to the repository of crop food value enhancement through cultural practices.

Key words: Cutting interval · Proximate composition · Weed management · *Telfairia occidentalis*

INTRODUCTION

Telfairia occidentalis Hook F. (Fluted pumpkin) is one of the most important vegetables grown in southern Nigeria. It is generally regarded as a leaf and seed vegetable. It is a pot-herb [1]; cultivated mainly for its succulent young leaves and shoots which are used as vegetables. It is a high climbing perennial with partial drought tolerance and parenting root system [2]. The leaf has a high nutritional, medicinal and industrial values being rich in protein (29 %), fat (18 %), minerals and vitamins (20 %) [3, 4]. It has non-drying oil in the seed and is useful in soap making and cooking [5]. In the recent time, fluted pumpkin had gained medicinal recognition having been discovered to be purifiers [6] and could therefore be useful in the maintenance of good health, most especially among poor resource ruralities in developing countries. Akoroda [7] observed that *Telfaria occidentalis* is a common homestead garden crop in southern Nigeria, mostly cultivated by women.

Weeds reduce the quality and quantity of agricultural production [8]. Ayeni [9] revealed that the number one pest which farmers contend with in 25 out of 30 common crops were weeds. Weber *et al*. [10] reported that weeds and shortage of labour for their removal are two of the most important production constraints in smallholder farms in the Northern Guinea Savanna (NGS) of Nigeria. Smallholder farmers spend 50-70 % of their total available farm labour on weed control and this is usually carried out by hoe-weeding. Although a lot of energy and resources are expended in removing weeds, crop yields are generally very low, partly due to untimely and ineffective weed control. Although Ogar and Asiegbu [11] concluded that harvest schedule of 2-4 weekly internals gave high

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marketable vegetables, the effect of such harvest on the proximate composition is not known. With this background, the present study was conducted to evaluate the effect of cutting frequency and weed management on the proximate composition of fluted pumpkin.

MATERIALS AND METHODS

The field and laboratory experiments were conducted during 2011 planting season at the Teaching and Research Farm and Analytical Laboratory of the Department of Crop Science, University of Nigeria, Nsukka. Nsukka is located in the derived savanna (06°52″;07°24″ E) and has an altitude of 447 m above mean sea level.

Soil Sample Collection and Analysis: Soil samples were randomly collected from eight locations on the experimental site at 0 to 20 cm depth prior to treatment application for the determination of the physic-chemical properties of the site. The samples were bulked and a composite sub-sample obtained, air-dried, sieved with a 2 mm sieve for laboratory analysis.

Experimental Design and Layout: Treatments consisted of six weed management options and three cutting frequencies. The weed management options were black polyethylene mulch, sawdust cover at the rate of 53.33 tonnes/ha supplemented with hoe weeding at 8 weeks after transplanting, pre-emergence application of atrazine at the rate of 2.25 kg a.i/ ha supplemented with hoe weeding at 8 weeks after transplanting, hoe-weeding at 4 weekly intervals, weed free check and weedy check plots. The cutting frequencies were 0, 2 and 4 weekly cutting intervals. These were laid out in a split plot arranged in randomized complete block design with three replications. The main plots comprised the cutting frequencies, while the weed management options was the sub plots. There were 18 plots per block each measuring 4 m by 3 m (12 m^2). Distance between sub-plots was 0.5 m and between two main plots was 1 m. A 2 m path-way was used to separate two blocks. The weed management options were randomized within the main plots according to the different cutting frequencies.

Land Preparation, Fertilizer Application and Planting: Healthy seeds were extracted from pods and pre-sprouted in a nursery box filled with sawdust for two weeks before transplanting. Healthy sprouted seedlings were transplanted to the field at a spacing of 1m x 1m apart. There were 12 plants per plot and this gave a population of 10,000 plants per hectare. The experimental site was ploughed, harrowed and ridged and later converted to beds. Fully decomposed pig dung (10 kg) was applied to each plot as a blanket application before the treatments were assigned to each plot. Split doses of NPK 20:10:10 at the rate of 750 kg/ha was applied to each plot at 4 and 10 weeks after transplanting using ring method.

Data Collection and Analysis: Two middle row plants per plot were used as sampling plant and the following harvest and yield data were collected from both the sampling plant and the whole plots.

