EFFECT OF VINE LIFTING, TYPES AND RATE OF ORGANIC MANURE APPLICATIONS ON SWEET POTATO *(Ipomea batata* (L.) Lam) PRODUCTION IN SAMARU

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Abstract

field experiment were conducted during the 2008 and 2010 raining seasons at the College of Agriculture student demonstration farm, Samaru Zaria (if ll'N Latitude, 07° 38'E Longitude, 686 above sea level) located in the northern guinea savannah ecological zone of Nigeria. The treatments consist of factorial combination of vine lifting and non vine lifting and five levels of organic manure and recommended chemical fertilizer. The treatments were laid out in a randomized block design replicated three times. Organic fertilizer (poultry manure) was applied in 2008 and (cow dung) in 2010. As soon as the vine sprouted the soil was drilled open and the organic manure was applied and covered back with soil. The vine lifting was done using pegs and rope when the vines started creeping on the ground. Data were collected on crop vigour score, number of leaves, number of branches, leaf area, crop dry matter, vine length. Yield data on number of tubers, weight of tubers, tubers diameter and length of tubers were also collected. Data collected were subjected to "F" test. The effect of time of planting and fertilizer application and their interaction in all characters measured were considered and where "F" test showed significant difference, the means were separated using Duncan's Multiple Range Test. From the result of tin's work, it was found that vine lifting did not result in any significant difference in both the vegetative and yield parameters of sweet potato in both years of experimentation. Vine lifting in the Northern guinea savannah should therefore not be a routine practice but should be undertaken only if root growth on stem nodes is observed and during moist soil condition. The application of 5.0 tones of both poultry and cow dung manure resulted in better plant growth and production of bigger, longer and weightier tubers as compared to other levels of applications and chemical fertilizer. The optimum recommended nutrient requirement for sweet potato in Samaru in the Northern guinea savannah of Nigeria is application of 5.0 tones ofboth poultry manure and cow dung manure.

Key words: Vine lifting, Poultry manure, Cow dung, Chemical fertilizers

INTRODUCTION

Sweet potato *(Ipomea batata* (L.) Lam) is an important root crop with adaptability to a wide range of ecological conditions (Afuape *et al,* 2011). Sweet potato is consumed in the tropics as human food. The foods are eaten fresh, boiled, fried and dried in the sun as sweet potato chips. It is used as feed for livestock such as silage and hay for animals. Sweet potato is mainly cultivated for local consumption in the study area. Tsuno and Fujise (1968) reported that nutrient also play vital role in the growth and yield of sweet potato. For example, too much nitrogen application on the crop increases vegetative parts at the expenses of reproductive growth. They also reported that if nitrogen application is deficient, the growth is severely restricted. The savanna region gives very poor yield because of a lot of deficiency in the status of the soil particularly Nitrogen. Partitioning of assimilates in crops storage organ can play an important part in yield of crop. In sweet potato, which is a crawling plant every node develops root that can attract assimilates to be stored in it. If these nodes are too plenty along the vines, assimilates will not be in one point of the tubers, instead, they will be distributed to too many roots on the vine, leading to many small tubers (Rasco and Amante, 2000). It may be better to lift up the vines to reduce the number of sites or roots that attract the assimilates. This will allow only one major point at which all assimilates from all leaves concentrate.

Moreover, the present global economic recession has led to inflation, scarcity and high cost of chemical fertilizer making it unaffordable to most peasant sweet potato farmers. Furthermore the increasing concern on the effects of agrochemicals and chemical fertilizers on the environment makes organic manure a safer and better available alternative source of nutrients to crop (Aliyu and Kunchinda, 2003) .Some of the works on the effect of nutrient in sweet potato includes the work of Grandy *et al.* (2002) and Snapp *et al* (2002). It is hoped that when the yield of sweet potato is increased it will increase food production and substitute other crops such as yam and cassava consumed by the masses.

