ASSESSMENT ON SPROUT OF PLANTING ON HEAP AND RIDGE OF FOUR YAM (*Dioscorea rotundata* Poir) MINISETT VARIETIES

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ABSTRACT
Field experiments were conducted in 2013, 2014 and 2015 rainy seasons at the Teaching and Research Farm of Federal University of Technology, Minna and at Kuta, in Niger State, Nigeria to assess the effect of seed bed type and yam varieties on minisett sprout. The experiment was a 2x4x3 factorial combination arranged in a randomized complete block design. The treatments consisted of four yam varieties (Kwasi, Laushi, Sule and Lagos) and two seed bed types (heap and ridge methods) giving a total of eight treatment combination replicated three times. Five heaps were prepared in a row spaced at 1 m x 1 m in which five rows were contained in a plot to give 25 heaps per plot (5 m x 5 m = 25 m^2). Five ridges measuring 5 m long at 1 m apart were prepared per plot (5 m x 5 m = 25 m^2). Sixteen minisett seed size of 50 g were planted on each row of the heaps and the ridge at 30 cm x 30 cm (16 x 5 =80 seeds) replicated three times to give a total of 960 minisett seed. Data collected on yam spout were subjected to analysis of variance (ANOVA).Results obtained showed that heap method significantly recorded highest number of yam minisett sprouts (74.00) compared to the use of ridge. Lagos variety significantly at $p<0.05$ had the highest number of minisett sprouts (70.00). Based on this result, farmers should use heap for planting yam minisett instead of ridge for better sprouts. It is therefore recommended that heap method together with yam minisett should be recommended to farmers in the study area.
Key words: Minisett, yam varieties, sprout, tubers, insecticides

INTRODUCTION

Yam is one of the root crops which belong to the genus *Dioscorea* (Family Dioscoreaceae) (Riley *et al.,* 2006). It is the second most important tropical root crop in West Africa after cassava (Osunde, 2008). Angus *et al.* (2012) stated that yam is ranked second to cassava as major staple food and it is accorded high priority due to its cultural attachment and is also now a cash crop. The aforementioned authors reported that it contributes substantially to Nigeria food security.

Yam is a member of flowering plant with about 600 species found around the world with most of the areas being in the tropics Oluwatusin (2011). There are more than 600 species but only few are important as staple food. These species of yam include; white yam (*Dioscorea rotundata Poir),* yellow yam (*D.cayenenses),* water yam (*D. alata*), trifoliate yam *(D. dumetorum),* aerial yam (*D.bulbifera*) and Chinese yam (*D.esculenta*) (Osunde, 2008).

Various species of yam are believed to have originated from different areas with white yam (*D.rotundata)* being from west Africa; water yam (*D.alata*) from Asia and Chinese yam (*D.opposite*) is believed to originate from China (Oluwatusin, 2011). The distribution of yam cuts across the world with the total global production being about 39.9 million tons with about 91 % coming from Nigeria to C'ote d'Ivoire (FAO, 2005). Osunde (2008), reported that Nigeria is responsible for about 70% of the quantity produced in West Africa. International Institute of Tropical Agriculture [IITA] (2009), had reported that 4.6 million hectares were planted world wide with 4.3 million of that being in Central and West Africa. Food and Agricultural Organization Statistics [FAOSTAT] (2014), estimated that world production of yam was about 58.7 million tones with West Africa producing more than 92 %. Yam production is constrained by several factors of which the cost of planting material is rated to be about one third of the total cost of yam production (Bolarinwa and Oladeji, 2009). Nweke *et al.*(1991), also observed that limited plantig material, high cost of labour for operations such as land preparation, staking, weeding and harvesting were major constraints with planting material accounting for about 50 % of the total cost of yam production, while labour accounted for over 40 %. Oguntade *et al.* (2010), also opined that seed yams used for the production of ware or table yam consumed as food constitutes about 50% of the total cost of production. The authors further stressed that yam farmers in Nigeria usually obtained planting material from harvest of previous years through milking or setting of good ware yam. Lawrence (2006), stated that scarcity and expensive nature of clean seed yam is the major constraint to increasing yam production and productivity in West Africa.

