Journal of Applied Biosciences 48: 3270– 3278

ISSN 1997–5902

Structural morphology of Cassava (*Manihot esculenta* Crantz) genotypes influenced yield and responses to weed management in the Guinea savanna zone of Nigeria

[1]Agahiu, A. E; *Baiyeri, K. P. and R. O. Ogbuji
Dept. of Crop Science, University of Nigeria, Nsukka, Enugu State, Nigeria.
[1]Dept of Crop Production, Kogi State University, Anyigba, Kogi State, Nigeria

*Corresponding author: paul.baiyeri@unn.edu.ng; paulkayodebaiyeri@yahoo.com
Original Submitted on 13th April 2011. Published online at www.biosciences.elewa.org on December 29, 2011.

ABSTRACT
Objective: The effects of nine weed management options on the yield and components of yield of two cassava (*Manihot esculenta* Crantz) morphological types were evaluated for two cropping seasons in a guinea savanna site of Nigeria.
Methodology and result: Field experiments were carried out during the cropping seasons of 2008 and 2009 at the Teaching and Research Farm of the Department of Crop Production, Kogi State University, Anyigba (Lat 7^0 29' N and Long 7^0 11' E), Nigeria. The experiment was laid out in a split-plot in randomized complete block design replicated three times. The main plots consisted of the two cassava morphological types - 'NR 8082' (short with profuse branching) and 'TMS 30555' (tall and non-branching). Nine weed management options including the application of 3.0, 3.5 and 4.0 kg a.i/ha of Primextra (atrazine x metolachlor), 2.0, 3.0 and 4.0kg a.i/ha of Taxastomp (atrazine x pendimethalin) [designated $P_{3.0}$, $P_{3.5}$, $P_{4.0}$ and $T_{2.0}$, $T_{3.0}$, $T_{4.0}$, respectively], three-time manual weeding, weedy and weed-free checks were the subplot treatments. The predominant weeds were *Cynodon dactylon, Panicum maximum, Andropogon gayanus, Chloris pilosa* and *Bracharia deflexa* constituting about 80% of the weed mass in the field. Except for the weedy check, weed fresh biomass (1.03 - 1.19 t/ha) and the dry matter (0.06 - 0.09 t/ha) were highest in plots to which 2.0 kg a.i/ha of taxastomp was applied. The two cassava morphotypes exhibited significant differences ($P < 0.05$) in plant height across the two-year trials and weed management systems, with the tallest stem height (153.5cm) obtained from the non-branching variety in the $P_{3.0}$ treated plot. The highest cassava biomass (12.1 - 14.1 kg) was obtained from the $P_{3.0}$ treated plots across morphological-types and year; and closely followed by plants in the $T_{3.0}$ plots. However, harvest index was highest in the $T_{2.0}$ treated plot irrespective of cassava morphological-types. Of all the treatments, $P_{3.0}$ and $T_{3.0}$ (i.e. 3.0 a.i. kg/ha) gave the highest root tuber yield (119.7 and 117.0 t/ha, respectively) from the non-branching type in both years as against 100.67 and 103.67 t/ha for the branching morphological type.
Conclusion and application of findings: Variable response pattern of the two cultivars to the weed management options evaluated suggested that morphological differences of the cultivars may have influenced effectiveness of herbicides applied. However, the application of Primextra and Taxastomp at 3.0 a.i. kg/ha seemed most appropriate for weed control in cassava fields in the guinea savanna zone of Nigeria.
Key Words: Cassava morphology, Yield and yield components, Weed management

INTRODUCTION:

Cassava (*Manihot esculenta* Crantz) is a dicotyledonous crop belonging to the family *Euphorbiaceae* and is believed to have originated from northeastern Brazil (Uguru, 1996). It is a short-day shrub that can grow to a height of about 3m depending on the variety, soil fertility and the level of farm management (Udoh *et al*, 2005). Nigeria is the world's largest producer of cassava with an annual production of about 39 million metric tonnes (FAO, 2001; Onyeigwe, 2005). Cassava is a major source of food in Africa where over 50% of the world production is found (FAO 1996). It is a major staple food for over 300 million people of the sub-Saharan Africa (Nweke and Enete, 1999). Cassava is a preferred food security crop because it can tolerate drought and low soil fertility and it requires little or no external input. It is easy to cultivate and it thrives across vegetations of the tropics (Abbah, 2006).

