

Domestication and Performance of Amara (*Tacca leontopetaloides* (L) Kuntze) Under Different N P K Fertilizer Rates in Lafia , Nasarawa State .

¹Umar, I. B.; ²Ali, A. G.; and ¹Babatunde, F.E.

¹College of Agriculture, Lafia; Department of Horticulture and Landscape Technology

²Abubakar Tafawa Balewa University Bauchi; Department of Crop Production
ibrahimumarbako@gmail.com

Abstract

A field trial was carried out for two years to study the performance of Amara (*Tacca leontopetaloides* (L) Kuntze) under different N P K fertilizer rates in Lafia Nasarawa State of Nigeria . Five different fertilizer rates (0: 0: 0; 60: 30: 30; 120: 60:60; 180: 90:90; and 240:120:120 kg/ha) were used. The five fertilizer rates were replicated three times and the fifteen plots were all laid out in a randomised complete block design (RCBD). The use of the different fertilizer rates during the two years of study revealed significant differences on stem diameter, tuber size ;and yield in both 2011 and 2012. Application of 60:30:30 kg N P K/ha gave the highest tuber size and yield during the two year study period.

Keywords: Amara, tuber size, fertilizer rate, yield, domestication .

Introduction

Amara (*Tacca leontopetaloides* (L) Kuntze) is a wild plant commonly called Amara in Plateau and Nasarawa States of central Nigeria . At present , the plant is harvested from the wild and eaten as a starchy food derived from tubers that are similar to those of Irish potatoes . Amara tuber can be processed into flour which is made into a 'Gel meal' prepared first by boiling water and making a soup sauce. The flour is added to make a fine gel and allowed to settle into a semi-solid tasty delicacy . Such a dish is highly cherished by the Taroh and Goemai people of Plateau state and the Alago people of Nasarawa state. The Basionym, *Leontice leontopetaloides* (L) appeared in *Species Plantarum*. The common synonyms today are *Tacca pinnatifida* and *Tacca involacurata*. The local names are also many and varied with some related to the local communities in which they are found. They include ; Batflower , Polynesian arrowroot, Yabio, Fiji arrowroot, Kabusa, Masao, and many more (NDB, 2004). Amara is a plant mostly found along the fringes of middle belt of Nigeria , notably Plateau and Nasarawa states . Although the plant possesses tremendous qualities in terms of food and medicine, it is yet to be domesticated in the country and no literature has so far reported its production under conventional agronomic practices as applied to crops such as Irish potato, cassava and yam. Thus, considering its food values, gelling quality and its medicinal qualities, amara is worth a plant to be recognised as more than a wild collection. As a result of these , it should be cultivated under field conditions in addition to other similar tuber crops such as Irish potatoes, cocoyam, cassava and yam in order to provide additional food source to feed the growing population of Nigeria.

Materials and methods:

A field trial was carried out at the Teaching and Research Farm of college of Agriculture, Lafia , Nasarawa state during the wet seasons of 2011 and 2012 . Lafia is located at latitude 08.33'N and longitude 08.32'E in the southern guinea savannah of Nigeria. Data on rainfall distribution, maximum and minimum temperatures and relative humidity of the study area for

the two years were obtained from the Nigerian Meteorological Agency (NIMET) of the Federal Ministry of Aviation, Lafia office. The physical and chemical composition of the soil of the study area is shown in table 1.

Table 1: Physical and chemical analyses of soil before planting:

Soil properties at 0 – 3cm depth	
Physical composition	
Clay (g/kg)	8.64
Silt	11.14
Sand	80.22
Textural classification (USDA)	Sandy loam
Chemical composition	
pH (H ₂ O)	5.18
pH (0.01M CaCl ₂)	5.04
TN%	0.13
Avail. P (ppm)	18.08
K (mg/kg)	0.16
OC (mg/kg)	0.42
C/N _c	3.23
Mg (Mol/kg)	1.45
Ca (Mol/kg)	2.21
Na (Mol/kg)	0.85
CEC (Mol/kg)	4.67