The minisett techinque was developed by National Root Crop Research Institute, Nmudike in collaboration with IITA Ibadan, Nigeria in the 1970s as a rapid means of multiplying yam germplasm to address the frequent problems of high cost and non-availabilty of seed yam (Oguntade *et al.,* 2010).

Yam responds to various agro-ecological factors. Thomas *et al.* (2007) declared that yam grows and develops well between altitude of 0-1500 metres above sea level with temperature range of 23-25 ˚C and rainfall above 1500 mm requiring about five months during the rainy season and transition zone between the tropical rainforest and savannah as the most suitable for its production. Deep soils that are

permeable, rich in humus and giving an application of well decomposed manure to ridges or mounds, and yams can yield 5 – 12 tons/ hectare and even up to 20 20 tons /hectare with the use of organic fertilizers or organic manuring (Thomas *et al.* 2007). Coyne *et al.*(2010) stated that the pest and disease problems have proven to be difficult to address, partly because of wide range of organisms involved and also because of their resistance throughout the cultivation, storage and marketing periods. Lawrence (2006), established that poor quality planting materials tend to carry pests from the barn back to the field resulting in adverse effects on establishment and low tuber yield and consequently carry over to the following season. Nematodes such as *Meloidogyne spp* often interact with fungal *Fusarium spp.* and bacteria (*Erwenia spp*) to attack tubers of suceptible varieties in the field and continue their damage during storage leading to losses of food quality and quantity as well as market value Lawrence (2006). Osunde (2008) reported that yam is an excellent source of carbohydrate, mineral, vitamin (especially vitamin C). Purseglove (1985), stated that some wild species of yam contain a toxic alkaloid that could be used in hunting (as arrow poison) and as insecticide. Yam can be prepared and consumed in form of boiled yam, fried, baked, dried flour - amala, pounded yam or pottage yam (Oguntade *et al.*, 2010 Okoro; 2008). According to Oguntade *et al.*(2010), other uses of yam include its being an integral part of social and religious festivals such as traditional marriages as well as sacrificial ceremonies of traditional religions. Linus (2003), also reported the importance of yam to include, mashed yam offered as meals to gods in South – East Nigeria and as stored wealth when kept for a long time.

Oluwatusin (2011) stated that yam has been used as heart stimulant and as well used by the traditional title holders in South East Nigeria that offer yam to gods first before they start consumption thus thanking their ancestral gods for the blessing of the land and women fertility and as well used for marriage customs for some communities in Nigeria where bridegrooms wealth is measured by the number of yams he can produce and ability to provide a minimum of 200 big tubers of yam to the in- laws as proof that he can take care of his wife and future family. Osunde (2008) reported that at present, whole roasted yam has become a popular street fast food which results to income derivation for livelihood of a common man.. Some poisonous variety of *D.bulbifera* is used in folk medicine in India where a paste from the tuber is used to cure snake bite and for the treatment of scorpion and centipede stings in Jamaica.

Minisetts are referred to as cut sections of yam tubers having the skin attached to them from carefully selected tubers used as alternative means to the production of seed yam through milking of ware yam. Oguntade *et al.* (2010), reported that the seed yam production potential is best from three yam species - (*D. Rotundata, D. alata*, and *D.cayenenses).* For the traditional method, 100-200 g setts can be used while minisett technique could be achieved using 25, 20, 15 and 10 g cut from other tubers. There is no supply of seed yam in Nigeria and farmers sell seed yam after they have met their own requirement (Asumugha *et al.,* 2009). The minisett technique can generate large quantities of seed yam with minimal inputs and the technique is less complicated. Thus, the minisett technique remains the only on-farm practicable alternative to the use of ware yam as seed yam (Oguntade *et al.*, 2010). The objective of this study was to assess the effect of seed bed type and yam varieties on minisett sprout.