In Nigeria and most African countries, cassava is gaining prominence as an important cash crop for use as an industrial raw material to manufacture starch (Nweke *et al*, 2002). Although improved varieties of cassava with high yield potential (> 25 tonnes/ha) have been developed (IITA, 2000), the average yield on farmers' fields is less than 10 tonnes/ha (FAO 2004). In spite of its enormous potentials, cassava succumbs easily to weed infestation especially during its early phase of establishment (Omale, 2008). Weeds cause yield loss of about 50-94% in cassava (Akobundu, 1987). Full season competition from weeds like spear-grass can cause root tuber yield reduction ranging from 70-80% depending on the cropping pattern and cultivar grown (Anonymous, 1990; Chikoye *et al*, 2001). In order to improve on the productivity of cassava crops, several weed management practices including, physical, cultural, biological, chemical and integrated control measures are proffered for adoption. In an earlier survey study on cassava weed management strategies in Kogi State, manual weeding was the dominant weed control measure adopted by farmers followed by the use of herbicides (Agahiu et al. 2009).

In this study, it is expected that the variable branching capacity of cassava i.e. canopy shape and dimension or structural morphological growth differences should influence light transmission to the ground, and so, the efficacy of weed control and management. Therefore, the objective of this study was to evaluate the growth and yield performance of two cassava morphotypes (branching and non-branching types) using the manual weeding option and varying rates of two herbicides (Primextra® and Taxastomp®).

MATERIALS AND METHODS

The experiment was carried out on a sandy loam soil of the Teaching and Research farm of the Department of Crop Production, Kogi State University, Anyigba (Lat 7^0 29N and Long $7'^0$ 11E). The weed flora of the experimental site was recorded during the study period. Fertilizer at the rate of 30 kg each of nitrogen, phosphate and muriate of potash per hectare/ha was applied to all the plots. In this study, two cassava cultivars, a branching type, 'NR 8082'and a non-branching type 'TMS 30555', mostly grown by farmers in the area were planted and investigated. The stem cuttings (25cm long) were treated with aldrin dust before planting. The cuttings were planted 1m x 1m on each ridge giving a plant population of 10,000 stands/ha. The prevailing weed control strategy (i.e., 3-times manual weeding) was compared with varying rates of Primextra and Taxastomp herbicides. The studied rates were 3.0, 3.5 and 4.0 kg a.i/ha of Primextra (atrazine + metolachlor) denoted as P_3, $P_{3.5}$ and P_4 respectively, and 2.0, 3.0 and 4.0 kg a.i/ha of Taxastomp (atrazine + pendimethalin) otherwise represented as T_2, T_3 and T_4. Weedy (WD) and weed-free (WF) plots served as the negative and positive control, respectively.

The experiment was conducted using a split-plot in a randomized complete block design (RCBD) with the eighteen treatment combinations (morphotype × weed control measure) replicated three times. The experimental field was ploughed and harrowed, two weeks thereafter, before planting.

RESULTS

The dominant weed species of the experimental site were Goose grass (*Eleucine indica),Guinea grass (Panicum maximum), Milk weed (Euphorbia heterophylla), Asthma weed (Euphorbia hirta), Purple nut sedge (Cyperus rotundus), Signal grass (Brachiaria deplexa), Carpet grass (Axonopus compressus), Stink grass (Eragrostis atrovirens), Spear grass (Imperata cylindrical), Bermuda grass (Cynodon dactylon), Giant star grass (Andropogon gayanus), False star grass (Chloris pilosa), Broom weed (Sida acuta),* and *Bush tea (Triumfetta rhomboidea).*

Results of weed biomass and weed dry matter studies conducted during the two-year trials (2008 and 2009) are shown in Tables 1 and 2, respectively. The weed suppressing ability of the weed management options is evident in this study. Data on Table 1 showed that the application of 2 kg a.i/ha of Taxastomp gave a poor weed control rating in both years. The large weed biomass of the weedy check was obvious. Of all the treatments, Taxastomp at 2.0 kg a.i/ha and the weedy check gave the highest weed biomass. The branching type better suppressed weed growth in both years.