- Number of vine cut was recorded by counting the number of vines harvested from the sampling plant.
- Length of longest vine cut was recorded by taking the length of the longest vine harvested from base to the apical bud with a metre rule.
- Weed index was calculated using the formula below:

$$WI\ (\%) = \frac{\text{Average yield of the crop inweed free plot} - \text{Average yield of the crop in plot under weed control treatment}}{\text{Average yield of the crop in weed free plot}} x100$$

- Fresh leaf yield per hectare (kg/ha): this was done by harvesting leaves on the plots and the figure extrapolated to yield per hectare.
- Fresh and dry weight per plant (g) were recorded by weighing the fresh and dry weight of leaf harvest per sampling plant

At each harvest based on the cutting frequency, leaves were air dried. The dry leaf samples were weighed and ground into uniform powder using Thomas Wiley Laboratory Mill Model 4 and stored in an air tight container for 20 days. The ground leaves were subjected to chemical analysis for proximate composition. The proximate composition was done to obtain values for the moisture content, crude protein, crude fiber, crude fat and ash following the procedures described by AOAC [12]. The moisture content was determined by air-oven drying as weight differences at 130°C for one hour and the crude protein contents by micro-kjeldahl method (% total nitrogen x 6.25; [13]). The crude fiber was determined using dilute acid and alkali hydrolysis. Crude fat was quantified by the method described by AOAC [13] with soxhlet apparatus using dimethyl ether (boiling range 30- 60°C) as the solvent. Ash was also determined by the incineration of 10 g 0f each sample placed in a muffle furnace maintained at 550°C for five hours. The total carbohydrates were calculated by difference: Total carbohydrates (%) = 100 – (crude protein+ crude fats+ crude fiber +ash) [13].

Data Analysis: The data collected were subjected to analysis of variance (ANOVA) using Genstat 3.0 release (2005) package to test for differences in the treatments. Mean separation was done using Fishers Least Significant Difference (F-LSD) as outlined by Obi [14].

RESULTS

The soil of the experimental site was characterized texturally as a sandy clay loam (Table 1). The pH was rather low, being high in exchangeable acidity. The N and K content were low, while P was high. Magnesium and Calcium contents and the base saturation were also low.

At the first four weeks after transplanting, there was no significant difference in dry weight of leaves at one month after transplanting (MAT) among the weed management options (Table 2). However, sawdust cover and weed free plots recorded higher leaf dry weight (26.50 g and 23.90 g, respectively) when compared with other weed management options. Sawdust cover produced the highest leaf fresh weight and yield per hectare which was statistically similar to those of weed free check and weedy check but significantly ($p < 0.05$) higher than the rest of the weed management options. A significantly ($p < 0.05$) lower weed index was obtained in weedy check plots (0.40 %) compared to other treatments. At 2 MAT, the whole parameters measured were not significant ($p > 0.05$), however, plots with polyethylene mulch consistently recorded higher dry weight (82.90 g), fresh weight (583.00 g), number of vine (8.83) and leaf yield (1457.0 kg/ha) compared to other weed management options (Table 2).

At 3 MAT, there was no significant difference in plant dry weight and weed index. Black polyethylene mulched plots produced the highest fresh weight of leaves and leaf yield per hectare, which were statistically similar to those of hoe weeded plots and weed free plots. On the other hand, plots with pre-emergence herbicide were significantly ($p < 0.05$) lower compared to other treatments. Hoe weeded plots gave the highest length of vine cut (211.30 cm) which was significantly ($p < 0.05$) higher than the rest of the weed management options. Weed free check recorded the highest number of vine cut (9.33), which was statistically similar to that of black polyethylene mulch but significantly ($p < 0.05$) higher than other weed management options (Table 2).

Yield data presented in Table 3 showed that all the parameters measured were not significant except number of vine cut and weed indices. At 2 MAT, the highest number of vine cut was recorded by plots with black polyethylene mulch (11.00), which was statistically similar to that of sawdust cover while the least was by plot

Table 1: Soil physico-chemical properties of the experimental site prior to treatment application

Soil properties	2011
Mechanical properties	
Clay (%)	23
Silt (%)	7
Coarse sand (%)	47
Fine sand (%)	23
Textural class	Sandy clay loam
Chemical properties	
pH in water	4.8
pH in KCl	3.8
Organic carbon (%)	1.46
Organic matter (%)	2.52
Total nitrogen (%)	0.042
Phosphorus (ppm)	22.38
Exchangeable bases in me/100 g soil	
Sodium (Na^+)	0.19
Calcium (Ca^{2+})	2.2
Potassium (K^+)	0.06
Magnesium (Mg^{2+})	1.0
CEC	8.8
Base saturation (%)	39.20
Exchangeable acidity in me/100 g soil	
Aluminum (Al^{3+})	-
Hydrogen (H^+)	2.0

Table 2: The effect of weed management on the yield data at 4 weekly cutting intervals

