EFFECT OF N-FERTILIZATION AND WEEDING REGIMES ON WEED INFESTATION, ROOT YIELD AND PROFITABILITY OF SWEETPOTATO PRODUCTION.

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ABSTRACT
The decrease in sweetpotato productivity has been traced to inadequate weed control, poor nutrient status of soils, among other factors. A study was conducted in 2014 and 2015 cropping seasons,to evaluate the effect of different N-fertilization and weeding regimes on weed suppression, root yield and profitability of sweetpotato at two locations (Umudike and Otobi). Treatments were arranged in a split plot in a randomized complete block design (RCBD) with three replications. Nitrogen fertilizer applied as urea occupied the main plots, while weeding regimes occupied the sub-plots.Data collected were subjected to analysis of variance (ANOVA) for a split plot in RCBD using Genstat Satistical Package,(Edition 4 of 2012). Significant treatment means were compared using the Fishers' least significant difference at 5% level of probability. Results obtained showed that application of 120 kg N ha^{-1}gave the lowest weed density and 60 kg N ha^{-1} the lowest weed biomass in both locations. Manual weeding at 4WAP and 8 WAP significantly suppressed weed incidence at 12 WAP in Otobi and Umudike, respectively. There was no significant interaction effect on weed density and biomass in both locations and years. Yield results showed highest root yield 22.66 and 21.82 t ha^{-1},at Umudike and Otobi locations,respectively, with the application of 120kgN/ha +8WAP treatment combination and produced highest return of ₦1.40, for every one naira invested in both locations.
Key words:N-fertilization, weeds, weeding regime, Sweetpotato production.

INTRODUCTION
Sweetpotato (*Ipomoea batatas* [L.] Lam) is an important root crop which is extensively cultivated in tropical and subtropical zones of the world (Islam, *et al.,* 2002). Sweetpotato ranks seventh among the world food crops, third in value of production and fifth in caloric contribution to human diet (Som, 2007). It is cultivated in over 100 countries of the world (Woolfe, 1992). It belongs to the family *Convolvulaceae (*Gill, 1998). The area under sweetpotato cultivation in Nigeria is estimated at 681,000 hectares annually (FAO, 2005). Nigeria is the largest producer of sweetpotato in Africa with 3.60 MT (FAOSTAT, 2014) and second in the world with China leading (106, 197,100 million metric tonnes (FAOSTAT, 2014). However, in recent time, the production rate of sweetpotato in Nigeria has been on the decrease. The decrease in the production of sweetpotato has been traced to inadequate weed control, poor nutrient status of the soil among other factors (IITA, 2008).

Weed management as defined by Akobundu (1987) is the ability to manipulate weeds so that they do not interfere with growth, development and economic yield of crops and animals. The practical implementation of weed management is to use the best weed control practices to reduce weed introduction, spread, competition with crops and their adaptation to any habitat. Soil native fertility and type and rate of fertilization have been identified as one of the environmental factors that affect weeds infestation (Orkwor, *et al.*, 1981). The objectives of the study were to determine the weed density, total root yield and economics of production of sweetpotato as influenced by N-fertilization and weeding regimes at Umudike and Otobi in Rainforest and Derived Savannah of Nigeria, respectively.

MATERIALS AND METHODS
The field trials were conducted at the National Root Crops Research Institute Farm between May 2014 and November 2015 at two locations, Umudike in Abia State (latitude 05^0, 29^1N, longitude 07^0, 33^1E and 122m above sea level) and Otobi Sub Station in Benue State (latitude 07^0, 19^1N, longitude 08^0, 32^1E and 141m above sea level). The site at Umudike represented the moist forest agro-ecology with tropical rainforest vegetation but much of it had been cleared for the cultivation of arable crops. The soil of Umudike is formed from coastal plain sands. It is acidic and belongs to the broad soil order, Ultisol. The area has a mean annual rainfall range of 1800-2200mm. Rainfall pattern is bimodal with peaks in July and September. The site of Otobi represented the wet and dry agro-ecology of the derived guinea savannah and had been under intensive cultivation for research on cassava, yam, maize, guinea corn, sweet potatoes and groundnut.