Table 1: Fresh weed biomass (t/ha) as influenced by two cassava varieties (BR=branching and NB=non-branching) and weed management during 2008 and 2009 cropping seasons**.**

Weed management	**2008**			**2009**		
	BR	**NB**	**Mean**	**BR**	**NB**	**Mean**
P3.0	0.0633	0.0800	0.0717	0.0467	0.533	0.0500
P3.5	0.0733	0.0733	0.0733	0.0533	0.0567	0.0550
P4.0	0.0367	0.0600	0.0483	0.0400	0.0567	0.0483
T2.0	1.0267	1.1933	1.1100	1.0267	1.0733	1.0500
T3.0	0.0833	0.0867	0.0850	0.0600	0.0667	0.0633
T4.0	0.0367	0.0533	0.0450	0.0467	0.0533	0.0500
MW	0.0733	1.0233	0.5483	0.0933	0.9000	0.4967
WF	0.0200	0.0167	0.0183	0.0267	0.0267	0.0267
WD	1.3067	1.4767	1.3917	1.3767	1.6300	1.5033
Mean	0.3022	0.4515	-	0.3078	0.4352	-
$LSD_{(0.05)}$	2008			2009		
Weed Mgt (WM)	0.04971			0.04902		
Variety (V)	0.02343			0.02311		
WM x V	0.07029			0.06933		

P3, P3.5 and P4 are 3.0, 3.5, and 4.0 kg a.i/ha of primextra, respectively; T2, T3 and T4 are 2.0, 3.0 and 4.0 kg a.i/ha of Taxastomp, respectively; WD: Weedy (unweeded) and WF: weed-free plots.

Expectedly, the weedy checks produced the largest weed dry matter (0.51 - 0.75 t/ha) in both years (Table 2). But in the herbicide treated plots, the highest weed dry matter (0.06 - 0.09 t/ha) was obtained where 2.0 kg a.i/ha of Taxastomp was applied. Besides the weed-free plots, low weed dry matter weights were recorded in plots to which P3.0, P3.5, P4.0, T3.0 and T4.0 were applied across varieties. The effect of variety and weed management on cassava plant height is shown in Table 3. In the two-year trials there were significant differences ($P < 0.05$) in the height of cassava across varieties and weed management. The tallest stem height (150.40 cm) was obtained from the non-branching variety in the P3.5 treated plots in 2008. In 2009, the tallest plant stem height (153.47 cm) was also got from the non-branching variety but in the P3.0 treated plot. The shortest plants (23.77 - 69.47cm) were obtained from the weedy checks irrespective of the variety. Among the herbicide treated plots, T2.0 plants were the shortest in both years. It was also observed that the non-branching variety was significantly ($P = 0.05$) taller than the branching type.

Table 2: Weed dry matter (t/ha) as influenced by two cassava varieties (BR=branching and NB=non-branching) and weed management strategy during 2008 and 2009 cropping seasons.

	2008			2009		
MGT	**BR**	**NB**	**Mean**	**BR**	**NB**	**Mean**
P3.0	0.0167	0.02233	0.0200	0.0167	0.0133	0.0150
P3.5	0.0267	0.0233	0.0250	0.0200	0.0233	0.0217
P4.0	0.0200	0.0133	0.0167	0.0167	0.0167	0.0167
T2.0	0.0600	0.0567	0.0583	0.0567	0.0900	0.0733
T3.0	0.0267	0.0333	0.0300	0.0233	0.0267	0.0250
T4.0	0.0100	0.0167	0.0133	0.0167	0.0233	0.0200
MW	0.0300	0.2400	0.1350	0.0433	0.0533	0.0483
WF	0.0100	0.0043	0.0072	0.0020	0.0020	0.0020
WD	0.5133	0.7133	0.6133	0.7500	0.7067	0.7283
Mean	0.0793	0.1249	-	0.1050	0.1061	-
$LSD_{(0.05)}$		2008			2009	
Weed Mgt (WM)	0.05632			0.02850		
Variety (V)		0.02655			0.01343	
WM x V	0.07965			0.04030		

P3, P3.5 and P4 are 3.0, 3.5, and 4.0 kg a.i/ha of primextra, respectively; T2, T3 and T4 are 2.0, 3.0 and 4.0 kg a.i/ha of Taxastomp, respectively; WD: Weedy (unweeded) and WF: weed-free plots.

Table 3: Plant height (cm) as influenced by two cassava varieties (BR=branching and NB=non-branching) and weed management strategy during 2008 and 2009 cropping seasons.