MATERIALS AND METHODS

Experimental Sites

The study consisted of two field trials conducted at Kuta village in Shiroro Local Government area of Niger State and the Teaching and Research farm at Gidan Kwano, Federal University of Technology, Minna, Niger State in 2013, 2014 and 2015 rainy seasons. Kuta is located in latitude 09˚ 30`N and longitude 60° 45`E with meanannua rainfall range of1,100 mm and 1,600 mm and a mean temperature of 29 ˚C (Anon, 2000). Minna is located on latitude 09˚ 40` N and longitude 60˚ 30'E with annual rainfall of 1,200mm and temperature of 29 ˚C (Tsado, 2012) Experimental field at Gidan Kwano was previously cropped with sorghum in 2012 prior to field establishment in 2013. Same field was used in 2014 and 2015 rainy seasons respectively.

Soil Analysis

Soil sample was collected along diagonal transects at both locations at the depth of 0-30 cm prior to preparation of heaps /ridges and bulked together to form a composite sample. The soil sample was air-dried, gently crushed and passed through 2 mm sieve. Sample was subjected to laboratory analysis for the determination of physical and chemical properties of soil such as particle size, soil pH, organic carbon, total nitrogen, available phosphorus (P), exchangeable bases ($Ca^{2+,}$ Mg^{2+}, K^+ and Na^+), K^+ and Na^+ using standard solution

Minisetting

Mother tubers (ware yams) which dormancy has been broken were selected for the minisett. Tubers selected were cut into several pieces like dices about 5cm long as reported by (Mkpado and Ouoha, 2008) using knife. Each of these pieces further cut into several units of 50g with carefulness to avoid damaging the skin. The minisetts cuts were treated with seed treatment chemical (Seed plus 30 WS) which possesses both insecticidal and fungicide properties. The active ingredients are Imidacloprid 10 % + Metalaxyl 10 % + Carbendazim 10 % ws; imidacloprid is an insecticide while metalaxyl and carbendazim are fungicides. The formular was used at the rate of 100 g in 10 litres of water. The minisett

cuts were dipped into the solution for about 5-10 minutes and then removed and allowed to drain and dry for 2 hours before planting as reported by Stephen, 2009.

Source of Planting Material

The yam varieties were sourced from farm gate of a farmer in Kuta village in the first year while the harvested ones were stored in yam barn subsequently in 2014 and 2015 for planting. The varieties used in this study are currently rated by the farmers to be the highest yielding in the State.

Land Preparation

The land was cleared using cutlasses and hoes. The preparation of heaps and ridges were manually done using hoes. The heaps and ridges were prepared in line with the treatments designed.

Treatments and Experimental Design

The experiment was laid out as a 2 x 4 factorial combination in a randomized complete block design. Four yam varieties (Kwasi, Laushi, Sule [Army] and Lagos) and two seed bed preparation methods (Heaps and Ridges). The experiment has eight treatment combinations which were replicated three times. The size of the plot was 5 x 5 ($25m^2$) with an alley of 1 m was left between replicates and as well 0.5 m between the treatments. On each plot, five rows of five heaps each made at a spacing of 1 m x 1 m were contained in a plot to give 25 heaps per plot of 25 m^2. The intra-row space between the heap in each row was filled with soil for planting minisett while 5 ridges measuring 5 m long at 1 m apart were prepared per plot (5 m x 5 m = 25 m^2). This resulted to 25 m^2 x 8 = 200 m^2 per block which fitted to the 8 treatment combination. An alley of 1 m was left between replicates and as well 0.5 m between the treatments. On each plot, five rows made of five heaps each spacing 1 m x 1 m were contained in a plot to give 25 heaps per plot of 25 m^2. The intra-row space between the heap in each row was filled with soil for planting minisett while 5 ridges measuring 5 m long at 1 m apart were prepared per plot (5 m x 5 m = 25 m^2). This resulted to 25 m^2 x 8 = 200 m^2 per block which fitted to the 8 treatment combination. An alley of 1 m was left between replicates and as well 0.5 m between the treatments.