Weed management	DYWT(g)	FSHWT(g)	LVC(cm)	NVC	Weed index	Yield/ha
			1 MAT			
Atrazine	2.20	17.30	46.50	1.00	85.00	43.00
Hoe weeding	12.20	92.80	84.80	2.50	12.50	232.00
Polyethylene mulch	5.70	41.90	49.20	2.33	55.00	105.00
Sawdust mulch	26.50	150.90	85.70	4.00	-43.60	377.00
Weedy check	13.20	112.00	97.20	2.67	0.40	280.00
Weed free	23.90	107.20	84.20	2.67	0.00	268.00
Mean	14.00	87.00	74.60	2.53	18.20	268.00
F-LSD$_{(0.05)}$	ns	55.37	32.23	1.17	45.13	138.40
			2 MAT			
Atrazine	42.90	250.00	129.00	6.67	50.60	624.00
Hoe weeding	52.10	317.00	195.00	4.67	46.60	793.00
Polyethylene mulch	82.90	583.00	192.00	8.83	-0.20	1457.00
Sawdust mulch	78.80	560.00	204.00	7.33	3.20	1400.00
Weedy check	41.20	278.00	207.00	3.67	44.70	694.00
Weed free	77.40	601.00	205.00	7.33	0.00	1503.00
Mean	62.60	431.00	189.00	6.42	24.20	1079.00
F-LSD$_{(0.05)}$	ns	ns	ns	ns	ns	Ns
			3 MAT			
Atrazine	29.90	179.00	141.80	4.17	58.20	448.00
Hoe weeding	50.00	407.00	211.30	4.67	11.60	1019.00
Polyethylene mulch	57.00	501.00	159.70	8.67	-22.60	1252.00
Sawdust mulch	25.10	243.00	97.00	4.33	48.70	607.00
Weedy check	21.90	184.00	118.70	2.83	59.80	459.00
Weed free	66.00	481.00	151.30	9.33	0.00	1203.00
Mean	41.70	333.00	146.60	5.67	25.90	831.00
F-LSD$_{(0.05)}$	ns	237.80	35.09	4.43	ns	594.00

DYWT=dry weight, FSHWT=fresh weight, LVC=length of longest vine cut, NVC= number of vine cut, Y/Ha=yield per hectare, MAT=months after transplanting, ns= not significant.

treated with atrazine (5.13). Polyethylene cover and saw dust cover recorded a negative weed index of -20.7 % and -47.4 %, respectively. The highest weed index was recorded in plots treated with atrazine (55.3 %).

In the second harvest (4 MAT) of the 8 weekly cutting frequency, most of the parameters measured did not differ significantly (p>0.05) except length of the longest vine cut and weed index. The plots treated with polyethylene cover recorded the highest vine length of 236 cm, which was statistically similar to that of weed free plots (222.0 cm) but significantly (p < 0.05) higher than others. The highest value of 43 % for weed index was obtained by plots with sawdust cover and weedy check while the least was recorded by atrazine (-78 %). The yield produced did not differ significantly (p>0.05) amongst the weed management options. However, plots covered with black polyethylene produced the highest yield of 1658.0 kg/ha, while those not treated (control) gave the least yield of 496.0 kg/ha (Table 3).

At zero cutting, the length of the longest vine and number of vine cut did not differ significantly (p>0.05) amongst the weed management options (Table 4). Other parameters assessed differed significantly (p<0.05) amongst the weed management options. Black polyethylene mulch recorded the highest dry weight of leaves (90.5 g) which was statistically similar to those of hoe weeding, atrazine and weed free. The same trend repeated itself on fresh weight per plant and yield per hectare. Plots treated with atrazine, hoe weeding and black polyethylene recorded negative weed index of -42.0 %, -4.0 % and -86.0 %, respectively, while sawdust covered plots recorded the highest weed index of 59.0 % (Table 4).

There was no significant (p>0.05) effect of cutting intervals on total yield in 2011 planting season (Table 5). However, cutting frequency of 4 weeks recorded the lowest yield (709 kg/ha) while the yield obtained in 0 and 8 weekly intervals were higher (1249 and 1218 kg/ha respectively). Significantly (p<0.05) higher total yield was obtained in plots with polyethylene cover (1617 kg/ha). This was statistically similar to that obtained in weed free check plots (1251 kg/ha) but significantly (p < 0.05) higher than other weed management options while the least total yield was recorded in weedy check plots (619 kg/ha). There was no significant interaction of cutting frequency and weed management options on total yield. However, the interaction of zero (0) cutting and black polyethylene cover gave the highest yield of 2187 kg/ha when compared with the rest of the weed management options.