	2008			2009		
Weed MGT	**BR**	**NB**	**Mean**	**BR**	**NB**	**Mean**
P3.0	128.20	149.70	138.95	130.47	153.47	141.97
P3.5	125.53	150.40	137.97	128.03	153.03	140.53
P4.0	126.23	145.73	135.98	128.83	142.90	135.87
T2.0	119.73	130.57	125.15	122.27	133.00	127.63
T3.0	127.23	147.93	137.58	128.83	152.47	140.65
T4.0	127.90	142.33	135.12	129.13	145.70	137.42
MW	126.47	141.57	134.02	128.53	142.00	135.27
WF	124.17	142.33	133.25	125.87	142.97	134.42
WD	24.17	69.47	46.82	23.77	67.47	45.62
Mean	114.40	135.56	-	116.19	137.00	-
$LSD_{(0.05)}$		2008			2009	
Weed Mgt (WM)	6.133				5.604	
Variety (V)		2.891				2.642
WM x V	8.673				7.926	

P3, P3.5 and P4 are 3.0, 3.5, and 4.0 kg a.i/ha of primextra, respectively; T2, T3 and T4 are 2.0, 3.0 and 4.0 kg a.i/ha of Taxastomp, respectively; WD: Weedy (unweeded) and WF: weed-free plots.

Plant stem girth varied across weed management and variety (Table 4). In 2008, plant girth ranged between 3.83 - 10.13 cm for the branching variety and 4.43 - 12.43 cm for the non-branching variety. In 2009, it ranged between 3.03 and 10.20 cm for the branching variety and 4.33 and 12.30 cm for the non-branching across treatments. In 2008, the highest stem girth (10.10 cm) was observed in the branching variety treated with $T_{3.0}$. The highest stem girth in respect of the non-branching variety in the same year was 12.43 cm. This was obtained among plants from the P3.0 treated plot. In 2009, the non-branching variety also produced the highest plant stem girth (12.30 cm) from the T3.0 treated plots.

Table 4: Plant girth (cm) as influenced by two cassava varieties (BR=branching and NB=non-branching) and weed management strategy during 2008 and 2009 cropping seasons.

	2008			2009		
Weed MGT	**BR**	**NB**	**Mean**	**BR**	**NB**	**Mean**
P3.0	9.733	12.433	11.083	10.200	12.267	11.233
P3.5	9.867	11.167	10.517	10.200	11.900	11.050
P4.0	7.567	8.933	8.250	7.733	8.200	7.967
T2.0	7.000	8.867	7.933	6.267	7.933	7.100
T3.0	10.100	12.400	11.250	10.133	12.300	11.217
T4.0	7.567	8.967	8.267	7.167	8.367	7.767
MW	9.933	10.867	10.400	9.733	10.433	10.083
WF	10.133	11.400	10.767	10.067	11.700	10.883
WD	3.833	4.433	4.133	3.033	4.333	3.683
Mean	8.415	9.941	-	8.281	9.715	-
$LSD_{(0.05)}$		2008			2009	
Weed Mgt (WM)	0.6858			0.5556		
Variety (V)		0.3233			0.2619	
WM x V	0.9699			0.7858		

P3, P3.5 and P4 are 3.0, 3.5, and 4.0 kg a.i/ha of primextra, respectively; T2, T3 and T4 are 2.0, 3.0 and 4.0 kg a.i/ha of Taxastomp, respectively; WD: Weedy (unweeded) and WF: weed-free plots.

Cassava plants in the P3.0, P3.5, T3.0, MW and WF plots produced significantly (P = 0.05) higher whole plant biomass compared to those in P4.0, T2.0 and WD plots across variety and year (Table 5). The largest plant biomass (12.07 - 14.13 kg) was obtained from the $P_{3.0}$ treated plot across variety and year. Closely following this, were plants in the $T_{3.0}$ plots which produced plant biomass ranging from 11.43 - 13.70 kg during the 2-year trials. Generally, the non-branching variety produced the highest plant biomass. Among the herbicide treated plots, the $T_{2.0}$ plants produced the poorest biomass yield, while the weedy plots had the poorest yield in both years.

Table 5: Whole plant biomass yield (kg) as influenced by two cassava varieties (BR=branching and NB=non-branching) and weed management during 2008 and 2009 cropping seasons.

	2008			2009		
Weed MGT	**BR**	**NB**	**Mean**	**BR**	**NB**	**Mean**
P3.0	12.067	13.700	12.883	12.333	14.133	13.233
P3.5	11.833	13.400	12.617	12.067	13.767	12.917
P4.0	9.600	10.533	10.067	9.133	10.567	9.850
T2.0	8.000	10.533	9.267	7.833	9.700	8.767
T3.0	11.433	13.440	12.437	12.100	13.700	12.900
T4.0	9.667	10.633	10.150	9.067	10.733	9.900
MW	10.733	12.333	11.533	11.000	12.300	11.650
WF	11.733	12.633	12.183	12.000	12.867	12.433
WD	0.767	1.367	1.067	0.733	1.233	0.983
Mean	9.537	10.953	-	9.585	11.00	-
$LSD_{(0.05)}$		2008			2009	
Weed Mgt (WM)	0.6300			0.5026		
Variety (V)		0.2970			0.2369	
WM x V	0.8910			0.7108		

P3, P3.5 and P4 are 3.0, 3.5, and 4.0 kg a.i/ha of primextra, respectively; T2, T3 and T4 are 2.0, 3.0 and 4.0 kg a.i/ha of Taxastomp, respectively; WD: Weedy (unweeded) and WF: weed-free plots.