Weed Control

Weeds were controlled using Premextra 500SC (formulation of 170/l atrazine and 330/l metolachlor), a pre-emergence herbicide applied 2 days after planting (5l/ha) using CP 15 Knapsack sprayer Supplementary hand weeding, using hoes, was carried out 3 times at 3 weeks, 6 weeks and 9 weeks after planting

Fertilizer Application

A basal dose application of N-P-K 15:15:15 fertilizer at 25 g/plant (250 kg/ha) as recommended by Thomas *et al*. (2007) was adopted two months after emergence by side placement.

Staking: Sticks measuring 1.5-2 m height were used for staking. The sticks were forced into the soil and two plants were trained to one stick as recommended by Onwueme and Hamon (2002).

Harvesting and Storage

Tubers were harvested when vines were fully dried using hoes. This was achieved by careful digging round the tuber to avoid injuries.

Data Collection

The parameters for which data were collected include number of sprouts, main vine length the number of leaves/plot, leaf length/plot and number of branches/ plot.

Statistics and Data Analysis

Data collected were subjected to analysis of variance (ANOVA) using the Statistical Analysis Software package (SAS, 1993). Duncan Multiple Range Test (DMRT) was used to separate the means at $P<0.05$.

RESULTS

Physical and chemical properties of soil in the experimental site

The physical and chemical analysis of the soils at both locations indicated that, the soil at Kuta was sandy loam while that of Gidan Kwano was sandy clay loam and both were slightly acidic at pH levels of 5.3, 5.4, 5.5 at Kuta while that of Gidan Kwano location was 5.5, 5.6, 5.5 in during the study years. Total nitrogen, Magnesium (Mg^{2+}) potassium (K^{+}) and Sodium (Na^{2+}) were high at both locations all through. Available phosphorus and calcium (Ca^{2+}) contents were medium at both locations throughout the study years but Organic carbon was low.

Minisett Sprout

Table.1 shows the effect of seed bed preparation method on the number of sprouting of four yam varieties 3 WAP at Kuta and Gidan Kwano in 2013, 2014 and 2015 rainy seasons. Planting methods significantly affected sprouting such that the use of heap method of planting produced the highest number of sprouts than the ridge method in both locations and in each year of the study.

Sprouting differed significantly between the yam varieties in this study. The use of Sule (Army) yam variety recorded the highest sprout at Kuta in 2013, 2014 and 2015 including Gidan Kwano in 2014. Similar highest sprout was observed with Lagos variety at Gidan Kwano in 2013 and 2015. Kwasi and Laushi recorded the lowest sprout at Gidan Kwano in 2013 and 2015. Interaction of p x v was observed at Gidan Kwano in 2013, both locations in 2014 and Gidan Kwano in 2015 (Table 2).

The interaction of planting methods and yam varieties on sprouting at 3 WAP was observed at Gidan Kwano in 2013, 2014, 2015 and at Kuta in 2014 as shown in Table 2. Result of the interaction as presented in Table 2 revealed that, heap method at 3 WAP significantly $P<0.05$ recorded the highest number of sprout when Lagos variety was planted under heap at Gidan Kwano in 2013, 2014 and2015. Similar highest number of sprout was observed with

Sule (Army) variety planted under heap method in 2014.

Table 1: Effects of Seed Bed Preparation Method on the Number of Sprouting in Four YamVarieties at 3 WAP in 2013, 2014 and 2015 Seasons

	2013		2014		2015	
Treatment	**Kuta**	**G/Kwano**	**Kuta**	**G/Kwano**	**Kuta**	**G/Kwano**
Planting (P)						
Heap	14.00a	26.00a	14.00a	15.00a	19.00a	20.00a
Ridge	9.00b	11.00b	8.00b	11.00b	13.00b	9.00b
S.E±	0.99	0.82	0.59	0.59	0.45	0.33
Variety (v)						
Kwasi	10.00b	7.00c	9.00b	9.00b	17.00b	7.00c
Laushi	8.00b	10.00c	9.00b	10.00b	14.00c	8.00c
Sule (Army)	20.00a	24.00b	17.00a	22.00a	19.00a	16.00b
Lagos	10.00b	35.00a	11.00b	11.00b	14.00c	28.00a
S.E±	1.40	1.16	8.83	0.83	0.65	0.46
Interaction						
P x V	NS	**	*	**	NS	**

