Fuzzy Publication

Journal of Agricultural and Food Chemical Engineering

4(1) (2024): 8 –21

https://doi.org/10.58612/jafce412

Research Article

Assessment of Seven Taro [*Colocasia esculenta* (L.) Schott] Cultivars for Growth under Poultry Manure Fertilization in Anyigba, Kogi State Nigeria

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ARTICLE HISTORY

Received: March 1, 2024

Accepted: May 25, 2024

Published: June 8, 2024

HOW TO CITE: Yusuf et al., (2024). Assessment of seven taro [*Colocasia esculenta* (L.) Schott] cultivars for growth under poultry manure fertilization in Anyigba, Kogi State, Nigeria. *Journal of Agricultural and Food Chemical Engineering*. 4(1), 8 - 21. https://doi.org/10.58612/jafce412

Abstract: A research was carried out at the Prince Abubakar Audu University Research Farm, Anyigba during the 2021 Cropping Season to assess the growth of seven taro cultivars under poultry manure fertilization. Treatments consist of 7 cultivars (6 improved and 1 local) and two poultry manure levels (0 and 6 t/ha) factorially combined to obtain a total of 14 treatments. The experiment was laid in a Randomized Complete Block Design (RCBD) with three (3) replicates Results obtained indicated that cultivars differed significantly ($P<0.05$) in growth. NxS 003 and Akirimgbawa performed best amongst others in terms of Establishment count, Plant height, Leaf Area, Leaf Length, Number of Suckers, Die Back leaves at all sampling stages except for number of leaves. NxS 001 cultivar though has the highest number of leaves at 12WAP but was significantly indifferent with Akirimgbawa and others. Cultivars under investigation performed best under 6 t/ha of poultry manure fertilizer than the control plots at all sampling stage except for number of leaves which was not significant at 16WAP. Overall interaction results showed that NCe 002 cultivars responded best to PM fertilization in most of the characters measured; plant height, leaf area, leaf length, number of suckers and die back leaves. similarly, no response was observed with emergence. NxS 001 & NxS 002 performed best on number of leaves at 8 and 12WAP respectively. This research therefore concludes that NxS 003 and Akirimgbawa cultivars are best for optimum growth in Anyigba environment. Further study on these best performing cultivars should be experimented for yield assessment at different fertilization levels.

Keywords: Growth Assessment, Poultry Manure Fertilization, Taro cultivars.

INTRODUCTION

Taro [*Colocasia esculenta* (L.) Schott] is a monocotyledonous and herbaceous crop that originated from South East Asia. It is a crop plant that tolerates shade as a C3 plant. Taro and Tannia are commonly called cocoyams in many parts of the world especially in Africa. In the Pacific regions both genera are known as taro (Buke and Gidago, 2016). In Nigeria, twelve cultivars of taro species among which include; NCe 001 (CocoIndia), NCe 002 (Ede ofe, green), NCe 003 (Ede ofe, purple), NCe 004 (Ede ofe, giant), NCe 005 (Nkpong), NCe 006 (Ghana), NCe 007 (Ibococo, green), NCe 008 (Ibococo, pink), NCe 009 (Ede Orba), NCe 0010 (Akiri), NCe 0011 (Akpahuri), and NCe 0012 (Akiri mgbawa) have been identified from germplasm collections at National Root Crop Research Institute (NRCRI), Umudike for cultivation. No new improved genotypes have been developed in Nigeria mainly due to difficulties associated with conventional breeding methods (NRCRI, 2009 and 2010). Taro has the ability to grow under diverse climatic regimes (Matthews and Ghanem, 2021), including its ability to survive and produce corms under salty conditions (Lloyd *et al.*, 2021); to some extent, it is tolerant to drought (Gouveia *et al.*, 2020) and is well adapted to wet or waterlogged soil (Yamanouchi *et al.*, 2021). Therefore, taro can be cultivated in the wetlands, while most other vegetable crops cannot (Lakitan *et al.*, 2019). Multiple vegetative parts of the taro plant can be used as planting materials, including cormel, sucker and stolon (Setyawan *et al.*, 2021). Cultivation of taro could deliver double benefits. The taro corm is characterized by high-quality and affordable source of starch, which is gluten-free, hypoallergenic and highly digestible (Singla *et al.*, 2020). Taro corm contains 70%–80% starch. The starch content in taro corm is higher than that of sweet potato and cassava (Kaith *et al.*, 2022). Young leaf blade and petiole are consumed as leafy vegetable and are rich in vitamins, minerals and fibre (Shekade *et al.*, 2018). Globally, taro is the fifth most cultivated root crop (Miyasaka *et al*., 2019).