MATERIALS AND METHODS

The field experiment was conducted during the 2008 and 2010 raining seasons at the Samaru College of Agriculture student demonstration farm, Samaru Zaria (11° ll'N Latitude, 07° 38'E Longitude, 686 above sea level), located

in the northern guinea savannah ecological zone of ^Nigeria. The treatments consist of factorial combination of vine lifting and non vine lifting and five levels of organic manure and recommended chemical fertilizer. The treatments were laid out in a randomized complete block design replicated three times. The land was cleared ploughed and ridged at 75 cm width; it was then marked out into 30 plots with 1.5m spacing between blocks and 1.0 m spacing between plots. The gross and net plot sizes were 31.5 m^2 and 22.5 m^2 respectively. The vines were planted by hand with one stick per hole at 40 cm spacing intra row. Organic fertilizer (poultry manure was applied in 2008 and cow dung in 2010) as soon as the vine sprouted the soil was drilled open and the organic manures were applied and covered back with soil. Manual hoe weeding was done thrice at 3, 6 and 9 weeks after sowing. The vine lifting was done using pegs and rope when the vines started creeping on the ground. Data were collected on crop vigour score, number of leaves, number of branches, leaf area, crop dry matter, vine length. Yield data on number of tubers, weight of tubers, tuber diameter and length of tubers were also collected. Data collected were subjected to "F" test. The effect of time of planting and fertilizer application and their interaction in all characters measured were considered and where "F" test showed significant difference, the means were separated using Duncan's Multiple Range Test (Duncan, 1955)

RESULTS AND DISCUSSION

Vine lifting did not result in any significant difference in crop dry matter, leaf area, vine length, number of branches and crop vigour as shown in table 1. There were significant difference in crop dry matter, vine length, leaf area, number of branches and crop vigour when poultry manure was applied. The application of 5 tonnes resulted in higher dry matter, though similar to application of 4 and 7.5 tonnes .The application of 5 tonnes also resulted in higher vine length as compared to other levels of applications. The leaf area was significantly higher when 5 tonnes of poultry manure was applied and was similar to when 7.5 tonnes was applied. The control, 2.5 tonnes, 4.0 tonnes gave similar result which was lower compare with application of 5 tonnes and 7 tonnes of poultry manure as shown in Table 1. Application of 7.5 and 5.0 tonnes of poultry manure gave higher number of branches as compared to other levels of application but was similar to application of 4.0 tonnes. The application of 4 tonnes was similarto 2.5 tonnes . The control was also similar to application of 2.5 tonnes. Application of 7.5,5.0 and 4.0 tons of poultry manure resulted in higher crop vigour which was similar to when 2.5 tonnes was applied. The control however was similar to the application of 2.5 tonnes (Table 1).

Vine lifting did not result in any significant difference in number of tubers, tuber diameter, tuber length, tuber weight and yield of sweet potato. Tuber length was however higher when 5 tonnes of poultry manure was applied but the diameter was not affected by the various levels of poultry manure application (Table 2). Application of 5.0 tonnes of poultry manure resulted in higher numbers of tubers, tuber weight and yield of sweet potato as compared to the control. There were similarities with other level of application as shown in Table 2.

Both vine lifting and rate of cow dung application did not result in any significant difference in crop dry matter, number of branches and crop vigour. Application of 7.5 Tonnes and Chemical fertilizers j resulted in longer vines than other level of nutrient applications; the result was same for both lifted and non lifted vines. Application of 7.5tonnes and chemical fertilizer in the non lifted vines resulted in higher leaf area which is similar to the lifted vines and other levels of nutrients application as indicated in Table 3.

In Table 4, application of 5.0 tones of cow dung resulted in higher numbers of tubers as compared to other level of applications and chemical fertilizer. The result was similar to application of 7.5 tones when the vines were lifted and 4.0 tones when; the vines were not lifted. The application of S.tonnes of cow dung resulted in higher tuber diameters which is comparable to the result obtained when chemical fertilizer was applied. Vine lifting did not have any effect on tuber diameter. The application of 5.0 and 7.5 tones of; cow dung resulted in longer tubers as compared to! other level of applications and chemical fertilizers.] The control however produced the shortest tube.! Application of 5.0 tones of cow dung and chemical fertilizers produced the highest yield of sweet potato. There was no significant difference on tuber length and yield between lifted and non lifted vines. The soil physio chemical analysis of the experimental site was similar in 2008 and 2010 as shown in Table 5,