Means followed by the same letter are not significantly different at P > 0.05 by Duncan Multiple Range Test (DMRT);S.E = Standard error; WAP= Weeks after Planting; NS = Not significant; * = Significant; ** = highly significant

Table 2: Interaction of Planting Method and Yam Varieties on the Number of Sprouting 3 WAP at Kuta and Gidan Kwano in 2013 and at Gidan Kwano in 2014 and 2015

	Variety			
Treatment	**Kwasi**	**Laushi**	**Sule**	**Lagos**
Planting method		**G/Kwano 2013**		
Heap	7.00b	15.00c	33.00b	52.00a
Ridge	8.00d	6.00d	14.00c	17.00c
S.E±			1.65	
		Kuta 2014		
Heap	11.00bc	10.00cd	19.00a	16.00a
Ridge	6.00e	7.00de	14.00ab	6.00e
S.E±			1.19	
		G/Kwano 2014		
Heap	37.00b	41.00b	55.00a	36.00b
S.E±	13.00c	11.00c	35.00b 1.41	39.00b
		G/Kwano 2015		
Heap	4.00e	12.00c	22.00b	42.00a
Ridge	10.00d	5.00e	10.00d	13.00c
SE±			0.65	

Means followed by the same letter(s) in a column and among rows in each year are not significantly different at P=0.05 using Duncan Multiple Range Test (DMRT)

Effect of seed bed preparation method and yam varieties on number of spouting is presented in Table 3. The result showed that heap method consistently produced the highest number of sprout across the locations at 6 WAP in 2013, 2014 and 2015 though there was no significant difference at Gidan Kwano in 2014 among the planting methods. Considering the use of different yam varieties, there was no significant difference at kuta in 2013 and botyh locations in 2014. Kwasi variety recorded the highest number of sprout in both locations with similar highest number of of sprout in Kuta with Sule (Army) variety. The lowest number of sprout was recorded in Gidan kwano in 2015 with Laushi variety.

Interaction of planting and variety was observed in Gidan Kwano (2013 and 2015) and Kuta (2014 and 2015). The interaction of planting method and variety on number of sprout at 6 WAP as presented in Table 4 showed that heap method at Gidan Kwano in 2013 recorded the highest number of sprout in combination with Laushi and Lagos varieties. Similar results were obtained at Kuta in 2014 and 2015 in combination with Lagos and Sule varieties respectively including Sule and Lagos at Gidan Kwano in 2015. All varieties were better under heap method while Lagos variety recorded the least number of sprout in 2015 though the result is at par with Sule at Gidan kwano in 2013 and Kwasi at Kuta in 2015 under heap planting method.

Table 3: Effects of Seed Bed Preparation Method on Number of Sprouting in Four yam Varieties at 6 WAP in 2013, 2014 and 2015 Seasons

	2013		2014		2015	
Treatment	**Kuta**	**G/Kwano**	**Kuta**	**G/Kwano**	**Kuta**	**G/Kwano**
Planting (p)						
Heap	63.00a	66.00a	52.00a	48.00a	67.00a	60.00a
Ridge	53.00b	57.00b	45.00b	47.00a	54.00b	17.00b
S.E±	1.97	1.13	1.76	2.47	0.79	0.40
Variety (v)						
Kwasi	61.00a	46.00b	51.00a	46.00a	64.00a	40.00a
Laushi	54.00a	69.00a	47.00a	49.00a	57.00b	31.00d
Sule (Army)	61.00a	67.00a	48.00a	45.00a	66.00a	35.00c
Lagos	54.00a	66.00a	50.00a	51.00a	55.00b	38.00b
S.E±	2.74	1.60	2.49	3.49	1.12	0.56
Interaction						
P x V	NS	*	*	NS	*	**

Means followed by the same letter(s) are not significantly different at $P > 0.05$ by Duncan Multiple Range Test (DMRT); S.E = Standard error. WAP= Weeks after Planting. NS = Not significant. * = Significant; ** highly significant