Organic fertilization has several advantages compared to chemical fertilization. It improves as physical and biological conditions of the soil; presents an economic advantage for the small rural producer, since it reduces the dependence on industrial inputs and makes the plant less susceptible to pests and diseases, according to the theory of trophobiosis (Natalli, *et al.*, 2020). Among the most widely used organic fertilizers, poultry manure is one of the most accessible fertilizers for family farmers because it is produced in large volumes and has low cost. In addition to providing savings for farmers, the use of manure from laying hens as fertilizer constitutes a destination for farm residues, without polluting soil and water resources, resulting in additional revenue and environmental conservation (Guimarães *et al.*, 2016). Currently, there is a dearth of information on plant nutrient management on taro production which may be attributed to its tuberous nature as a deep- feeding crop. Nevertheless, succeeding in crop grown with application of organic manures significantly produced higher seed yield in organic farming. Given the above, this work is aim to evaluate the growth performance of seven taro accession [*Colocasia esculenta* (L.) Schott] under poultry manure fertilization in Anyigba, Kogi State Nigeria**.**

MATERIAL and METHODS

Study Area

The study was carried out during the rainy season of 2021 at Prince Abubakar Audu University Research Farm, Anyigba, Kogi State, Nigeria, the farm is located on latitude ($7^0 29^1$N and longitude $7^0 11^1$E) on elevation of 420 m above sea-level within the Southern Guinea Savannah Ecological Zone of Nigeria, the area is characterized by an average rainfall of about 180 mm mostly distributed between the months of April and October. Mean monthly minimum and maximum temperature of about 17^o C and 36.2^o C respectively. The soils generally are sandy to sandy-loam. Temperature shows some variation throughout the years. Mean monthly temperature varies between 15.1^oC and 31.3^oC (Amhakhian *et al.*, 2012).

Soil Preparation and Analysis

Experimental site was firstly ploughed, then harrowed and prepared into beds while representative surface soil sample (0 – 15, 0 – 30 cm) was collected with a tubular sampling auger, bulked and taken to the Department of Soil and Environmental Management of the Prince Abubakar University, Anyigba for the determination of its physiochemical properties.

Treatments and Experimental Design

Treatments are 7 taro accession (6 improved and 1 local); NxS 002, NCe 003, NCe 002, Akirimgbawa, NxS 001, NxS 003 respectively (obtained from the National Root Crops Research Institute (NRCRI) with one Local Cultivar obtained from Anyigba market) and two levels of pure poultry manure 0tha^{-1} and 6 tha^{-1} (collected from a Mu'cobs farm Lokoja). Total treatments obtain after factorial combination was 14 which was laid in a Randomized Complete Block Design (RCBD) with three (3) replications. The experimental site measures 0.085ha. Each replicates contained 14 plots carrying a randomized treatment, each plot measures 13.50 m^2, consisting of four ridges (3.0m long) with plant population of forty (40), giving a total of one thousand six hundred and eighty (1680) plants in the whole experiment.

One viable daughter corm of each varieties was planted per hole (15cm deep) at 45 cm spacing within ridges and 75cm between ridges, covered with 2 – 3 cm of soil. After planting, oil around the planted corms was patted down gently and watered until the taro got soaked. Poultry manure was incorporated into the soil during tillage two weeks before planting for rapid decomposition and nutrients release to the crop. Weeding was done manually starting from three (3) weeks after planting. The experiment was kept weed free throughout the period of the work. organic insecticides neem oil extract, was used plus one inorganic Fungicide (Thiopsin 70% ppm) at 30ml/16litres of water was applied at 3weeks interval for the control of insect pests; cluster caterpillars, nematodes, aphids, taro beetles and horn worms, which were observed on the field.

Observations and Data Collection

Observation were made on growth characters; establishment count, Plant Height, Number of Leaves/plant, Leaf Area, Leaf Length, Number of Suckers and Die Back Leaves.

Analysis of Data

All data on growth characters were subjected to Analysis of Variance (ANOVA) using CROPSTAT. Significant differences amongst treatment means were separated using the New Duncan Multiple Range (N-DMRT) as described by Duncan (1955).

RESULT AND DISCUSSION

Table 1 presents the result of soil analysis at the experimental site. It shows that soil belongs to the textural class of Sandy Clay Loam marked with slight acidity (pH 4.61). It contains organic matter 1.52%, organic carbon of 0.88%. The N, Mg and K contents were 0.04%, 2.74mg kg^{-1} and 2.31cmol kg^{-1} respectively which are considered to be significantly low. However, the soil supports the growth of the taro.

Analysis of the pure poultry manure used for the experiment showed that the manure constituted 1.86 % Nitrogen, 1.78 % Phosphorus and 0.89 % potassium which are major nutrient requirement of taro crop and can sufficiently support growth and yield in Anyigba, their deficiencies in the soil relative to the crop requirement and their ration in the poultry manure utilized for this experiment informed the rates applied.