The treatment consisted of only fertilizer at 5 different levels and replicated three times and the fifteen plots were then laid out in a randomised complete block design (RCBD). The experimental site in each of the two years under investigation was harrowed twice at the onset of the rainy season. The area was then mapped out into plots of 9m each. The plots were arranged side by side in rows of three blocks with each block having 5 plots. The spacing between blocks was 1m while the spacing between plots within a block was 50cm. Amara seedlings for transplanting were collected from around Lafia town. The seedlings were dug and lifted to the prepared plots using small hoes. The sprouts were then planted at a depth of 3-5cm. Fertilizer application was carried out at 2 and 6 weeks after transplanting (WAT). N P K 15: 15: 15 fertilizer at the different rates was basally applied at 2 WAT while the remaining balance of N was applied at 6 WAT by top-dressing using Urea. Weed control was carried out manually using the West African small hoe. The activity started at 2 WAT and continued as at when due. Diseases and pests on the other hand, were not observed on the field during the two year research period. Therefore, no disease or pest control measure was taken.

Data collection

Ten sampled plants were randomly chosen from each plot and tagged for data collection. From the ten tagged plants, data on plant height and stem diameter were taken while data on tuber size and tuber yield were collected from tubers harvested from 1m² area of each plot.

Data analysis: Analysis of variance (ANOVA) was carried out to test for the level of significance among the treatments using F-test as described by Synedecor and Cochran (1967). Where the F-test was significant, Duncan's Multiple Range Test (DMRT) was used to separate the means of the treatments.

Result and discussion:

Plant height: Application of the different fertilizer rates did not show any significant difference on plant height in both years of the study as shown in table 2. This may be due to the fact that the amara plants in the wild was not used to mineral fertilizer application. It must have been used to organic fertilizer in the wild. This is also justified from the result that plants in the control plots had greater growth heights than the treated plants in both years of the study . This shows that mineral fertilizer has little or no significant effect on growth of amara plants.

Table 2: Effect of fertilizer rate on plant height (cm) of Amara plant at Lafia, Nasarawa State during 2011 and 2012 wet seasons

Treatments	Weeks after Transplanting (WAT)											
	2		4		6		8		10		12	
Fertilizer rate (kg/ha)	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
0:0:0	25.60a	24.44a	26.80a	26.62a	28.40a	28.22a	30.00a	29.24a	30.70a	29.98a	30.70a	27.00a
60:30:30	25.60a	24.00a	26.80a	24.30a	28.40a	25.60a	30.00a	26.89a	30.70a	27.80a	30.70a	32.25a
120:60:60	25.10a	24.00a	27.20a	27.35a	28.00a	28.01a	29.60a	29.02a	30.20a	29.65a	30.20a	31.87a
180:90:90	20.50a	20.53a	21.60a	21.93a	23.00a	23.37a	24.40a	24.10a	24.70a	24.63a	24.70a	24.63a
240:120:120	25.50a	24.26a	27.40a	25.74a	28.30a	26.97a	30.00a	28.07a	31.00a	29.00a	31.00a	29.11a
±SE	1.249	1.256	1.292	1.332	1.374	1.403	1.437	1.455	1.501	1.507	1.509	1.565

Means within a column of a set of treatments followed by unlike letter (s) are significantly different using Duncan's Multiple Range Test (DMRT) at 5% level of probability.

Stem diameter : On the application of the different fertilizer rates, the control (N P K 0: 0:0 kg/ha) in the two seasons produced the least stem diameter. In 2011 wet season, it was observed that except at 2 WAT , all the different fertilizer rates had significantly ($p>0.05$) higher stem diameter than the control. Also in 2012 wet season, except at 2 and 4 WAT, the different fertilizer rates produced significantly ($p >0.05$) higher stem diameter than the control. Again , the application of N P K 180: 90: 90 consistently resulted in higher stem diameter than the rest of the treatments used. This also shows that treated plants had significantly greater stem diameter than the control. This result also agrees with that got by Mainasara (1989) who reported an increase in plant growth height, canopy spread, LAI, main stem diameter, length of branches, root dry weight, number of fruits, and yield with increasing nitrogen up to 150kg/ha in chilli pepper.