Table 6 shows the harvest index of the two cassava genotypes studied in the two-year trials. Harvest index was significantly ($P < 0.05$) influenced by the weed management [WM], cassava variety [V] and WM x V interaction in both years. Branching variety had higher harvest index in 2008 but in 2009 the harvest index of the non-branching variety was higher. Plots treated with T2.0 herbicide generally had high harvest index values. The weedy plot had the lowest harvest index irrespective of cultivar or year of evaluation.

Table 6: Harvest index as influenced by two cassava varieties (BR=branching and NB=non-branching) and weed management strategy during 2008 and 2009 cropping seasons.

	2008			**2009**		
Weed MGT	**BR**	**NB**	**Mean**	**BR**	**NB**	**Mean**
P3.0	0.8343	0.8466	0.8405	0.8406	0.8464	0.8435
P3.5	0.8425	0.8305	0.8365	0.8397	0.8448	0.8422
P4.0	0.8572	0.8545	0.8558	0.8503	0.8676	0.8589
T2.0	0.8714	0.8514	0.8614	0.883	0.8795	0.8839
T3.0	0.8543	0.8506	0.8825	0.8458	0.8540	0.8499
T4.0	0.8484	0.8522	0.8503	0.8344	0.8664	0.8504
MW	0.8418	0.8459	0.8438	0.8455	0.8563	0.8509
WF	0.8526	0.8285	0.8406	0.8472	0.8444	0.8458
WD	0.7870	0.6782	0.7326	0.6369	0.6248	0.6309
Mean	0.8433	0.8265	-	0.8254	0.8316	-

$LSD_{(0.05)}$	2008	2009
Weed Mgt (WM)	0.02089	0.02643
Variety (V)	0.00985	0.01246
WM x V	0.02954	0.03738

P3, P3.5 and P4 are 3.0, 3.5, and 4.0 kg a.i/ha of primextra, respectively; T2, T3 and T4 are 2.0, 3.0 and 4.0 kg a.i/ha of Taxastomp, respectively; WD: Weedy (unweeded) and WF: weed-free plots.

Root tuber weight per plant, apart from the weedy check was poor (6.96 - 8.96kg) in $T_{2.0}$ and $T_{4.0}$ (7.56 - 9.30 kg) across variety and year (Table 7). The highest tuber yield of 11.60 and 11.96 kg were obtained from the non-branching variety from $P_{3.0}$ plots in 2008 and 2009 respectively. The non-branching variety produced a higher tuber yield in both years.

Table 7: Tuber weight per plant (kg) as influenced by two cassava varieties (BR=branching and NB=non-branching) and weed management during 2008 and 2009 cropping seasons.

	2008			**2009**		
Weed MGT	**BR**	**NB**	**Mean**	**BR**	**NB**	**Mean**
P3.0	10.067	11.600	10.833	10.367	11.967	11.167
P3.5	9.967	11.133	10.550	10.133	11.633	10.883
P4.0	8.233	9.000	8.617	7.767	9.167	8.467
T2.0	6.967	8.967	7.967	6.967	8.533	7.750
T3.0	9.767	11.433	10.600	10.233	11.700	10.967
T4.0	8.200	9.067	8.633	7.567	9.300	8.433
MW	9.033	10.433	9.733	9.300	10.533	9.917
WF	10.000	10.467	10.233	10.167	10.867	10.517
WD	0.600	0.933	0.767	0.467	0.767	0.617
Mean	8.093	9.226	-	8.107	9.385	-

$LSD_{(0.05)}$	2008	2009
Weed Mgt (WM)	0.5652	0.4991
Variety (V)	0.2664	0.2353
WM x V	0.7993	0.7059

P3, P3.5 and P4 are 3.0, 3.5, and 4.0 kg a.i/ha of primextra, respectively; T2, T3 and T4 are 2.0, 3.0 and 4.0 kg a.i/ha of Taxastomp, respectively; WD: Weedy (unweeded) and WF: weed-free plots.

