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Analysis of vegetative growth parameters of some accessions of African Yam Bean *Sphenostylis stenocarpa* (Hocsht ex. A. Rich) Harms

[1,2]Agbeleye OA and [2*]Ilori CO

[1]Institute of Agricultural Research and Training, Obafemi Awolowo University, Moor Plantation, Ibadan
[2]Department of Crop Protection and Environmental Biology, University of Ibadan

Email: chrisilori@gmail.com

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Abstract

Few legumes are being utilised for man's need of food, feed, fuel and fibre. One of the underutilized legumes; African yam bean has great potentials for food and nutritional security. Vegetative growth parameters of twenty three African yam bean accessions were investigated to assess genetic diversity among accessions studied. The experiment was set up using a Completely Randomised Design replicated four times. Data were collected on three traits: plant height, number of leaves and number of branches. The data were subjected to analysis of variance and significant means were separated using Duncan Multiple Range Test. Significant differences were observed among the AYB accessions for the measured traits. Highest branching, number of leaves and plant height was observed in TSs 62 (8.00), TSs 1 (38.00), TSs 95 (143.5 cm) respectively. These genetic materials are suggested for use in the improvement of African yam bean.

Keywords: Food security, *Sphenostylis stenocarpa,* Underutilised legumes

Introduction

African yam bean (*Sphenostylis stenocapra*) is a legume belonging to the family *Fabaceae*. It is one of the underutilized grain legumes with potentials of assuring food and nutrition security. It grows on poor soils in hot climates and yields more than most other pulses (Okigbo, 1973). African yam bean (AYB) is a dual crop producing edible grains and underground tubers. It is cultivated in Nigeria mainly for its seeds although there are reports of the tubers being used for food as well (Ezueh, 1984, Potter, 1992). African yam bean also has soil restoration abilities (Saka *et al*., 2004). Its seed crude protein levels range from 21 to 29%, which is lower than soybean (38%), but the amino acid analysis indicates high level of methionine and lysine, equal to or better than those of soybean and corresponding to WHO/FAO recommendations (Evans *et al*., 1997). Crude protein in Potato is about 5%, while proteins in the tubers of African yam bean ranged between 11-19% (Okigbo, 1973, Ene-Obong and Okoye, 1992).

In Nigeria, there is no released variety of this crop yet probably due to many constraints in its production. African yam bean is a long duration crop staying for more than 6 months in the field. It is a climber requiring additional costs for provision of stakes (Togun and Olatunde, 1998). The crop is also in the hands of older farmers and as such is in danger of going into extinction (Saka *et al*., 2004). Report on its toxic components indicates the presence of alkaloids and flavonoids (Asuzu and Undie, 1986). The water extracts of African yam beans has the tendency of stimulating muscarine receptors in the intestine which leads to diarrhoea; therefore a minimum of 12-14 hour cooking period was suggested by Asuzu and Undie (1986) as this ensures the complete destruction of the toxic components.

The constraints to the cultivation of AYB can be eradicated through breeding. However, breeding strategies for crop improvement is dependent on available genetic diversity (Ojuederie *et al*., 2015). Hence, there is a need to assess genetic diversity in AYB to identify strategies for improvement. Most diversity assessments concentrate on yield however; vegetative parameters can have an important impact on later life stages and affect the overall fitness of plants. Therefore, the objective of this study therefore was to obtain information on vegetative growth parameters of some accessions of African yam bean which may be useful in the improvement of the crop.

Materials and Methods

Twenty three accessions of early maturing African Yam Bean were obtained from the Genetic Resources Center, International Institute of Tropical Agriculture (IITA), Moniya, Ibadan, Nigeria. The twenty three accessions consisted of 19 from Nigeria, one each from Ghana and Zaire while the origins of the other two were not known (See Table 1 for list of genetic materials). The experiment was set up at the roof top garden of the Department of Crop Protection and Environmental Biology, University of Ibadan. Experimental design was Completely Randomised Design (CRD) replicated four times. Top soil was obtained from the field and filled into 25cm diameter plastic pots with drainage holes at the bottom. Three seeds were sown per pot and this was later thinned down to one per pot after seedling establishment. The plants were staked using bamboo poles and pots were weeded when necessary.

Data were collected fortnightly on number of leaves from the 5^{th} to the 15^{th} week while data on number of main branches and main plant height were collected at the 15^{th} week. Plant height was measured from the soil level to the tip of the plant using a meter rule. Data were subjected to analysis of variance using SAS (version 9.2) statistical package and the significance of the means were separated using Duncan multiple range test (DMRT).