Table 3: Effect of fertilizer rate on plant stem diameter (cm) of Amara plant at Lafia, Nasarawa State during 2011 and 2012 wet seasons

Treatments		Weeks after Transplanting (WAT)											
		2		4		6		8		10		12	
Fertilizer (kg/ha)	rate	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
0:0:0		0.2822a	0.2733a	0.3122b	0.2844a	0.3600b	0.2967b	0.4078c	0.3244b	0.4556c	0.3822b	0.4833c	0.4200b
60:30:30		0.2767a	0.2800a	0.3578a	0.3300a	0.4822a	0.3900a	0.6100b	0.4911a	0.7422b	0.6211a	0.8778b	0.7544a
120:60:60		0.2767a	0.2756a	0.3644a	0.3267a	0.5011a	0.3844a	0.6333a	0.4989b	0.7689ab	0.6378a	0.9056ab	0.7711a
180:90:90		0.2722a	0.2756a	0.3611a	0.3200a	0.5033a	0.3800a	0.6465a	0.4967a	0.7778a	0.6367a	0.9111a	0.7778a
240:120:120		0.2767a	0.2733a	0.3722a	0.3122a	0.4956a	0.3678a	0.6422a	0.4867a	0.7856a	0.6258a	0.9222a	0.7444a
±SE		0.004	0.006	0.004	0.007	0.004	0.006	0.005	0.005	0.005	0.006	0.004	0.005

NB: Means within a column of a set of treatments followed by unlike letter (s) are significantly different using Duncan's Multiple Range Test (DMRT) at 5% level of probability.

Tuber Size(cm). Effect of fertilizer rate on tuber size at harvest observed during the wet seasons of 2011 and 2012 as shown in table 4. In 2011 the application of fertilizer at the rate of 60:30:30kgNPK/ha resulted in tubers with greater mean tuber size (26.36cm) than all the other treatments. Application of N P K at the rate of 180:90:90 on the other hand, had the least mean tuber size(18.14cm). In 2012 wet season, the control (0:0:0), NPK 120:60:60 and 180:90:90 produced tubers of almost equal sizes while NPK 240:120:120kg/ha produced tubers with the least tuber size(18.14cm).

Table 4: Effect of fertilizer rate on tuber size during 2011 and 2012 wet seasons

Fertilizer Rate (kg/ha)	2011	2012
0:0:0	21.47b	18.38b
60:30:30	26.36a	19.88a
120:60:60	22.31b	19.87a
180:90:90	20.87bc	19.68a
240:120:120	18.14c	18.39b
±SE	0.440	0.713

Means within a column of a set of treatments followed by unlike letter(s) are significantly different following Duncan's Multiple Range Test (DMRT) at 5% level of probability.

Tuber Yield (t/ha): Effect of fertilizer rate on tuber yield (tuber weight) observed during the 2011 and 2012 wet seasons is presented in table 5. In both 2011 and 2012, application of NPK 60:30:30kg/ha produced significantly ($p>0.05$) higher tuber yield of 5.88t/ha and 5.26t/ha over the control and other treatments.

Table 5: Effect of fertilizer rate on tuber yield during 2011 and 2012 wet seasons

Fertilizer Rate (kg/ha)	2011	2012
0:0:0	3.78b	3.75b
60:30:30	5.88a	5.26a
120:60:60	5.76a	4.95a
180:90:90	3.65b	3.34b
240:120:120	3.63b	3.25b
±SE	0.186	0.245

Means within a column of a set of treatments followed by unlike letter(s) are significantly different following Duncan's Multiple Range Test (DMRT) at 5% level of probability.

Summary: It was observed during the study period ,that fertilizer rate did not show any significant effects on plant height but showed significant effects on plant stem diameter. Also, during the study period, fertilizer rates showed significant effects on tuber size and tuber yield with the lowest fertilizer rate (60: 30: 30) producing the highest tuber size and yield in both years.

Conclusion: From the foregoing result, it can be concluded that when amara plants are domesticated and sown on the field, little or no fertilizer would be required to give higher yields since the lowest level of fertilizer gave the highest yield.

Recommendation: Little or no fertilizer application from the foregoing result, can be recommended to farmers in order to have higher yields when amara is finally domesticated as a crop plant.

References:

Duncan, D.B.(1975).Biometrics 31 Pp 339

Mainasara, M.(1989). Effects of nitrogen, phosphorus fertilizer and F Y M on growth and yield of chilli pepper (*Capsicum frutescens* L) Var TCA 14. Unpublished M.Sc. thesis , Dept of Agronomy A B U Zaria Pp86-98.

N D B : Nomenclature Data Base; (2004).

Synedecor, G,W. and Cochran, W.G. (1967).Statistical methods, 7th edition, Iowa State University Press, U S A ,Pp 215-237..