Table 4: Interaction of Planting Method and Yam Varieties on Number of Sprouting 6 WAP at Gidan Kwano in 2013 and 2015; Kuta in 2014 and 2015 Seasons

	Variety			
Treatment	**Kwasi**	**Laushi**	**Sule**	**Lagos**
Planting method		**G/Kwano 2013**		
Heap	46.00e	73.00a	70.00ab	76.00a
Ridge	45.00e	65.00bc	64.00c	55.00d
S.E±			2.27	
		Kuta 2014		
Heap	51.00b	51.00b	45.00bc	61.00a
Ridge	50.00b	42.00bc	50.00b	39.00c
S.E±			3.52	
		Kuta 2015		
Heap	19.00ab	19.00bc	21.00a	16.00cd
Ridge	14.00de	10.00f	17.00bc	12.00ef
S.E±			1.58	
		G/Kwano 2015		
Heap	38.00d	57.00b	61.00a	62.00a
Ridge	41.00c	5.00g	9.00f	12.00e
SE±			0.79	

Means followed by the same letter (s) in a column and among rows in each year are not significantly different at P=0.05 using Duncan Multiple Range Test (DMRT)

Table 5 presents the results on effect of seed bed preparation method on number of sprouting of yam varieties at 9 WAP. Result indicates that heap method recorded the highest number of sprouts at both locations in 2013 and Kuta in 2015. Varietal performance showed no significant difference in 2013 at Kuta, but at Gidan kwano, only Kwasi was least. At Kuta in 2014 and 2015, Kwasi variety recorded the highe3st number of sprout which was statistically similar with the results obtained at Gidan kwano in 2014 and 2015 in combination with Lagos variety. Though Lagos variety produced similar highest number of sprout at Kuta in 2014. The variety with the least number of sprout was Kwasi at Gidan kwano in 2015.

Interaction of planting method and variety was observed at Kuta and Gidan kwano in 2013 and 2015 as presented in Table 6 showed that heap method recorded similar highest number of sprouts in all varieties at Kuta in 2013, though similar results were obtained with ridge planted with Kwasi and Lagos varieties. In 2015 at Kuta, Kwasi, Laushi and Sule (army) produced the highest number of sprouting planted on heap including Sule (Army) planted on both heaps and ridges in 2015 at Gidan Kwano though results were at par with Lasushi and Lagos varieties planted on heap in same location. The least number of sprout was observed in Kwasi variety at Gidan kwano in 2015.

Table 5: Effects of Seed Bed Preparation Method on Number of Sprouting in Four Yam Varieties at 9 WAP in 2013, 2014 and 2015 Seasons

	2013		2014		2015	
Treatment	**Kuta**	**G/Kwano**	**Kuta**	**G/Kwano**	**Kuta**	**G/Kwano**
Planting (p)						
Heap	67.00a	71.00a	63.00a	56.00a	74.00a	66.00a
Ridge	60.00b	66.00b	65.00a	55.00a	65.00b	64.00a
S.E±	1.38	1.36	3.35	3.04	0.59	0.66
Variety (v)						
Kwasi	62.00a	54.00b	70.00a	56.00ab	72.00a	57.00c
Laushi	58.00a	76.00a	57.00b	54.00ab	68.00b	66.00b
Sule (Army)	67.00a	73.00a	60.00ab	48.00b	69.00b	67.00b
Lagos	67.00a	72.00a	69.00a	64.00a	68.00b	70.00a
S.E±	1.95	1.92	3.35	4.43	0.84	0.93
Interaction						
P x V	*	NS	NS	NS	*	*

Means followed by the same letter(s) under each factor are not significantly different at $P > 0.05$ by Duncan Multiple Range Test (DMRT); S.E = Standard error; WAP= Weeks after Planting; NS = Not significant; * = Significant

Table 6: Interaction of Planting Method and Yam Varieties on Number of Sprouting 9 WAP at Kuta in 2013 and 2015 and at Gidan Kwano in 2015 Seasons