Results and Discussion

Leaf growth increased steadily in all the accessions and reached the peak at week 11 after planting. After the eleventh week, leaf loss was observed but with greater prominence in TSs 9, TSs 77 and TSs 33 (data not shown). TSs 27, TSs 33 and TSs 77 were able to grow fresh leaves after the decline. Duration of leaves determines how long assimilates can be produced () hence genetic materials with early leaf loss may have huge yield loss.

Significant differences were observed in the number of leaves produced by the different accessions (Table 2). Highest number of leaves at week 11 was observed for TSs 1 (38), TSs 62 and TSs 77 (37) while the lowest values were observed for TSs 22 (20), TSs 84 and TSs 77 (18). The best leaf producer was not significantly different from eight other accessions. TSs 1 was classified as non-shattering (Adewale *et al*., 2012) and early maturing accession (Popoola *et al*., 2011). Good leaf production with non-shattering of pods in the field are desirable features for a variety which could aid better productivity and adoption

Since photosynthesis is the major process by which assimilates for partitioning into economic sinks are produced, it is safe to suggest that accessions with profuse leaf production may be able to produce higher yield. Popoola *et al*. (2011) have previously reported that African yam bean accessions with high values of vegetative parameters (number of leaves/plant, main branches/plant, stems/plant etc.) produced higher yield.

Number of branches among the accessions differed significantly with the highest number of branches observed for TSs 62, TSs 63 and TSs 65 (Table 2). TSs 95 had the longest vine while TSs 9 had the shortest vine (Table 2). Long plant height correlates positively with yield (Popoola *et al*., 2011) probably due to more branching and availability of sites of attachment for pod-carrying peduncles.

Most of the accessions with high leaf number, number of branches and plant height are brown seeded. TSs 16 with grey seed colour and appreciable leaf production could be a better parental stock for breeding high yielding varieties with low antinutrient content because dark seed coat is implicated in high antinutrient content (Nehad, 1990; Ajibade et al., 2005).

Conclusion

In this study, variability was observed for vegetative parameters of African yam bean. These vegetative characteristics can serve as indices for selection in breeding programmes. The reported accessions are suggested for further yield-related research that could lead to genetic improvement of African yam bean.

Conflict of Interests

The Authors declare no conflict of interests.

Tables, Figures and Chart

Table 1. Details of Accessions of AYB used in the experiment

S/N	Accession	Seed Colour	Origin
1	TSs 1	Light brown	Nigeria
2	TSs 9	Dark brown	Nigeria
3	TSs 10	Mottled Dark brown	Nigeria
4	TSs 16	Grey	Nigeria
5	TSs 22	Light brown	Nigeria
6	TSs 23	Mottled Light brown	Nigeria
7	TSs 24	Mottled brown	Nigeria
8	TSs 27	Mottled Dark brown	Nigeria
9	TSs 30	Mottled Light brown	Nigeria
10	TSs 31	Grey	Nigeria
11	TSs 47	Grey	Nigeria
12	TSs 53	Light/dark brown	Nigeria
13	TSs 59	Mottled brown	Nigeria
14	TSs 61	Dark brown	Nigeria
15	TSs 62	Light brown	Nigeria
16	TSs 63	Mottled brown	Nigeria
17	TSs 65	Mottled brown	Zaire
18	TSs 77	Light brown	Ghana
19	TSs 78	Light brown	Unknown
20	TSs 84	Dark brown	Nigeria
21	TSs 89	Light brown	Nigeria
22	TSs 95	Dark brown	Nigeria
23	TSs 118	Grey	Unknown

Table 2. Means of three vegetative growth parameters of 23 African yam bean accessions

Accessions	Number of leaves	Number of branches	Plant height (cm)
TSs 62	37.00[ab]	8.00[a]	119.00[a-f]
TSs 63	35.00[abc]	6.00[ab]	92.00[g-j]
TSs 65	37.00[ab]	5.75[ab]	114.00[b-f]
TSs 89	34.00[abcd]	5.75[ab]	137.50[abc]
TSs 16	32.50[bcd]	5.50[ab]	137.00[abc]
TSs 10	36.00[abc]	5.25[ab]	99.50[e-j]
TSs 30	35.75[abc]	5.25[ab]	130.00[a-d]
TSs 61	22.50[fgh]	5.25[ab]	101.00[e-i]
TSs 1	38.00[a]	5.25[ab]	139.50[ab]
TSs 27	25.00[fg]	4.50[ab]	123.00[a-e]
TSs 53	33.00[bcd]	4.50[ab]	96.00[f-j]
TSs 23	27.00[ef]	4.25[ab]	105.00[d-i]
TSs 95	36.50[abc]	4.25[ab]	143.50[a]
TSs 59	22.00[gh]	4.25[ab]	111.50[c-h]
TSs 78	22.00[gh]	4.00[ab]	84.50[i-l]
TSs 9	25.00[fg]	3.75[ab]	44.25[m]
TSs 47	30.00[de]	3.75[ab]	120.00[a-f]
TSs 118	34.00[abcd]	3.50[ab]	77.50[jkl]
TSs 24	22.00[gh]	3.25[ab]	96.00[f-j]
TSs 31	32.00[cd]	3.00[ab]	120.00[a-f]
TSs 84	18.00[cd]	2.75[ab]	87.50[h-k]
TSs 22	20.50[gh]	2.00[b]	67.50[klm]
TSs 77	18.00[h]	1.25[b]	60.25[lm]