Field trials were conducted to determine the effect of N-fertilization and weeding regimes on weed incidence and productivity.The experiment was laid out in a split plot design replicated three times. Three levels of nitrogen fertilizer, namely, 0, 60 and 120kgNha^{-1}occupied the main plots treatment. While three levels of weeding regimes namely; no weeding, weeding at 4 weeks after planting (WAP) and weeding at 8 WAP occupied the sub plots treatments. The net experimental area measured 810 m^2. Each sub-plot measured 5 x 6 m. The replicates and the main plots were delineated by an alley of 2 m. Sweetpotato variety 87/0087 was used as the test crop. Phosphorus (P) and potassium (K) at 15 kg P_20_5 ha^{-1} and 75 kg K_20 ha^{-1}, were applied basally in the form of single super phosphate and muriate of potash respectively to boost the growth of the test crop.

Routine soil analysis was carried out to determine the physico-chemical properties of the soil for each season of cropping in the two locations. Measurements were obtained on total weed density at 4, 8 and 12 WAP by the throwing of a 1 x 1m quadrat randomly and counting the number of weeds within the quadrat. Total root yield was measured at harvest(4 MAP). The economics of N-fertilization and weeding regimes of the enterprise were also determined.

Data Analysis

Data collected were subjected to analysis of variance (ANOVA) for a split plot in RCBD using Genstat Satistical Package, (Edition 4 of 2012). Significant treatment means were compared using the Fishers' least significant difference at 5% level of probability.

RESULTS

The soil physico-chemical properties of the experimental sites are presented in Table 1. The particle size distribution showed that Otobi soils were sandy clay loam in both 2014 and 2015 at 15 – 30 cm depth and sandy loam in 2014 and 2015 at 15 – 30 cm depth. The results also indicated slight acidic soil reaction, withpH values that ranged from 5.20 – 5.60, with mean values of 5.40 and 5.58 recorded at Umudike and Otobi soils, respectively.Two years mean values of soil organic matter (SOM) at Umudike and Otobi were 16.7 and 17.6gkg^{-1}, respectively. The soils of both sites were generally low in total nitrogen (< 0.1 g kg^{-1}). Available phosphorous in Umudike soils were medium and ranged from 19.45 – 20.25 mg/kg. However, Otobi soils recorded high available P, with values > 30 mg/kg. Effective cation exchange capacity was low in both soils, ranging from 7.93 Cmol/kg in Umudike soils to 18.6 Cmol/kg in Otobi soils. However, the exchangeable acidity was high at both locations in both years due to low pH values of the soils.

Table 1: Initial soil physico-chemical properties for the study soils in 2014 and 2015 cropping seasons

	Umudike 2014			Otobi 2014			Umudike 2015			Otobi 2015		
	Soil Depth (cm)			Soil Depth (cm)			Soil Depth (cm)			Soil Depth (cm)		
	0-15	15-30	(Mean)	0-15	15-30	(Mean)	0-15	15-30	(Mean)	0-15	15-30	(Mean)
Particle size analysis:												
Sand (gkg^{-1})	804.0	764.0	784.0	464.0	564.0	514.0	785.0	704.0	744.5	566.0	603.0	584.5
Silt (gkg^{-1})	114.0	134.0	124.0	414.0	174.0	294.0	113.6	134.0	123.8	302.0	156.0	229.0
Clay (gkg^{-1})	82.0	10..20	92.0	122.0	262.0	192.0	101.4	162.0	131.7	132.0	241.0	186.5
Soil texture	S	SL	SL	L	SCL	SL	SL	SL	SL	SL	SCL	SL
pH	5.60	5.20	5.40	5.56	5.60	5.60	5.50	5.30	5.40	5.55	5.56	5.56
Organic matter (gkg^{-1})	17.1	16.0	16.6	19.8	15.3	17.6	17.3	16.2	16.8	19.6	15.5	17.6
Total Nitrogen (gkg^{-1})	0.08	0.08	0.08	0.10	0.08	0.09	0.08	0.08	0.08	0.10	0.08	0.09
Available P ($mgkg^{-1}$)	21.6	17.30	19.45	23.10	46.20	34.65	22.10	18.40	20.25	23.20	44.10	33.65
Calcium ($cmolkg^{-1}$)	2.80	4.00	3.40	4.80	3.60	4.20	2.78	4.10	3.44	4.82	3.58	4.2
Magnesium ($cmolkg^{-1}$)	1.60	2.40	2.00	3.20	2.00	2.60	1.60	2.42	2.01	3.24	2.10	2.67
Sodium ($cmolkg^{-1}$)	0.10	0.11	0.11	0.12	0.13	0.13	0.10	0.12	0.11	0.13	0.13	0.13
Potassium ($cmolkg^{-1}$)	0.10	0.07	0.09	0.10	0.06	0.08	0.04	0.07	0.06	0.10	0.07	0.09
Exchangeable acidity ($cmolkg^{-1)}$)	0.80	1.28	1.04	0.88	1.36	1.12	0.82	1.30	1.06	0.91	1.40	1.16
Organic carbon(gkg^{-1}) ($cmolkg^{-1}$)	9.9	9.3	9.6	11.5	8.9	10.2	9.8	9.0	9.4	11.6	9.0	10.3
ECEC ($cmolkg^{-1}$)	5.35	7.56	6.46	9.10	7.15	8.13	6.03	5.15	5.60	9.20	7.16	8.18
Base saturation (gkg^{-1})	850.4	837.2	843.8	903.3	809.8	856.6	852.0	818.0	835.0	924.3	809.9	867.1