Genotype by genotype by environment (GGE) biplot analysis of the root yield per hectare is shown in Fig 1. The GGE analysis of the root yield per hectare captured 99.9% of the total variation in the treatment combinations in to the model. The biplot revealed differential effects of the weed management methods, besides; it showed that morphological types were similar in yield performance across the two-year evaluation trial. It was also evident from the biplot that cassava root yields were similar in $P_{3.0}$ and $T_{3.0}$ treated plots.

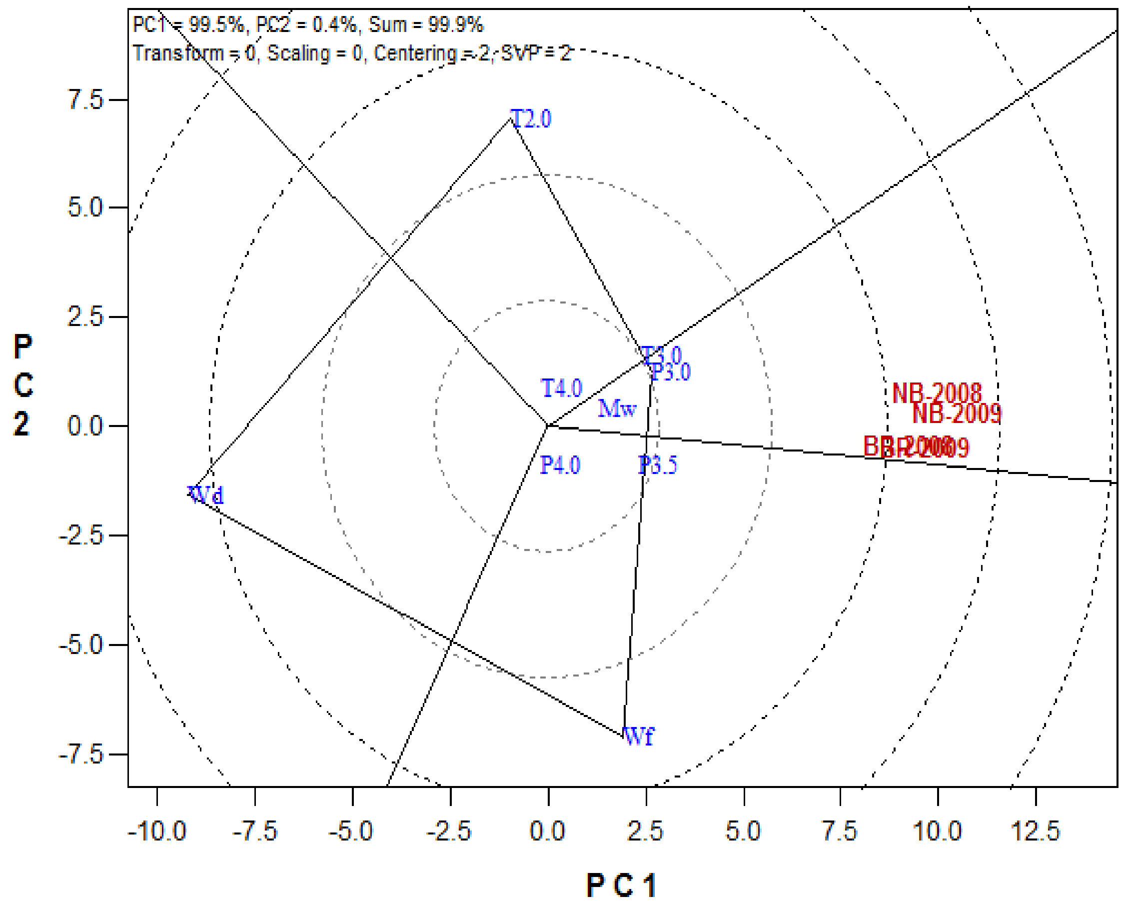

Figure 1: Biplot showing performance based on yield per hectare
P3, P3.5 and P4 are 3.0, 3.5, and 4.0 kg a.i/ha of primextra, respectively; T2, T3 and T4 are 2.0, 3.0 and 4.0 kg a.i/ha of Taxastomp, respectively; WD: Weedy (unweeded) and WF: weed-free plots.