Table 3: The effect of weed management on the yield data at 8 weekly cutting intervals

Weed management	DYWT(g)	FSHWT(g)	LVC(cm)	NVC	Weed index	Y/ha(kg/ha)
			2 MAT			
Atrazine	35.5	262	102	5.13	55.3	260
Hoe weeding	97.4	583	196	7.33	16.6	1457
Polyethylene mulch	05.4	728	211	11.00	-20.7	1819
Sawdust mulch	132.4	942	258	9.17	-47.4	2355
Weedy check	57.3	485	223	5.83	17.8	1214
Weed free	110.6	718	257	8.83	0.0	1796
Mean	89.8	620	208	7.88	3.6	1484
$F\text{-}LSD_{(0.05)}$	ns	ns	ns	3.390	75.06	ns
			4 MAT			
Atrazine	49.8	558	50	3.85	-78.0	917
Hoe weeding	55.2	392	145	7.67	-8.0	979
Polyethylene mulch	107	663	236	7.83	-77.0	1658
Sawdust mulch	28.4	217	114	5.17	43.0	542
Weedy check	26	198	118	2.67	43.0	496
Weed free	41.7	458	222	5.67	0.0	1146
Mean	51.4	414	148	5.47	-13.0	956
$F\text{-}LSD_{(0.05)}$	ns	ns	90.0	ns	113.70	ns

DYWT=dry weight, FSHWT=fresh weight, LVC=length of longest vine cut, NVC= number of vine cut, Y/Ha=yield per hectare, MAT=months after transplanting, ns=Not significant.

Table 4: The effect of weed management on the yield data at 0 weekly cutting intervals

Weed management	DYWT(g)	FSHWT(g)	LVC(cm)	NVC	Weed index	Y/ha(kg/ha)
Atrazine	86.90	628.00	276.00	2.83	-42.00	1571.00
Hoe weeding	73.40	517.00	268.00	2.33	-4.00	1292.00
Polyethylene mulch	90.50	875.00	357.00	2.67	-86.00	2188.00
Sawdust mulch	35.20	250.00	213.00	1.50	59.00	625.00
Weedy check	31.40	210.00	183.00	1.83	44.00	525.00
Weed free	81.60	517.00	299.00	2.33	0.00	1292.00
Mean	66.50	499.00	266.00	2.25	-5.00	1249.00
$F\text{-}LSD_{(0.05)}$	45.10	409.30	ns	ns	86.90	1023.30

DYWT=dry weight, FSHWT=fresh weight, LVC=length of longest vine cut, NVC= number of vine cut, Y/Ha=yield per hectare, MAT=months after transplanting, ns=not significant.

Table 5: Total yield (kg/ha) as influenced by the interaction of weed management and cutting frequency

	Weekly cutting intervals			
Weed management options	0	4	8	Mean yield (kg/ha)
Atrazine	1571	372	589	844
Hoe weeding	1292	681	1218	1064
Polyethylene mulch	2187	938	1725	1617
Sawdust mulch	625	795	1448	956
Weedy check	525	478	855	619
Weed free	1292	991	1471	1251
Mean	1249	709	1218	1059

$F\text{-}LSD_{(0.05)}$ for comparing cutting frequency=not significant

$F\text{-}LSD_{(0.05)}$ for comparing weed management=464.9

$F\text{-}LSD_{(0.05)}$ for comparing cutting frequency and weed management=not significant.

Table 6: Effect of Different Cutting Intervals and weed management on Proximate Composition of fluted pumpkin in 2011 planting season

		Proximate Composition					
Weed Management	Cutting Frequency	Ash (%)	Carbohydrate (%)	Fats (%)	Fibre (%)	Moisture (%)	Protein (%)
Atrazine	0	23.33	24.16	0.82	13.33	9.77	28.59
	4	20.83	20.31	0.52	12.00	10.50	35.84
	8	16.41	39.58	0.34	7.92	6.47	29.28
	Mean	20.19	28.02	0.56	11.08	8.91	31.24
Hoe weeding	0	25.33	22.66	0.60	15.00	9.10	27.30
	4	20.00	23.00	0.57	8.67	10.73	37.03
	8	20.34	36.19	0.43	11.39	7.70	23.94
	Mean	21.89	27.28	0.54	11.69	9.18	29.42
Polyethylene mulch	0	20.67	20.45	1.08	14.00	9.95	33.85
	4	13.00	15.50	0.72	15.17	13.50	42.12
	8	18.86	28.43	0.86	13.29	9.11	29.45
	Mean	17.51	21.46	0.89	14.15	10.85	35.14
Sawdust cover	0	19.70	23.72	0.65	14.67	8.70	32.61
	4	13.17	21.52	0.40	14.67	12.73	37.52
	8	9.17	37.29	0.30	11.62	9.57	32.06
	Mean	14.01	27.51	0.45	13.65	10.33	34.06
Weedy check	0	15.83	22.52	0.58	16.83	10.97	33.27
	4	12.67	27.10	0.43	15.67	12.02	32.12
	8	10.76	33.90	0.44	14.59	10.52	29.80
	Mean	13.09	27.84	0.49	15.70	11.17	31.73
Weed free	0	21.50	24.29	0.78	17.17	9.37	26.89
	4	20.63	15.03	0.44	14.50	12.52	36.88
	8	15.25	32.02	0.31	12.03	9.10	31.28
	Mean	19.13	23.78	0.51	14.57	10.33	31.68
Grand Mean		17.64	25.98	0.52	13.47	10.13	32.21
F-LSD$_{(0.05)}$		4.667	n.s	n.s	2.963	n.s	4.605