Means in the same column with the same letters are not significantly different at $p \leq 0.05$

References

Adewale, B. D., Morphological diversity analysis of African yam bean (Sphenostylis stenocarpa Hochst. ex A. Rich.) Harms and prospects for utilization in germplasm conservation and breeding. 2012. *Genetic Resources and Crop Evolution* 59: 927-936

Ajibade, S. R., Balogun, M. O., Afolabi, O. O., Ajomale, K. O. and Fasoyiro, S. B. 2005. Genetic variation in nutritive and antinutritive contents of Africam Yam Bean (*Sphenostyli stencarpa*) *Tropical Science* 445: 144-148

Amoatey, H. M., Klu, G. Y. P., Bansa, D., Kumaga, F. K., Aboagye, Bennet-Lartey, S. O. and Gamedoagbao, D. K. 2000. The African yam bean (*Sphenostylis stenocarpa*): A neglected crop in Ghana. *West African Journal of Applied Ecology* 1:53-60

Asuzu, I. U. and Undie, A. 1986. Some observations on the toxic effects of the seed extract of S*phenostylis steenocarpa* (Hochst ex. A. Rich) Harms on intestinal muscle. *Qual. Plant Foods,*

Edem, D. O., Amugo, C. I. and Eka, U. O. 1990. Chemical composition of yam beans (*Sphenostylis stenocarpal).* Tropical Science *30:59-63*

Ene-Obong, E. E. and Okoye, F. I. 1992. Interrelations between yield and yield components in African yam bean (Sphenostylis stenocarpa (Hochst ex A. Rich) *Beitr. Trop. Landwirtshaft. Vet. Med. 30:283-290*

Evans, I. M., D. Boulter, A. Eaglesham and P. Dart. 1997. Protein content and quality of tuberous roots of some legumes determined by chemical methods. *Plant Food for Human Nutrition* 27: 275-285

Ezue, M. I. 1984. African yam bean as a crop in Nigeria. *World Crops* 36: 199-200

Nehad, N. A. M. 1990. Effect of pre-soaking of Faba bean enzyme inhibitors and polyphenol after cooking. *Journal of Agriculture and Food Chemistry* 38: 1479-1482

Nwokolo, E. 1987. A nutritional assessment of African yam bean *Sphenostylis stenocarpa* (Hochst ex A. Rich) Harms and bambara groundnut *Voandzeia subterranean L. Journal of Food Science and Agriculture* 41:123-129

Ojo, D. K. and Amanze, C. O. 2001. Prediction of grain yield through heritability and genetic advance of yield parameters in soybean. *Nigerian Journal of Ecology* 3:10-13

Ojuederie, O. B., Balogun, M. O., Akande, S. R., Korie, S. and Omodele, T. 2015. Intra-specific variability of African Yam Bean (*Sphenostylis stenocarpa* Hochst ex. A, Rich) Harms. *Journal of Crop Science and Biotechnology* 18(2):53-62

Okigbo, B.N. 1973. Introducing the yam bean Sphenostylis Stenocarpa (Hochst ex A. Rich) Harms In proceedings of the first IITA grain legume development improvement Workshop. 29th October-2nd November, 1973

Popoola, J. O.., A. E. Adegbite, O. O. Obembe, B. D. Adewale and B. O. Odu. 2011. Morphological intraspecific variabilities in African yam bean (AYB) (*Sphenostylis stenocapra* Ex. A. Rich)Harms. *Scientific Reasearch and Essay* 6(3): 507-515

Potter, D. 1992. Economic botany of *Sphenostylis* (Leguminosae). *Economic Botany* 46(3): 262-275

Saka, J. O., Ajibade, S. R., Adeniyan, O. N., Olowoyo, R. B. and Ogunbodede, B. A. 2004. Survey of underutilized grain legumes production systems in South-West agricultural zone of Nigeria. *Journal of Agriculture and Food Information* 6:93-108

Togun, A. O. and A. O. Olatunde. 1998. Effect of soil applied fertilizer on the growth and yield of African yam bean (*Sphenostylis stenocarpa*). *Nigerian Journal of Sci ence* 32:43–48