Keywords: S = Sand; SL = Sandyloam; L = loam; SCL= Sandy clay loam; ECEC = Effective cation exchange capacity

Sweetpotato Establishment Percentage

The effects of Nitrogen levels and manual weeding regimes on establishment percentage of sweetpotato in 2014 and 2015 season at Umudike and Otobi showed that both nitrogen and manual weeding regimes indicated no significant effect ($P > 0.05$) in both cropping seasons at both locations. The interaction between nitrogen levels and manual weeding regimes was not significant ($P > 0.05$) on sweetpotato establishment percentage in 2014 and 2015 at both locations.

Weed Density (Number m^{-2})

The effects of nitrogen and manual weeding regimes on weed density in sweetpotato plots in 2014 and 2015 at Umudike and Otobi are as presented in Table 2.At Umudike in 2014 and 2015, weed density was significantly affected by levels of N-fertilizer applied in the sweetpotato plots. Plots that received no nitrogen fertilizer had significantly higher weed densities at 4, 8 and 12 WAP in both years. Plots that were treated with 60 or 120 $kgha^{-1}$ of nitrogen had similar weed densities, which were significantly ($P < 0.05$) lower than those from the control plots. The least weed density at 12 WAP (17.2 and 10.7) was from plots treated with 120 $kgha^{-1}$ nitrogen at Umudike in 2014 and 2015 seasons, respectively. Amongst the weedingregimes, weed densities of sweetpotato plots were significantly ($P < 0.05$) affected at Umudike in both seasons except at 4 WAP in 2014 where weeding regime did not significantly affect weed density. Unweeded plots consistently had the highest weed densities at the various sampling times in both years. At 12 WAP in 2014, weed density was in the order unweeded > weeding at 4 WAP > weeding at 8 WAP, while weeding either at 4 or 8 WAP had similar weed densities when observed at 8 WAP in 2014 and at 4, 8 and 12 WAP in 2015 at Umudike.

Table 2: Weed density as influenced by nitrogen fertilizer levels and weeding regimes at Umudike and Otobi in 2014 and 2015 cropping season.

	Umudike						Otobi					
	2014			2015			2014			2015		
	Weeks After Planting			Weeks After Planting			Weeks After Planting			Weeks After Planting		
Treatment	4	8	12	4	8	12	4	8	12	4	8	12
Nitrogen($kgha^{-1}$)												
0	24.3	83.3	154.4	26.17	60.6	19.2	31.7	66.2	128.2	27.28	62.5	124.8
60	12.8	29.4	30.2	8.61	27.8	17.50	11.1	32.0	35.5	10.33	29.1	34.2
120	13.2	26.1	17.2	7.50	22.4	10.7	8.9	29.1	22.0	8.23	21.8	20.7
LSD(0.05)	7.58*	4.56*	8.99**	4.28*	10.19*	NS	5.98*	9.40*	5.71**	4.94*	7.02*	7.18**
Weeding Regimes												
0 WAP	25.6	59.6	89.5	17.17	51.4	104.9	22.2	47.9	77.7	17.89	53.3	74.9
4 WAP	21.0	35.8	61.4	11.78	30.1	52.6	14.2	31.8	51.4	13.50	31.3	49.5
8 WAP	20.7	33.4	50.9	10.33	29.4	43.9	15.2	47.6	56.6	14.50	28.9	55.4
LSD(0.05)	NS	7.50*	7.17*	2.07*	9.47*	20.33**	6.18*	2.61*	3.22*	2.65*	4.87*	3.74*
Interaction	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