	Ash	carbohydrate	Fats	Fibre	Moisture	Protein
F-LSD$_{(0.05)}$ for comparing any 2 Cutting frequency	3.975	3.993	0.175	2.04	1.797	1.766
F-LSD$_{(0.05)}$ for comparing any 2 Weed management	2.200	3.826	0.185	1.61	1.255	2.807
F-LSD$_{(0.05)}$ for comparing any 2 Cutting frequency x Weed management	4.667	n.s	n.s	2.96	n.s	4.605

n.s= not significant.

The interaction between hoe-weeded plots and zero cutting frequency gave significantly ($p < 0.05$) higher ash value (25.33 %) (Table 6). This was statistically similar with interaction of the plots treated with atrazine (23.33 %), polyethylene mulch (20.67 %) and weed free plots (21.50 %) respectively and zero cutting, but significantly ($p < 0.05$) higher than the rest of the weed management options. Significantly ($p < 0.05$) lower value was recorded in weedy check plots (15.83) compared to other management options. In the interaction of 4 weekly cutting and weed management option, ash and crude protein contents differed significantly among the weed control treatments. Plot treated with atrazine had significantly ($p < 0.05$) higher ash content of 20.83 %, which was statistically similar to weed free plots (20.63 %) and hoe weeded plots (20.0 %), while the least significant value for ash was obtained in plots mulched with black polyethylene films (13.0 %). Black polyethylene mulched plots produced significantly ($p < 0.05$) higher protein content of 42.12 %, which was statistically similar to those of sawdust cover (37.52 %) but significantly higher than the rest of the weed management options. The interaction of 8 weekly cutting and hoe weeded plots recorded significantly ($p < 0.05$) higher ash content (20.34 %) when compared to atrazine (16.41 %) and polyethylene mulch (18.86 %) but significantly ($p < 0.05$) higher than other weed management options. Plots treated with atrazine recorded the highest carbohydrate content of 39.58 %

which was similar to those of hoe weeded plot (36.19 %) and sawdust cover plots (37.29 %) but significantly higher than the rest of the weed management options and the least value was recorded by polyethylene mulched plots (28.43%). Polyethylene mulched plots recorded the highest value for crude fats (0.86 %), which was significantly higher than the rest of the weed management options. Weedy check plots and saw dust cover plots had the highest fiber (14.59 %) and protein (32.06 %) respectively, while a significanty ($p < 0.05$) lower protein (23.94 %) was obtained in hoe weeded plots.

DISCUSSION

From the study, higher fresh weight of leaves, vines and number of vine cut observed in the frequent harvest of 4 weekly intervals than in the infrequent harvest of 8 and zero (0) suggests that frequency of harvest encourages new flushes to emerge. This was therefore in agreement with those reported by Asiegbu [11], who found higher leaf yields with frequent harvest compared with infrequent harvest schedule. Who also explained that greater branching resulting from more frequent removal of apical dominance with cutting of the terminal buds allowed for more flushes. This also corroborates the later findings by Ossom [15] on fluted pumpkin in which reduced harvest interval caused profuse branching resulting in more vines and leaf growth. The higher total yield recorded in black polyethylene mulch compared to other weed control option could be attributed to the low light transmittance of black polyethylene, which probably resulted in reduced photosynthetic activity of underlying weeds and hence high yield of the vegetable. In addition to weed control, soil warming efficiency of the plastic mulches would have played a major role in determining yield. This could be confirmed by the findings of Subrahmanian *et al*. [16], who reported that biomass accumulation, chlorophyll content, yield parameters and yield of winter rapeseed were increased through better weed control under plastic mulch.