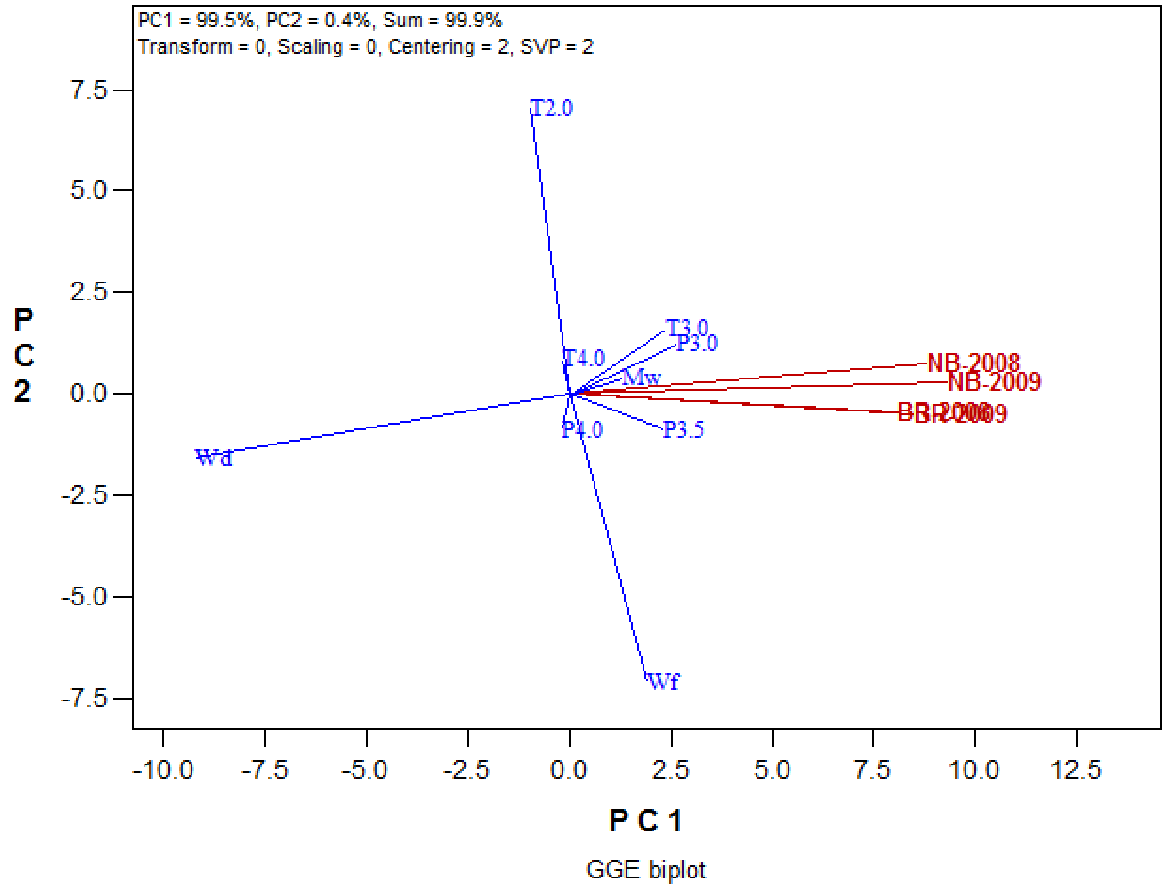

Figure 2: Biplot showing the relationship between weed management and cassava genotypes based on yield per hectare

P_3, $P_{3.5}$ and P_4 are 3.0, 3.5, and 4.0 kg a.i/ha of primextra, respectively; T_2, T_3 and T_4 are 2.0, 3.0 and 4.0 kg a.i/ha of Taxastomp, respectively; WD: Weedy (unweeded) and WF: weed-free plots.

In the two-year trial, the highest tuber yield (116 and 119 ton/ha) was obtained from the branching variety in the P3.0 herbicide treated plot. Least tuber yields among the herbicide applied plots were produced in the T2.0 plots across variety and year. Figure 2 showed the distinctiveness or relatedness of the nine weed control strategies evaluated. The biplot revealed that the weed free (Wf), weedy (Wd), and the application of 2.0 kg a.i./ha of taxastomp ($T_{2.0}$) had distinct physiological effects on the yield performance of the cassava genotypes evaluated. It was also evident from Fig. 2 the extent of relatedness of the effects of all other weed management methods especially T3.0 and P3.0 that were closely associated; suggesting that the two methods had very similar effectiveness in cassava weed control.