		Variety		
Treatment	**Kwasi**	**Laushi**	**Sule**	**Lagos**
Planting method		**Kuta 2013**		
Heap	67.00a	66.00a	68.00a	67.00a
Ridge	59.00a	49.00c	65.00ab	67.00a
S.E±			2.76	
		Kuta 2015		
Heap	76.00a	75.00a	75.00a	71.00b
Ridge	69.00b	61.00d	64.00cd	65.00c
S.E±			2.76	
		G/Kwano 2015		
Heap	55.00e	69.00ab	70.00a	68.00ab
Ridge	58.00de	62.00cd	70.00a	65.00bc
SE±			1.32	

Means followed by the same letter(s) in a column and among rows in each year are not significantly different at P=0.05 using Duncan Multiple Range Test (DMRT)

DISCUSSION

Planting methods and the use of different yam varieties significantly affected yam spout. Heap method constantly was superior over ridge method in both years and locations. The significant superiority of heap method over the use of ridge method at both locations could probably be attributed to the fact that, the heap method had higher raised and bulky seed bed than the ridge which could retain more moisture and heat protection to enhance better sprouts. This result is similar to the findings of Ijoyah *et al.* (2006),who reported a superior minisett sprouts on raised bed system than the use of ridge method.

The varietal response on minisett sprouts showed a significantly greater number of sprouts in Sule at Kuta and in Lagos variety at Gidan Kwano in 2013 than others which probably suggests the varietal response to locations. Sule, Kwasi and Lagos at Kuta, Sule and Lagos at Gidan Kwano in 2014 and as well Sule and Kwasi at Kuta in 2015 that produced similar number of sprouts could be attributed to similar potential genetic sprouting ability of the varieties while the difference between the years could be due to seasonal effects. This agreed with the view of Okezie and Nzekwe (2009) who observed that sprouting generally depends on hormonal control and the recovery from dormancy would imply the existence of the sprout promoting hormone at the level that is optimal for bud break and hence sprout emergence.

The significant interaction response between planting method and variety on minisett sprouts showed that Lagos variety planted on heap produced the highest number of minisett sprouts at both locations in the study periods. This however disagreed with the similar work by Ennin *et al.* (2014) who found the interaction of yam stands to be higher with the use of ridge method of planting.

CONCLUSION

From this study, it can be concluded that heap method of planting minisett resulted to the higher number of sprouts than the use of ridge. Based on these findings, farmers should be encouraged to use heap method for planting yam minisett instead of ridge for better sprouts.

REFERENCES

Angus, N., George, E.,and Lawrence K. (2012). Evaluation of yield productivity and Economic Returns of some yam (*Dioscorea esculenta* (poir) Genotypes grown in a Kaolinite utisol. *Journal of Biology, Agriculture and Health Care*, 2(6), 2224-3208

Asumugha, G. N., Njoku, M. E., Okoye, B., C., Asiedu, O. C., Ogbonna, M. C., Anyaegbunam, H. N., Akinpedu, O. A., Ibeagi, O., & Amaefula, A. (2009). An Analysis of the supply for seed yams in Nigeria *African Journal of Business Management*, 3 (I), 28-31

Bolarinwa, K. K., & Oladeji J. O. (2009).Adoption and Relevance of yam Minisett Technology Practices to Famers Indigenous Practices in Rain forest and Derived Savannah Zones of Nigeria. *Journal of Applied Sciences Research*, 5(12), 2461-2464.

Coyne, A, Claudius A., & Kikuno, H. (2010). Sowing the seeds of bitter yam. Technical Innovation Brief .CGIAR SP-IPM, www.spim.cgiar.org, 7, 4-5.

Ennin, S. A., Issaka, R. N., Acheampong, P. P., Numafo, M., & Owusu, D. (2014). Mecahnization and Staking Options for Environmentally Sound Yam Production. *African Journal of Agricultural Research*, 9 (29), 1-4

FAO (2005). Satistical Data Base. FAO, Rome, 21-23

FAOSTAT (2014). Yams Production Quantity in Nigeria faostat3.fao.org/foastat-gateway/go/to/download/q/QC/E, 32.