The leaves of fluted pumpkin are eaten mainly for carbohydrate and protein [15]. Proximate analysis established that fluted pumpkin contains high carbohydrate and protein, which are very essential in energy production as well as growth and repairs of tissues. Although, there was no significant difference in the values of the moisture content with the maturity of the plant, higher moisture content recorded in four weekly cutting intervals than in other cutting frequency may be attributed to the fact that moisture content decreased with stage of maturity of the plant. Okwu and Morah [17] reported that high moisture content in vegetables is a function of quality and this definitely determines how fresh the vegetables are. The possibility of spoilage however reduces with maturity of the leaves as indicated by the decrease in moisture content for leaves harvested at eight weeks and zero cuttings intervals. Moisture content of vegetables can be affected by season, the location of the plant and the stage of maturity [17]. The value of the proximate composition obtained from the different cutting intervals were higher than those reported by Fasuyi and Nonyerem [18]; Okwu and Ukanwa [19]; Adeyeye and Omolayo [20]; and Yekeen *et al*. [21]. Differences observed in the proximate composition could be attributed to factors like age before harvesting, differences in the weed control methods employed and fertility status of the soil. The crude fibre content is high ranging from 7.92 % to 17.17 % with the highest recorded by weed free plots under the zero (0) cutting intervals. The crude fibre content recorded in the study is high when compared to *Talinum triangulare* (6.2 %), *Piper guineeses* (6.40 %), *Corchorus olitorius* (7 %), bitter leaves (*Vernonia amygdalina*) 6.5 % [22]. Fibre cleanses the digestive tract by removing potential carcinogens from the body and prevents the absorption of excess cholesterol [23]. Non-starchy vegetables are the richest sources of dietary fibre [24] and according to Saldanha [25] are employed in the treatment of diseases such as obesity, diabetes and gastrointestinal disorders. Fibre also adds bulk to the food and prevents the intake of excess starchy food and may therefore guard against metabolic conditions such as hypercholemia and diabetes mellitus [23]. Higher crude fat content was recorded in the zero (0) cutting intervals when compared with other cutting intervals. This disagrees with the report of Sossa-Vihotogbe *et al*. [26] who reported that *S. radiatum* gave higher crude fat content at 6 weeks after transplanting than at 9 and 12 weeks after transplanting which could be explained by the transfer of nutrients from leaves to the reproductive organs during flowering and fruiting [27]. The differences observed could be as a result of the different method of weed control employed in the study. Dietary fats function to increase food palatability by absorbing and retaining flavours [28]. A diet providing 1-2% of its caloric energy as fat is said to be sufficient to human beings, as excess fat consumption yields to certain cardiovascular disorders such as atherosclerosis, cancer and aging [29, 30]. The amount of crude fats present seems to be moderate and may be adequate for consumption without health threat. Lovejoy [31] reported that fatty acids in vegetables are known to increase membrane fluidity and allow for osmosis intracellular and extracellular gaseous exchange. Whitney and Rolfes [32] reported that crude protein serves as enzymatic catalyst, mediate cell responses, control growth and cell differentiation. There was an increase in protein content at 4 weekly intervals and a decrease at 8 weekly harvest intervals and the zero cut with plots with black polyethylene mulch given the highest value at four weekly harvests. This may be explained by the report of Rafiq *et al*. [33], who said that mulches can conserve moisture content as well as promote soil fertility which could in turn promote protein content of the crops. Boomsma *et al*. [34] also said that availability of sufficient soil N and moisture for plants can lead to higher

chlorophyll contents and photosynthesis which could produce crops with higher protein content. The protein value observed in this study was between 23.94 % and 42.12 %, which is higher than 3.3% recorded by the USDA Nutrient Database for Standard Reference [35]. This makes the plant advantageous as a rich source of vegetable protein over some vegetables such as raw cocoyam leaf (3.4%), cooked cocoyam leaf (2.1%), *Amaranthus* (6.1%) and *Moringa oleifera* (4.2%) as reported by Adepoju *et al*. [36]. Also the crude protein values compares favourably with the leaves of the plants like Cassava (*Manihot utilisima*), *Piper guineeses* and *Talinum triangulare* with values of 24.88 %, 29.78 % and 31.00 % respectively [22]. Ash content, which is an index of mineral contents in biota, is relatively high in Fluted pumpkin *leaves* when compared to the values reported in leaves of *Hibiscus esculentus* (8.00% DW) by Akindahunsi and Salawu, [22]. The ash content, however, is not within the range of values (16.30% - 17.31%) reported for some vegetables by Dairo and Adanlawo [37]. Although cutting frequency of eight (8) recorded higher carbohydrate content when compared with other cutting intervals, yet the leaves could not be used as a substitute for carbohydrate in food when compared to traditional carbohydrate sources such as rice, maize, cassava, yam and plantain. This is in agreement with those obtained by Mnzava [38] and Fasuyi [39] who reported that the nutrient content of different types of vegetables varies considerably and they are not major sources of carbohydrate compared to the starchy foods but contain vitamins, essential amino acids as well as minerals.