DISCUSSION

Significant reduction in weed biomass and weed dry matter obtained in $P_{3.0}$, $P_{3.5}$, $P_{4.0}$, $T_{3.0}$ and $T_{4.0}$ treated plots attests to the weed control effectiveness of Primextra and Taxastop herbicides at the rates specified. This is in agreement with the findings of Lagoke (1994) and Kumar (1999) who recommended 3.0 and 3.5 kg a.i/ha Primextra and 3.0 kg a.i/ha of Taxastomp in the production of cassava and cocoyam. Similarly, there was a lower weed dry matter in plots planted to the branching cassava variety in comparison to the non-branching. The decrease in weed dry matter with the branching variety was most likely due to shading occasioned by the lesser quantity and quality of light reaching the soil surface, thereby negatively influencing weed growth. High vegetative biomass of a main crop is a good potential for physical obstruction of light and weed seedling emergence (Teasdale and Daughty, 1993).

Shorter cassava plants in the $T_{2.0}$ treated plots in comparison to plants given other treatments could be the result of early weed interference occasioned by sub-optimal dose of herbicide application. Generally, taller plants were obtained from the non-branching variety, suggesting differential varietal growth potential.

Reduction in stem height, plant girth and tuber dry matter could probably be that application of 2.0 and 4.0 kg a.i/ha of Taxastomp and 4.0 kg a.i/ha of primextra to cassava in the study area was inappropriate. Phytotoxicity was suspected among plants treated with 4.0kg a.i/ha of primextra as some of the leaves were chlorotic. However, chlorosis was not observed among plants in which 4.0 kg a.i/ha of Taxastomp was applied. Reduction in these parameters including yield in plots treated with 4.0kg a.i/ha of primextra could probably be due to the toxicity of this herbicide formulation.

The observed trends in harvest index suggested that the agricultural efficiency of the two cassava varieties were modulated by weed management options evaluated. Earlier study of Baiyeri (2002) on plantain (*Musa* spp. AAB) revealed that fertilizer management significantly influenced harvest index. Similarly, Baiyeri and Tenkouano (2008) reported significant varietal effect of *Musa* species on harvest index as also found in this cassava study.

Cassava plants grown in $P_{3.0}$, $P_{3.5}$ and $T_{3.0}$ plots produced bigger storage roots and out-yielded those subjected to other treatments. This could mean that application of primextra at 3.0 or 3.5 kg a.i/ha and or Taxastomp at 3.0 kg a.i/ha is most appropriate for cassava production in the study area.

REFERENCES

Abbah, R.L., 2006. How to make Nigeria Greater, Sam Artrade Limited, Kano State p178.

Akobundu, I.O., 1987. Weed Science in the tropics: Principles and Practice, John Wiley and Sons, London, 522p.

Anonymous, 1990. Cassava in tropical Africa: a reference manual IITA, Ibadan pp1-10.

Baiyeri, K. P. 2002. Nitrogen fertilizer influenced harvest index of plantain (*Musa* AAB, cv. Agbagba) in a sub-humid zone of southeastern Nigeria. *Journal of sustainable Agriculture (USA)* 20(1): 95 – 102.

Baiyeri, K. P. and A. Tenkouano. 2008. Variability in Agricultural and Biological Yields of Ten *Musa* Genotypes Evaluated for Two Cropping Cycles in a Sub-Humid Environment of Nigeria. *Journal of Crop Improvement* 21(1): 27 – 40.

Food and Agricultural Organization (FAO), 1996. Bulletin of Statistics, 9 (3/4) Rome.

Food and Agricultural Organization (FAO), 2001. Bulletin of Statistics, 4 (3/4) Rome, Italy

Food and Agricultural Organization (FAO), 2004. Bulletin of Statistics, Rome, Italy.

IITA, 1990. Cassava in Tropical Africa. A reference manual. (United Nations Children Emergency Fund) 28p

Kumar, L.M., 1999. Chemical weed management. In Handbook of Weed Management Systems. Albert E. Smith (ed) Marue Dekker Inc. New York p279

Lagoke, S.T.O., 1994. Chemical weed control in field crops. Paper presented at the National Workshop in Farming System Research at Kano, Nigeria.

Omale, J.F., 2008. Cassava: a food security crop-In a paper presented at a Workshop, Ministry of Agriculture, Lokoja, Kogi Stat.

Onyeigwe, M.C.J., 2005. Cassava production and processing for exports and markets. Paper presented in a Workshop on consolidating Imo State economy through sound integrated farm practice, Owerri.

Udoh, J.U, Bassey A.N., Polycarp E.S. and Ndaeyo, N.U., 2005. Production techniques for the tropics, concept publication limited, Lagos p190.