IITA (2009). Research to Nourish Africa news and Events. Global initiative underway to preserve yam Biodiversity, 1-6

Ijoyah, M. O., Aba, J., & Ugannyan, S. (2006). Effects of Seed Bed Types on Yam- Minisetts Yield: A Case Study of Ushongu Local Government area of Benue State of Nigeria. *African Journal of Biotechnology*, 5(22), 1-5

Lawrence, K. (2006). Up-scaling sustainable"*clean"* Seed Yam Production Systems for Small Scale Growers in Nigeria. United Kingdom Department for International Development, R8416 (2a06 48) Crop Protection Programme. Final Technical Report, 1-2

Linus, U. O. (2003). Yams: Post – Harvest Operation Edited by AGST/FAO. FAO (Technical), 5-7

Mkpado, M., & Onuoha E. (2008). Refined Indigenous Knowledge as Sources of Low Input Agricultural Technology in Sub-saharan Africa Rural Communities: Nigerian Experience. *International Journal of Rural Studies, (IJRS)*,2(5), 1-7

Nweke, F. I., Ugwu, B. O., & Asiedu, R. (1991). Production Costs in Yam - Based Cropping System of Southern Nigeria. Resoruce of Crop Management Programme (RCMP) Rsearch Monogram No.6 IITA, Ibadan, Nigeria, 29.

Oguntade, A. E., Thompson, O. A., & Ige T. (2010). Economics of Seed. Yam Production Using Minisett Techniques in Oyo State, Nigeria. *The Journal of field Actions*, 4(3), 3-10

Okezie, C. E. A., & Nzekwe, U. (2009). The Synergistic Effect of Gebrerellic Acid and Modolebutyric Acid on Multiple Sprout Formation and Early Seedling Establishment from *Dioscorea rotundata* poir Minisetts, *Nigeria Journal of Botamy*, 22(1), 129-146,

Okoro, J. K. (2008). Awareness and use of the rapid yam multiplication technology by farmers in Nigeria's yam Belt. *PAT*,5(1), 22 -25

Oluwatusin F. M. (2011). Measuring Technical Efficiency of yam Farmers in Nigeria: A Stochastic Parametric Approach. *Agricultural Journal*, 6 (2), 40-46.

Onwueme, I. C., & Hamon, P. (2002). *Dioscorea cayenensis* Lam. (Internet) Record from Protabase. Oyen, L.P.A and Lemmens, R. H. M. J (Editors) PROTA(Plant Resources of Tropical Africa) Wageningen Neatherlands<http.//data base prota.org/search.htm>retrieved, 9th April, 2012, 3-6.

Osunde, Z. D. (2008). Minimizing Post harvest losses in yam (*Dioscorea spp*): Treatments and Techniques. Chapter 12 from using Food Science and Technology to Improve Nutrition and Promote National Development, Robertson, G.C and Lupien,

J.R (Editions). Internation Union of Food Science and Technology, 1-11.

Pursegolve, J. N. (1985). Monocotelydon: 1 and 2 combined. ELSB Edition, produced by Longman, Sigapore Publishers, 97-108.

Riley, C. K., Wheatley, A. O., & Asemota, H. N. (2006).Isolation and Characterization of Starches from Eight *Dioscorea alata* Cultivars Grown in Jamaica. *African Journal of Biotechnology* 5 (17), 1528-1536,

SAS (1993). Statistical Analytical Software package. System for windows. SAS User's Guide; Statistics, Version 9.1.SAS Institute Inc. Cary.NC, USA. p.56.

Stephen, M. (2009). Potential for Clean Seed Yam Production by Resource Poor Farmers in the Middle Belt of Nigeria. Partly Funded by the Department for International Development (DFID) of the UK (ZA0566), 3-9.

Thomas, N. B., Andre, M., & Domini, N. (2007). Technology Guide for the Production and Conservation of Yams (*Dioscorea spp*) Publication of Cameroon, Ministry of Agriculture and Rural Development, National Programme for Roots and Tubers Development, 10-17

Tsado, E. K. (2012). Substituting Wooden Sticks with Plastic Stakes in Yam Production in Niger State Nigeria. *Journal of Natural Sciences Research*. 2(9), 88-89.