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Tablel: Effect of poultry manure and vine lifting on vegetative characters of sweet potato at 9WAS in Zaria during the 2008 rainy season

Treatments	Crop dry matter(g)	Leaf area (cm^2)	.. Vine length (cm)	Number of branches	Crop vigour score
Non vine lifting	35.69	3566.3	82.21	7.80	5.50
Vine lifting	34.02	3416.9	80.33	7.53	6.20
S.E±	1.634	9.340	4.561	0.265	0.128
Poultry					
0	18.43[C]	: 2673.3[b]	49.35*	4.75*	4J[e]
2.5	27.50''	2827.6[b]	52.08*	5.83*	5.67[b]
4.0	33.82*[b]	2588.8[b]	61.46[b]	8.08*	6.08[m]
5.0	36.42*	4079.3'	74.96*	9.08*	6.75*
7.5	33.12*	3539.1*	63.48[b]	10 .58'	6.25*
S.E+	1.634	97.207	4.561	0.265	0.128

Means within a column of treatments followed by unlike letters) ire significantly different using DMRT at 5% level of significance. ; ,

Table 2: Effect of poultry manure and vine lifting on yield characters of sweet potato in Zaria duing the 2008 rainy season. '

Treatments	Number of tubers /plots	Tuber diameters(cm)	Tuber length (cm)	Tuber weight (kg)	Tuber yields in tonnes
Non vine	31	6.64	16.83	3.33	3718.50
Vine lifting	32	6.71	17.47	3.84	4266.60
S.E+	1.09	0.105	0.278	0.151	166.459
Poultry					
0	23[e]	6.31	16.34[C]	2.57*	2851.9''
2.5	30[b]	6.41	16.57[s]	3.25 *	3611.1''°
4.0	34[b]	6.80	16.82[C]	3.95 *[b]	4388.90''
5.0	38*	7.19	18.51*	4.65*	5055.50*
7.5	31''	7.67	17.51[b]	4.60*	5000*
S.E±	1.09	0.105	0.278	0.151	166.459

Means within a column of treatments followed by unlike letler(s) are significantly different using DMRT at 5% level **of** significance.

Table 3: Effect of cow dung manure and vine lifting on vegetative characters of sweet potato at 9WAS in Zaria during the 2010 rainy seasons

Treatments	Crop dry matter (g)	Leaf area (cm^2)	Vine length (cm)	Number of branches	Crop vigour
Vine lifted 0	50.0	164.33*"	179.00[b]	6.00	5.66
2.5	30.67	188,67**	178.83"	4.66	5.00
4.0	42.67	187.33 *	180.67"	9.00	6.00
5.0	44.33	167.33*	177.00"	7.00	5.33
7.5	64.67	177.00 *	275.50*	7.33	5.66
NPK	86.00	182.67*	208.00*	5.33	5.66
Non lifted					
0	67.00	222.00[th]	171.00"	8,00	7.00
2.3	28.67	19133*	173.17*	";•::: •v:[1];—:- ••-';• ·«4-33·-·. ·•	5.33
4.0	40.67	194.00*	172.00"	*i\ i'-9Ml: '•*	5.66
.;ip;: ,/ -	64.67	215.67*	175.50"	'••/• :7i.33,—:-.V-. :	6.66
:.:m:" - •	70.67	243.33"	208.67*	-;:"'".' 9,00	7.0
;NPK	70.00	243.33 '	205.27*	8.00	7*^i^
S.E±	1.813	2^11	1.785	0.522	0.347

Mean* within a column of treairaena followed by unlike lctter(s) are significantly different using DMRT it 5* level of lignifionce. x ;l

Table 4: Effect of cow dung manure and vine lifting on yield parameters of sweet potato in Zaria during the 2010 rainy season

