Direct RESEARCH JOURNALS
Vol.4 (7), pp. 169-172, July 2016
ISSN 2354-4147
Article Number: DRJA73662179

Direct Research Journal of Agriculture and Food Science
http://directresearchpublisher.org/aboutjournal/drjafs

Research Paper

Nitrogen Content and Effect of Different Nitrogen Rates and Lime on the Growth and Yield of African Yam Bean (*Stephenpstylis stenocarpa*) in Makurdi, Nigeria

Moses Ogbaji

Department of Crop Production, University of Agriculture, Makurdi, Nigeria.
E-mail: ogbamosphd@yahoo.com

Received 11 April 2016; Accepted 3 June, 2016

Food security and sustainability is a serious challenge in Africa. Legumes are the main source of protein since most people cannot afford animal protein. Many indigenous legumes of Africa with potentials to ameliorate nutritional food securities are presently neglected and underutilized. African yam bean (*Spenostylis stenocerpa*) (AYB) is one of such crop with tremendous nutritional value with poor awareness especially its nutritive value, the precise knowledge of factors affecting its growth and yield particularly the use of nitrogen fertilizers. The nutritive value of AYB including nitrogen content was therefore compared with cowpea (*Vigna unguiculta* (L.) Walp) in the laboratory using the methods of AOAC (1995). Kjeldehl method was used to determine the nitrogen content. Secondly, a field experiment using Randomized Complete Block Design (RCBD) was carried out in 2014 to test the growth and yield response of five varieties of AYB to different nitrogen and lime rates. Results of the study indicated that AYB was as nutritious as cowpea when all the nutrients including nitrogen in percentages were compared. AYB gave a nitrogen content of 0.096% compared with that of cowpea (0.093%). Similarly, 90 kg N /ha combined with 90 kg lime /ha better enhanced the growth and yield of different AYB varieties better than all other treatment combinations. The interactive effects between fertilizers and the different accessions of AYB were also significant as far as growth and yield of the crop were concerned. Favorable intensified research findings to encourage the production, wide consumption and general acceptability of AYB are hereby strongly advocated.

Keywords: African Yam Bean, Nitrogen, Growth, Nutrition, Rates and Yield.

INTRODUCTION

Africa Yam Bean *(Sphonostylis stenocarpa Hochstex. A Rich*) is an underutilized tropical African tuberose legume (Adewale and Dumet, 2011). It belongs to the Order Fabeles, family of *Fabaceae* and genus of *Sphenostylis* (Adewale, 2011). It is important in most Africa indigenous diet. The African yam bean *(Sphenostylis stenocarpa*) provides two consumable products, the tubers which grows as a root source and the actual yam bean seeds which develops above the ground level (Allen and Allen, 1981). The economic potentials of AYB are immense.

Apart from the production of two major food substances, the value of the protein in both tubers and seeds is comparatively higher than what could be obtained from most tuberous and leguminous crops (Alozie *et al.,* 2009). The protein in the tuber of AYB is more than twice the protein in sweet potato *(Ipomea batatas)* or Irish potato (*Solanum tuberosum)* and higher than those in yam and cassava (Alozie *et al.,* 2009). Moreover, the amino acid values in AYB seeds are higher than those in pigeon pea, cowpea, and bambara groundnut (Saxon,

1981). Protein content is up to 19% in the tuber and 29% in seed grain (Saxon, 1981). The amino acid spectrum indicated that the level of most of the essential amino acids especially lysine, methionine, histidine, and iso-leucine in AYB is higher than those in other legumes including soybean (Saxon, 1981). Generally, the amino acid profile of AYB compares favorably with whole hens' eggs and most of them meet the daily requirement of the Food and Agriculture Organization (FAO) and World Health Organization (WHO) (Klu *et al.,* 2001). AYB is also rich in minerals such as K, P, Mg, Ca, Fe, and Zn but low in Na and Cu (Ameh,2007).