***, ** = Significant at 5 and 1% probability levels, respectively; NS = Not significant at 5% probability level.**

At Otobi location in 2014 and 2015, weed density was significantly affected ($P < 0.05$ at 4 and 8 WAP and $P < 0.01$ at 12 WAP) by levels of nitrogen fertilizer applied in the sweetpotato plots. Plots without nitrogen fertilizers had significantly higher weed densities at 4, 8 and 12 WAP in both seasons. Plot treated to 60 or 120 $kgha^{-1}$ of nitrogen had similar weed densities at 4 and 8 WAP in 2014 and 4 WAP in 2015 which were significantly lower than those from the control plots. Whereas at 12 WAP in 2014 and 8 and 12 WAP in 2015 the weed densities as influenced by levels of nitrogen fertilizers were in the order 120 $kgha^{-1}$< 60$kgha^{-1}$< 0$kgha^{-1}$ at Otobi location. Amongst the weeding regimes used weed densities of sweet potato plots were significantly ($P<0.05$) affected at Otobi in both seasons. Unweeded plots consistently had the highest weed densities at 4, 8, and 12 WAP in both years. Weeding at 4 or 8 WAP gave similar weed densities at 4 WAP in 2014 and at 4 and 8 WAP in 2015. While at 12 WAP in both years weed densities as influenced by weeding regimes were in the order: weeding at 4 WAP < weeding at 8 WAP < unweeded at Otobi. However the interaction between nitrogen levels and manual weeding regimes showed no significant difference ($P>0.05$) on weed density in both locations irrespective of the cropping seasons.

Total Root Yield

The effect of nitrogen fertilizer levels and weeding regimes on total root yield of sweetpotato at Umudike and Otobi in 2014 and 2015 season is presented in Table 3. The result showed that the total root yield of sweetpotato was significantly affected by nitrogen levels and weeding regimes adapted at both locations and seasons. Sweetpotato that were treated with 120 $kgNha^{-1}$ produced significantly ($p < 0.05$) highest total root yield than those that

Table 3: The effect of nitrogen fertilizer levels and manual weeding regime on total root yield (t ha^{-1}) of sweetpotato at Umudike and Otobi in 2014 and 2015 cropping season

	Umudike		Otobi	
	2014	2015	2014	2015
Nitrogen (kg)				
0	4.26	10.30	4.39	7.90
60	9.19	17.02	8.21	18.18
120	11.77	21.15	10.55	23.07
LSD (0.05)	1.04	3.18	2.30	4.71
Weeding regime				
0 WAP	5.41	11.79	5.53	10.62
4 WAP	8.38	15.58	7.39	16.23
8 WAP	11.41	21.10	10.24	22.30
LSD (0.05)	1.22	4.75	1.13	2.38

Key:NS=Not significant at 5% level of probability; WAP = Weeks after Planting

received 60 kg Nha^{-1}, while those from the control plots (0 kg Nha^{-1}) produced the least total root yield at both locations and seasons.

Amongst the weeding regimes, the unweeded plots produced sweetpotato with the least total root yield that was statistically similar to those from plots weeded at 4 WAP at Umudike in 2015. When weeding of sweetpotato plots was done at 8 WAP the total root yield were significantly higher than weeding at 12 WAP at both locations and seasons . The interaction between nitrogen fertilizer levels and weeding regime was not significantly ($P > 0.05$) different on total root yield of sweetpotato at both locations and seasons.

Economics of N-Fertilizer and Weeding Regimes in Sweetpotato Field in 2014 and 2015 Seasons

The economics of N-fertilizers and weeding regimes in sweetpotato field at Otobi in 2014 and 2015 seasons are presented in Table 4. The analysis showed, that total variable cost (TVC) ranged from ₦203,000.00 obtained from the absolute control (zero fertilizer + zero weeding plot) to ₦311,000 obtained from the plots treated to 120kgha^{-1} with either hand weeding at 4 WAP. Application of 120kgNha^{-1} + 8 WAP manual weeding returned a profit of ₦125,401 per hectare and a return per Naira investment of 1.40 in Otobi location. This wasfollowed closely by the application of 60kgNha^{-1} + manual weeding at 8 WAP as it gave an income of ₦51,000.00 and a return of N1. 17 kobo to every one Naira invested.