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Trcatmenu	Number of tubers /plots '	Tuber diameter s(cm)	Tuber length (cm)	Tuber weight (kg)	Tuber yields in tonnes
Vine lifted					
0	28"	5.93*	15.04[C]	4.70"	4110.7
2.5	26"	10,40 "	18,04"	5.20"	5588.33
4,0	34"	•^i2*;:.:,,	18.58"	5.03[b]	8443.6
5.0	44*	28.92*	20.83*	8.6*	4666.2
7^	40*	9.38"	20.05 *	5.93"	7699.23
NPK	35"	27.80*	18.66"	7.7*	8554.7
Non lifted					
0	31"	5.87"	15.52°	4.56"	5066.16
2,5	37" •	6.05"	17,58"	5.16"	5732.76
4.0	41*	6.66"	17.66"	5.30"	6999.3
5.0	43*	21.56*	20.00*	7.90*	9999
7.5	32"	12.07"	20.08*	5.50"	31663.5
NPK	36"	21.62*	is^*	7.80*	15776.2
S.E+	1.062	0.542	0.556	1.137	

Meant! within • column of treatments followed by unlike lcttetts) are significantly different using DMRT at 3% level of significance.

Table 5: Soil analysis of the site in which the research was carried out in 2008 and 2010 rainy seasons

Soil Characteristics	2008 Soil depth in centimeter	2010 Soil depth in centimeter
	0 – 30	0 – 30
pH in water 1: 2.5	6.1	6.0
pH in $CaCl_2$ 1: 2.5	5.2	5.6
% Organic Carbon	0.49	0.47
% Total Nitrogen	0.053	0.06
Available Phosphorus (ppm)	12.3	12.08
Exchangeable base meg/100g		
Ca	3.4	3.50
Mg	0.86	0.81
K	0.61	0.64
Na	1.48	1.49
CEC	7.2	7.6
Particle size distribution		
% Clay	18.00	18.00
% Sand	56.00	57.00
% Silt	26.00	25.00
Textural class	Sandy loam	Sandy loam

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Effect of vine lifting on the growth and yield of sweet potato

From the result of this work, it was found that vine lifting did not result in any significant difference in both the vegetative and yield parameters of sweet potato in both years of experimentation. The result is in accordance with the work of Duvill (1982) who reported that vine lifting does not increase the growth or yield "of crop irrespective of the period of vine planted, weather condition and cultivars. Rasco and Amante (2000) also reported that cultivars with more upright bushy habit generally do not need lifting and some trailing types do not root readily at the node. Vine lifting is only necessary when root formation is observed on vine. This will allow only one major point at which all assimilates from all leaves concentrate. They therefore, concluded that lifting may be necessary only in prolonged humid condition. Their conclusion was based on the research carried out in Indonesian which shows that vine lifting produced higher yield in moist conditions. Vine lifting in the Northern guinea savannah should therefore not be a routine practices but should be undertaken only after root growth on stem nodes had been observed. Fanners should look out for root formation on vine during routine field observation and decides whether the labour investment in vine lifting is worthwhile or not. Vines should not be turned over because this may cause rotting of the leaves thereby reducing the photosynthetic ability of the crop.

Effect of nutrients application on the growth and yield of sweet potatoes

The application of 5.0 tones of both poultry and cow dung manure resulted in better plant growth and production of bigger, longer and weightier tubers as compared to other level of applications and chemical fertilizer. The application of the chemical fertilizer was comparable to the application of 5.0 tones of both poultry manure and cow dung in some «f ihe parameters measured. This clearly shows that the use of organic manure can replace Jlhe inorganic fertilizer which is scares, expensive tive effect on man, livestock and the Application of more «han 5.0 tones ^was **JUilMHilal** to sweet potatoes growth and yield. The optimal nutrient requirement for sweet potato in Samaru is 5.0 tones of poultry or cow dung manure. The use of organic manure has shown that sweet potato responded to organic fertilization which confirms the work of Alfred (2003). The report is similar to the work of Mukhtar *et al.* (2010) who found both organic and inorganic fertilizer useful in sweet potato production in a Samaru.

CONCLUSIONS

Vine lifting in the Northern guinea savannah should ^therefore not be a routine practice but should be undertaken only if root growth on stem nodes is observed and during moist soil condition. The optimum nutrient requirement for sweet potato is application of 5.0 tones of both poultry manure and cow dung manure. Therefore, the application of 5 tonnes of either poultry or cow dung is recommended for sweet potato production to substitute chemical fertilizers in Samaru in the Northern guinea savannah of Nigeria.

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