Ameh, (2007) observed that AYB as a crop is less susceptible to pests and diseases compared with most legumes; this quality may undoubtedly be due to the inherent lectin in the seed of the crop. Omitogun *et al.* (1999), advanced the prospect that the lectin in the seed of the crop is a promising source of a biologically potent insecticide against field and storage pests of legumes.

Even though the crop is a legume and can nodulate, one major limitation to its production in Nigeria has been lack of precise knowledge of its nutritional value including Nitrogen content, factors affecting its growth and yield particularly the use of fertilizers (Okpara and Omaliko, 1995). The research was to study the response of African yam beans to N and Lime fertilizers.

MATERIALS AND METHODS

The study area

The study was carried out at the Research Farm of the University of Agriculture, Makurdi, Nigeria (Latitude 7'41ºN and Longitude 8.37ºE) during the 2014 cropping season to first compare the mineral content of AYB and cowpea including nitrogen. Secondly, the effect of different nitrogen and lime rates on the growth and yield of AYB (Sp*henostylis stenocarpa*). The chemical properties of the experimental site (0.20 cm below ground level has very low total N(0.08%), low in available P (0.31%) and K (0.47%), (Table 1).

Experimental design

In the first experiment, five varieties of AYB and two varieties of cowpea were analyzed in the laboratory using AOAC 1995 method. For the second experiment, Randomized Complete Block Design (RCBD) was used. The treatments were replicated three times. The inter row and intra row spacing were 50 x 30 cm respectively.

The experiment consisted of 5 accessions of African yam beans (Ogbadogbo, Okpokwu, Oju, Gboko and Buruku).Three different rates of N (0, 45, 90 kg/ha) and three rates of lime (0, 45 90 kg/ha) arranged in all possible treatment combinations. All agronomic and plant protection practices were applied to the crop. Data collected included plant height (cm), number of leaves per plant (at 2, 4, 6 WAP), pod length (cm), number of pods per plant, number of seeds per pod and grain yield in tons/ha. Data was analyzed using analysis of variance (ANOVA). Treatment means were separated using Fishers Least Significant Difference (FLSD) at 5% level probability.

RESULTS AND DISCUSSION

The results indicated that Africa yam bean (AYB) is very rich in all minerals including nitrogen when compared with cowpea (Table 1).

Table 1. Comparative mean nutritive value between African yam bean and some varieties of cowpea (%).

Nutrients	AYB	Iron Bean	Ife Brown
Protein	25.32^{bf}	26.14^{b}	25.05^{b}
Nitrogen	0.096^{f}	0.094^{f}	0.093^{f}
Ash	3.13^{d}	4.20^{d}	4.00^{d}
Potassium	0.33^{c}	0.35^{f}	0.32^{f}
Fat	2.12^{e}	2.11^{e}	2.00^{e}
Carbohydrates	64.40^{a}	65.02^{a}	64.03^{a}
Organic Carbon	0.96^{f}	0.95^{f}	0.94^{f}
Fibre	2.06^{e}	2.10^{e}	2.12^{e}
Phosphorus	0.64^{f}	0.70^{f}	0.78^{c}
Moistures	7.10^{c}	8.60^{c}	8.71^{c}
LSD (0.05)	2.01	2.04	2.00

AYB=African Yam Bean. If the difference between two treatment means is greater than the LSD value then those treatments are different from each other at 5% level of probability.

The results (in percentages) revealed a high protein content of 28.30, carbohydrate of 68.40 and nitrogen of 0.096. AYB could therefore substitute cowpea when not available or at a higher price margin compared to AYB (Babatola, 2006). The results of the soil analysis (Table 2) showed that the soil pH of the experimental site was okay for AYB production but however low in the major macro elements (N, P and K). Generally the soil fertility status was low hence the need for soil amendment and good agricultural practices for optimum productivity (Alozie *et al.,* 2009). Addition of N and lime formulations is expected to enhance the nutrient status of the soil. Fertilizer application irrespective of the rate of application and type enhances the growth and yield of African yam bean (AYB) relative to the control (Okpara and Omaliko, 1995).