The Economics of N-fertilizer and weeding regime in sweetpotato field at Umudike in 2014 and 2015 seasons are presented in Table 5. The result showed that total variable cost (TVC) ranged from ₦203,000 obtained from the absolute control (Zero fertilizer + Zero weeding plot) to ₦311,000 obtained from the plots treated to 120kg Nha^{-1} with either hand weeding at 4 WAP or 8 WAP. Using 120kg ₦/ha of Nitrogen + weeding at 8 WAP gave a gross

Table 4: Economics of N-fertilizer and weeding regimes in sweetpotato field in Otobi, 2014 and 2015

Treatments	Mean Yield (t ha^{-1})	Total Variable Cost (TVC) (₦ ha^{-1})	Price of Root (₦ /t)	Gross Revenue (₦ ha^{-1})	Gross Margin (₦ ha^{-1})	Return per Naira Investment	Ranking
0 kg N/ha + no manual Weeding	7.645	203,000	20,000	152900	-50,100	-1.25	5
0kg N/ha + 4WAP	6.985	267,000	20,000	139700	-127,300	-1.45	9
0kg N/ha + 8WAP	7.4	267,000	20,000	148000	-119,000	-1.48	8
60kg N/ha +no manual weeding	7.425	241,000	20,000	148500	-92,500	-1.38	7
60kg N/ha+4WAP	12.635	305,000	20,000	252700	-52,300	-1.17	6
60kgN/ha + 8 WAP	17.8	305,000	20,000	356000	51,000	1.17	2
120kg N/ha + no Manual weeding	10.905	247,000	20,000	218100	-28,900	-1.11	4
120kgN/ha +4WAP	14.82	311,000	20,000	296400	-14,600	-1.05	3
120kgN/ha +8WAP	21.82	311,000	20,000	436400	125,401	1.40	1

Key:WAP = Weeks after Planting

Table 5:Economics of N-fertilizer and weeding regimes of sweetpotato field, 2014 and 2015 at Umudike

Treatments	Mean Yield (t ha^{-1})	Total Variable Cost (TVC) (₦ ha^{-1})	Price of Root (₦ /t)	Gross Revenue (₦ ha^{-1})	Gross Margin (₦ ha^{-1})	Return per Naira Investment	Ranking
0 kg N/ha + no manual Weeding	7.46	203,000	20,000	149200	-53,800	-1.27	7.46
0kg N/ha + 4WAP	6.97	267,000	20,000	139400	-127,600	-1.48	6.97
0kg N/ha + 8WAP	7.36	251,000	20,000	147200	-103,800	-1.45	7.36
60 kg N/ha+no manual weeding	7.16	241,000	20,000	143200	-97,800	-1.41	7.16
60kg N/ha+4WAP	13.44	305,000	20,000	268800	-36,200	-1.12	13.44
60kgN/ha8 +WAP	18.72	289,000	20,000	374400	85,401	1.30	18.72
120kg N/ha + no Manual weeding	11.18	247,000	20,000	223600	-23,400	1.09	11.18
120kgN/ha +4WAP	15.56	311,000	20,000	311200	200	1.01	15.56
120kgN/ha +8WAP	22.66	295,000	20,000	453200	158,201	1.54	22.66

Key:WAP = Weeks after Planting

revenue of ₦453,200 per hectare and a return of ₦1.54 to every one naira invested at Umudike location. This was followed by application of 60kg N/ha + manual weeding at 8 WAP as it gave a gross margin of ₦85,401 and a return of N1. 30 kobo to every one naira invested.

DISCUSSION

Sand was the predominant fraction and constituted 78.4 and 74.5% and 51.4 and 58.5% at Umudike and Otobi in 2014 and 2015 seasons, respectively. This confirmed that the soils at Umudike were derived from coastal plain sand parent materials with highly leached low base saturation (Obigbesan, 1999). The organic carbon content of the soil for both years means at Umudike and Otobi (9.5 and 10.3 g kg^{-1}) was within the 10 – 20g kg^{-1} range regarded as the critical value for soils (Obigbesan, 1999). The total nitrogen content in the soil was low at both locations and seasons, being below the critical level (1.0 – 2.0gkg^{-1}) recommended by Obigbesan, (1999) thereby requiring fertilizer nitrogen application either from organic and/orinorganic sources. Available phosphorus (19.5 and 20.3 mgkg^{-1}) and (34.7 and 33.7 kg kg^{-1}) for Umudike and Otobi in 2014 and 2015 respectively was above the critical value (10mgkg^{-1}), recommended by Obigbesan, (1999). The soil did not require application of phosphorus fertilizer. The exchangeable acidity was high equally in both locations and seasons due to the low pH values of the soils.The establishment percentage of sweetpotato grown under different rates of nitrogen fertilizer, tillage practices, manual weeding regimes and showed no significant differences at both locations and seasons throughout this study. This observation is in consonance with the opinion of Udom, *et al.*, (2012) that potato varieties differ significantly in their percentage emergence as a result of their genetic make-up, therefore as this study consisted of one variety as the test crop and uniformity in the handling of the experimental plots, the variety, TIS 87/0087 expressed itself uniformly in terms of establishment percentage in both location and seasons of the study.