The results of weed control with black polyethylene mulch in the four (4) weekly intervals of harvest recorded higher moisture, crude protein and lesser carbohydrate compared to other cutting intervals and was closely followed by the result obtained from sawdust mulch but with higher carbohydrate content than in the polyethylene mulch. This may be attributed to some of the benefits of mulching which includes suppression of weeds, conservation of soil moisture, reduction of temperature fluctuations within the soil and reduced nutrient leaching [40]. This can be properly explained by Anyakoha [41] who suggested that darker surfaces besides being a better radiation of heat than brighter surfaces are also a better absorber of heat. This might have contributed in the improvement of these parameters recorded in them than in the unmulched plots.

CONCLUSION

Since, more frequent harvest of four (4) weekly harvest intervals gave high leaf yield and tender and more nutritious leaves and vines than other cutting intervals, it should be adopted because vegetables are cheap sources of protein, minerals and vitamins. Harvesting at a later age and maturity may not provide these required elements for proper nourishment of the body.

REFERENCES

1. Akobundu, I.O., 1987. Weed Science in the Tropics: Principles and Practices. New York. John Wiley and Sons, pp: 146.
2. Tindall, H.D., 1968. Commercial Vegetable Growing. London: Oxford University Press.
3. Tindall, H.D., 1986. Vegetable in the Tropics. Macmillan Education LTD. Houndmills, Hampshire, pp: 533.
4. Badifu, G.I.O. and A.O. Ogunsua, 1991. Chemical composition of kernels grown from some species of Cucurbitacea grown in Nigeria. Plant Food Human Nutrition, 41: 35-44.
5. Fashina, A.S., K.A. Olatunji and Alasiri, 2002. Effect of different plant populations and poultry manure on the yield of ugu(*Telfaria occidentalis*) in Lagos State, Nigeria. In: Proceedings of the Annual Conference of Horticultural Society of Nigeria (HORTSON), 14-17th May, 2002, NIHORT, Ibadan, Nigeria.
6. Aletor, O., A.A. Oshodi and K. Ipinmoroti, 2002. Chemical composition of common leafy vegetables and functional properties of their leaf protein concentrates. Food Chemistry, 78: 63-68.

7. Akoroda, M.O. (1988) “Ethnobotany of *Telfaria occidentalis* (Cucurbitaceae) among Igbos of Nigeria”. Economic Botany 44(1):29-39.
8. Food and Agriculture Organization of the United Nations. 2013. Integrated weed management. www.fao.org/ agriculture/crops/core-themes. Accessed on 26 September, 2013.
9. Ayeni, A.O., 1991. Hand/Mechanical weed management as an option in Nigerian agriculture. Nigerian Journal of Weed Science, 4: 71-78.
10. Weber, G., K. Elemo and S.T.O. Lagoke, 1995. Weed communities in intensified cereal-based cropping systems of the Northern Guinea Savanna. Weed Res. 35: 167-178.
11. Asiegbu, J.E., 1983. Effects of method of harvest and intervals between harvest on edible leaf yield in fluted pumpkin. Scientia Hort, 21: 129-136.
12. AOAC. 1995. Official Methods of Analysis (16th Ed), Association of Official Analytical Chemist, International, Arlington, USA, pp: 31-65.
13. AOAC. 1990. Official Methods of Analysis (15th Ed.), Association of Official Analytical Chemist, Washington D.C., pp: 210.
14. Obi, I.U., 2002. Statistical Methods for Detecting Differences Between Treatment Means for Field and Laboratory Experiments. A.P. Publishers Co. Nig. Ltd, pp: 117.
15. Ossom, E.M., 1986. Influence of harvest interval and yield, crude protein, N, P and K contents and longevity of the fluted pumpkin, *Telfairia occidentalis* Hook. Tropical Agriculture (Trinidad), 63(1): 63-65.
16. Subrahmaniyan, K., W. Zhou and P. Veeramani, 2011 Weed control through degradable, herbicidal and organic plastics and organic mulches and their effect on crop growth and yield of winter rapeseed (*Brassica napus*). Indian Journal of Agricultural Sciences, 81(4): 348-352.
17. Okwu, D.E. and F.N.I. Morah, 2004. Mineral and nutritive value of *Dennettia tripetala* fruits. Fruits, 59: 437-442.
18. Fasuyi, A.O. and A.D. Nonyerem, 2007. Biochemical, nutrition and haematological implications of *Telfairia occidentalis* meal as protein supplement in broiler starter diets. African Journal of Biotechnology, 6(8): 1055-1063.
19. Okwu, D.E. and N.S. Ukanwa, 2007. Nutritive value and phytochemical contents of fluted pumpkin (*Telfairia occidentalis* Hook f) vegetable grown with different levels of turkey droppings. African Crop Science Conference Proceedings, 8: 1759-1764.
20. Adeyeye, E.I. and F. O. Omolayo, 2011. Chemical composition and functional properties of leaf protein concentrates of *Amaranthus hybridus* and *Telfairia occidentalis*. Agriculture and Biology Journal of North America, 2(3): 499-511.
21. Yekeen, T.A., M.A. Falodun, M.A. Azeez, O.A. Adetiba and M.A. Ogundiran, 2011. Nutritional qualities and cytotoxic evaluation of *Vernonia amygdalina, Amaranthus caudatum* and *Telfairia occidentalis* vegetables widely consumed in South West Nigeria. Applied Science Research, 3(6): 383-391.
22. Akindahunsi, A.A. and S.O. Salawu, 2005. Phytochemical Screening and nutrient/antinutrient composition of selected tropical green leafy vegetables. African Journal of Biotechnology, (4): 497-501.
23. Mensah, J.K., R.I. Okoli, J.O. Ohaju-Obodo and K. Eifediyi, 2008. Phytochemical, nutritional and Medicinal properties of some leafy vegetables consumed by Edo people in Nigeria. African Journal of Biotechnology, 7(14): 2304-2309.
24. Agostoni, C., R. Riva and M. Giovannini, 1995. Dietary Fiber in Waning Foods of Young Children. Pediat, (96): 1000-1005.
25. Saldanha, L.G., 1995. Fibre in the diet of U. S. Children: Results of National Surveys. Pediat, (96): 994-996.
26. Sossa-Vihotogbe, A.N.C., B.V. Anihouvi, H.N. Akissoe, L.G. Amadji and D.J. Hounhouigan, 2013. Effect of organic and mineral fertilization on proximate composition of three leafy vegetables harvested at different periods. Int. J. Biol. Chem. Sci., 7(1): 271-286.
27. Hewitt, J.D. and M. Marrush, 1986. Remobilization of nonstructural carbohydrates from vegetative tissues of fruits in tomato. J. Am. Soc. Hort. Sci., 111: 142-145.
28. Lindsay, R.C., 1996. Flavours. In: Fennema, R.O., Karel, M., Sanderson, G.W., Tannenbaum, S.R., Walstra, P. and Witaker, J.R. (eds). Food Chemistry, Marcel Dekker Inc. New York, pp: 611-612.
29. Davidson, S.P., J.F. Brock and A.S.l. Truswel, 1975. Human Nutrition and Dietetics. 6th Ed. Churchill Livingstone / Longman Group Ltd, pp: 107-119, 221-224.
30. Kris-Etherton, P.M., K.D. Hecker, A. Bonanome, S.M. Coval, A.E. Binkoski, K.F. Hilpert, A.E Griel and T.D. Etherton, 2002. Bioactive compounds in foods: their role in the prevention of cardiovascular disease and cancer. PubMed, 113 Suppl 9B: 71S-88S.