The main effect of fertilizer and accessions was significant ($p \leq 0.05$) on the plant height and number of leaves per plant of African yam bean at 4,6 and 8 WAP and the interactive effects of fertilizer X accession was also significant (Tables3,4 and 5). Amongathetreatment

Table 2. Physical and chemical properties of the experimental site.

Soil Properties	Values
pH (H_2O)	6.3
Organic matter (%)	1.22
Total N (%)	0.06
K (C mol Kg^{-1})	0.41
Na (C mol Kg^{-1})	0.22
Ca (C mol Kg^{-1})	3.05
Mg (C mol Kg^{-1})	1.24
Exchangeable acidity	0.03
ECEC	3.08
Sand (%)	64.60
Silt (%)	28.70
Clay (%)	6.70
Soil class	Sandy loam
Available P mg/Kg	5.24

Table 3. Main effect of fertilizer and accession on some growth parameters of African yam beans in Makurdi in 2014.

Fertilizer Rates (kg/ha)	Height (cm)			Number of Leaves		
	4 WAP	6 WAP	8 WAP	4 WAP	6 WAP	8 WAP
N0L0	25.45	35.97	67.84	31.47	92.82	199.62
N0L45	25.63	35.27	61.36	28.58	83.48	184.48
N0L90	27.06	36.52	63.08	30.98	86.53	177.63
N45L0	26.98	37.29	69.17	32.79	94.14	200.94
N45L45	27.04	36.57	62.66	29.88	84.78	185.78
N45L90	28.35	37.48	64.05	31.95	87.50	178.60
N90L0	27.98	38.26	70.14	33.76	95.11	201.91
N90L45	27.83	37.54	63.63	30.85	85.75	186.75
N90L90	35.65	44.78	71.35	39.25	94.80	185.23
LSD (0.05)	0.77	0.73	0.37	0.73	0.72	0.81
Accession						
Ogbadibo	28.32	38.41	60.46	35.54	104.38	192.80
Okpokwu	27.38	36.74	72.20	28.87	84.87	193.29
Buruku	29.27	37.58	71.53	40.20	95.70	225.29
Gboko	28.79	38.71	67.37	27.87	79.20	161.79
Oju	26.22	37.26	58.03	28.37	83.03	171.79
LSD (0.05)	0.58	0.54	0.27	0.54	0.53	0.60

Table 4. Interaction effects of fertilizer X accession on the plant height of African yam beans at 8 WAP in Makurdi in 2014.

Fertilizer Rates (kg/ha)	Plant Height (cm)				
	Accession				
	Ogbadigbo	Okpokwu	Buruku	Gboko	Oju
N0L0	59.73	74.85	73.10	69.43	62.10
N0L45	57.73	67.85	70.10	63.02	48.10
N0L90	57.50	68.00	65.50	66.42	58.00
N45L0	61.83	76.15	74.40	70.07	63.40
N45L45	59.03	69.15	71.40	64.32	49.40
N45L90	58.80	69.30	66.80	66.05	59.30
N90L0	63.13	77.45	75.70	69.70	64.70
N90L45	60.33	70.45	72.70	63.95	50.70
N90L90	66.10	76.60	74.10	73.35	66.60
F-LSD (0.05)	1.63				
CV (%)	1.50				

Key: N = Nitrogen L = lime N0 L0 =0 kg N/ha, 0 kg lime/ha

Table 5. Interaction effects of fertilizer x accession on the number of leaves of African yam beans at 4 WAP in Makurdi in 2014.