Manual weeding regime had no significant effect on sweetpotato establishment percentage at Umudike and Otobi in both seasons. The non-significant response of crop establishment percentage to manual weeding might be due to absence of competition during the early stages of crop growth with weeds. When establishing plants seedlings or sprouts depended entirely on food reserve in the seed. This is in line with the observations of Tanaka and Sekioka (2010) while investigating the effect of herbicides and manual weeding regimes on yield of sesame in the Sudan Savanna zone of Nigeria, who explained that though treatments as manual weeding regimes creates favourable condition for plant growth it had no significant effect on establishment stage as emerging seedlings depended on stored food in the cotyledons.

Application of nitrogen fertilizer reduced weed population density in sweetpotato plots at Umudike and Otobi locations in both years. Increasing the rate of nitrogen to 120 kgN ha^{-1} resulted in a decrease in weed density of 91.8% at Umudike and 82.1% at Otobi at 12 WAP, when averaged over the two seasons and compared with the unweeded plots in this study. The findings are in agreement with similar report by Korieocha and Ekeleme (2012) that the ability of nitrogen fertilizer to stimulate vigorous growth in sweetpotato helps to smoother early weed growth. However in related study, Aderi, (2013) while investigating the response of upland rice to population density and complementary use of organic and inorganic fertilizer on an Ultisol in Uyo, showed that weed density in unweeded were increased in organic manure plots complemented with inorganic fertilizer, explaining that high nutrient availability encouraged high weed growth. The possible reason for the contrary view with the present study is the differences in the growth habit of the test crop used in the study.

Sweetpotato has a trailing growth habit which confers on it a smoothing potential against weed seedlings that are growing under it leading to their death and reduction in weed population density. Woolfe (1992) observed that sweetpotato suppressed weeds better on account of better ground cover attained by sweetpotato. This ground coverage could have been enhanced by the increased rate of nitrogen fertilizer used in this study. The control treatment plot that received 0 kgN ha^{-1} recorded highest weed population densities at both locations and seasons, with poor vegetative growth of sweetpotato, which reduced their capacity to smothered germinating weed seedlings resulting in high weed population densities in zero nitrogen plots. Here the weeds demonstrated their natural capacity to compete with cultivated crops for growth resources that are in limited supply. This is in consonance with opinion of Akobundu (1987) that the competitive effect of weed against cultivated crops are evident in situation of poor soil fertility than in fertile soils.

The reduction in weed density with increase nitrogen rate could also be attributed to the effect of both intra and inter specific competition among weed stands and the sweetpotato, for which the sweetpotato were more competent due to its growth habit and enough nutrient supplied. This is in line with Eghball, *et al.*, (2004) who report that increase nitrogen fertilizer rates provided improvement for crop growth and yield as a result of being more competitive than the weeds in associations.

Application of 120 kgN ha^{-1} and manual weeding at 8 WAP gave a net income of ₦125,401 per hectare as the return per naira investedshowed that for every one naira invested in thisenterprise, it returned₦1.40 kobo at Otobi location. At Umudike, the treatment of

120 kg N ha^{-1} and manual weeding at 8 WAP gave a net income of ₦158,201 per hectare as the return per naira investment returned ₦1.54 kobo for every one naira invested.

CONCLUSION

Based on the findings of these trials, it could be concluded that the application of 120 kg N ha^{-1} suppressed weed growth and thus encouraged growth and yield of sweetpotato.Manual weeding at 8 WAP was more ideal compared to manual weeding at 4 WAP as it suppressed weedand also increased root yield of sweetpotato.

RECOMMENDATIONS

Application of 120 kgN/ha and Weeding at 8WAP is recommended for Sweetpotato in both derived guinea savanna and rain forest agro-ecological zones of Nigeria.

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