31. Lovejoy, J.C., 2002. The influence of dietary fats in insulin resistance Current Diabetes Reports, 2(5): 430-440.
32. Whitney, E.N. and S.R. Rolfes, 2005. Understanding Nutrition. 10th Edition. Thompson/Wadsworth Publishing Company Belnont, C.A, pp: 132-139.
33. Rafiq, M.A., A. Ali, M.A. Malik and M. Hussain, 2010. Effects of mulches and plant densities on yield and protein contents of autumn planted maize. Pak. J. Agric. Sci., 47(3): 201-208.
34. Boomsma, C.R., J.B. Santini, M. Tollenaar and T.J. Vyn, 2009. Maize morphophysiological response to intense crowing and low nitrogen availability: an analysis and review. Agron. J., 101: 1426-1452.
35. Hall, R., 1998. Kale, *Brassica oleraceae* (Acephala group). USDA Database for standard reference, release 12. About.com. Nutrition guide. http://www.nutrition.about.com. Accessed 03/02/2011.
37. Dairo, F.A.S. and I.G. Adanlawo, 2007. Nutritional Quality of *Crassocephalum crepidiodes* and *Senecio biafrae*. Pakistan Journal of Nutrition, 6(1): 35-39.
38. Mnzava, N.A., 1997. Comparing Nutritional Values of Exotic and Indigenous vegetables. Limbe Cameroon, January 1997. Schippers, R.R; Budd, L (eds). Chatham. UK; NRI/IPGRI/CPRO workshop.
39. Fasuyi, A.O., 2006. Nutritional potentials of some tropical vegetable meals: chemical characterization and functional properties. African Journal of Biotechnology, 5(1): 49-53.
40. Singh, R., 2005. Influence of mulching on growth and yield of tomato (*Lycopersicon esculentum*) in North India Plains. Vegetable Science, 32(1): 55-58.
41. Anyakoha, M.W., 2010. New School Physics for Secondary Schools. 3rd Edition. African First Publishers PLC, Onitsha, Nigeria, pp: 51.