Fertilizer Rates (kg/ha)	Number of Leaves				
	Accession				
	Ogbadigbo	Okpokwu	Buruku	Gboko	Oju
N0L0	36.60	29.60	37.60	26.18	27.35
N0L45	32.60	21.85	37.85	25.52	25.10
N0L90	31.00	29.25	39.25	28.67	26.75
N45L0	38.70	30.90	38.90	26.82	28.65
N45L45	33.90	23.15	39.15	26.82	26.40
N45L90	32.20	30.55	40.55	28.30	28.05
N90L0	40.00	32.20	40.20	26.45	29.95
N90L45	35.20	24.45	40.45	26.45	27.70
N90L90	39.60	37.85	47.85	35.60	35.35
F-LSD (0.05)	1.63				
CV (%)	3.10				

Key: N = Nitrogen L = lime N0 L0 =0 kg N/ha, 0 kg lime/ha

combinations, 90 kg N /ha combined with 90 kg lime /ha gave the best growth and yield results of AYB. Among all the varieties, Buruku variety gave the best growth and yield (Table 3). The interactive effect between fertilizer and accessions on the plant height and number of leaves per plant also showed that 90 kg N /ha combined with 90 kg lime /ha better enhanced plant growth and yield. These results are in conformity with works by (Okpara and Omaliko, 1995) who reported same results. N Fertilization has always been a significant effect on the growth and yield of African yam bean as indicated on all the parameters in this study.

Conclusion

The results of the present study has shown that African yam bean can grow very well in Makurdi and responds to N fertilizers especially when the soil is poor in fertility. AYB performed better using 90 kg N /ha. Farmers in Makurdi should therefore plant African yam bean and apply 90 kg N /ha combine with 90 kg lime /ha to enhance optimum growth and yield of AYB.

AUTHORS` DECLARATION

I declare that this study is an original research by me and I agree to publish it in the Journal.

REFERENCES

Adewale D, Dumet D (2011). Descriptors for African yam bean, *Sphenostylis stenocarpa* (Hoschst ex. A. Rich.) Harms (online) Available:http://old.iita.org/cms/articlefiles/1488-ayb_descriptors.pdf.

Adewale BD (2011). Genetic diversity, stability and reproductive biology of African yam bean, *Sphenostylis stenocarpa* (Hoschst ex. A. Rich.) Harms. PhD Thesis, University of Agriculture, Abeokuta, Nigeria. pp.203.

Allen ON, Allen EK (1981). The leguminous. a source of book of characterization, uses and nodulation. London, Macmillan Publishers Ltd. pp 420-422.

Alozie YE, Udofia US, Lawal O, Ani IF (2009). Nutrient composition and sensory properties of cake made from wheat and African yam bean flour blends. J. Food Technol. 7:115-118.

Ameh GI (2007). Proximate and mineral composition of seed and tuber of African yam bean, *sphenostylisstenocarpa*(Hoechst. ex. a. rich.) Harms. ASSET Series. B, 6:1-10.

Babatola IA (2006) Effects of NPK 15:15:15 fertilizer on the performance and storage life of okra (*Albemuschus esculentus*). Proceedings of the Horticultural Society of Nigeria Conference, Pp.125-128.

Klu GYP, Amoatey HM, Bansa D, Kumaga FK (2001). Cultivation and uses of African yam bean (*sphenostylis stenocarpa)* in the volta region of Ghana. The Journal of food technology in Africa, 6:74-77.

Okpara DA, Omaliko CPE (1995). Effects of Staking, nitrogen and Phosphorus fertilizer rates on yield and yield components of African yam bean (*Sphenostylisstenocarpa*).Ghana Journal of Agricultural Science, 28:23-28. http://dx.doi.org/10.4314/gjas.v28i1.2004.

Omitogun OG, Jackai LEN, Thottappilly G (1999). Isolation of insecticidal lectin-enrich extracts from African yam bean (*Sphenostylisstenocarpa*) and other legume species. *Entomologia Experimentaliset Applicata, 90*, 301-311.

Saxon EC (1981). Tuberous legumes: preliminary evaluation of tropical Australian and introduced species as fuel crops. Economy Botany,35:163-173. http://dx.doi.org/10.1007/BF02858683.