Table 1. Physical and chemical Characteristics of Soil taken from the Experimental Site before the Establishment.

Properties	0-15 & 15-30cm depth
Physical	
Sand	2.28%
Slit	21.20%
Clay	76.52%
Textural Class	Sandy Clay Loam
Chemical	
pH in H_20 (1:2:5)	4.61
Organic carbon (%)	0.88
Organic matter (%)	1.52
Total Nitrogen (%)	0.04
Available phosphorus (mg/kg)	5.36
Exchangeable Cation (Meq/100gm Soil)	
K+	2.31
Mg+	2.74
Ca+	4.39
Na+	0.41
CEC	10.91
Poultry Manure	
Nitrogen	1.86 %
Phosphorus	1.78 %
Potassium	0.89 %
Potassium	0.89 %

Growth Characters of Seven Cultivars of Taro (*Colocasia esculenta*) Under Poultry Manure Fertilization in Anyigba, during the 2021 Cropping Season.

Cultivars, poultry manure and interactions significantly influenced ($P \leq 0.05$) the establishment count, plant height and number of leaves of taro crop during the 2021 cropping season in Anyigba (table 2). NxS 003 and Akirimgbawa varieties performed best (67.08%, 75.43%) among other cultivars at 4 and 8WAP respectively. Establishment of NxS 003 variety was though highest but not significantly different from those of Akirimgbawa, NxS 002, NCe 003 and NCe 002 respectively at 4WAP while Akirimgbawa was also not significantly different from those of NxS 003, NxS 002 and Local varieties respectively at 8WAP. Other varieties behaved alike at 4WAP and 8WAP. The least response to emergence (31.25%) was observed with varieties NxS 001 at 4WAP, NCe 002 (51.68%) at 8WAP respectively. emergence of taro cultivars was significantly influenced by poultry manure as application of 6t/ha produced the highest emergence rate (50.48 & 68.10) at 4 and 8weeks respectively. V x PM interaction was significant for establishment count. Our result corroborates with Rajeswari *et al*., (2014) and Ojeniyi *et al*., (2013) who reported high emergence rates of improve cultivars of crops.

Similarly, NxS 003 produced the tallest plants (24.80 cm) at 8 WAP, Akirimgbawa produced the tallest plants (32.73 & 36.08 cm) at 12 and 16 WAP respectively. However, heights of taro plants produced by other varieties were significantly indifferent with varieties

NCe 003 (18.38 cm) and NCe 002 (25.27 & 30.93 cm) producing the shortest plants at 8, 12 and 16WAP respectively. Application of 6t/ha of poultry manure significantly influenced taro heights by consistently producing taller plants (22.77 cm, 30.16 cm and 35.03 cm) than the control plots. V x PM interaction was significant for plant height at 8, 12 and 16WAP respectively.

Number of taro leaves was highest with varieties Akirimgbawa (4.58) and NxS 001 (4.82) at 8 and 12WAP. This was however statistically at par with those obtained with NxS 002, NCe 003 and NCe 002 during these sampling periods. NxS 001 had the least number of leaves (4.05) at 8WAP, while NxS 003 had the least number of leaves (4.33) at 12WAP. Application of 6t/ha of poultry manure also produced the highest number of leaves (4.43, 4.62) significantly different from the control at 8 and 12 WAP respectively. V x PM interaction on number of leaves was significant. However, at 16WAP, Number of leaves of taro was not significantly affected (P≥0.05) by varieties, poultry manure fertilization and interaction. Our results on plant height and number of leaves is in line with the works of Udom *et al.*, (2017); Legesse *et al* (2021).

Table 2. Establishment count, Plant Height and Number of leaves of Seven Cultivars of Taro *(Colocasia esculenta)* Under Poultry Manure Fertilization in Anyigba, during the 2021 Cropping Season.

Treatments	Establishment count (%)		Plant height (cm)			Number of Leaves		
	Sampling Periods (Weeks After Planting)							
Cultivars (V)	4	8	8	12	16	8	12	16
NxS 002	58.33^{ab}	72.08^{ab}	20.53^{b}	25.92^{cd}	31.78^{b}	4.30^{ab}	4.56^{ab}	4.45
NCe 003	42.93^{bc}	54.18^{b}	18.38^{b}	30.32^{a-d}	35.77^{ab}	4.38^{ab}	4.55^{ab}	4.22
NCe 002	49.58^{abc}	51.68^{b}	19.35^{b}	25.27^{d}	30.93^{b}	4.40^{ab}	4.43^{ab}	4.08
Akirimgbawa	59.18^{ab}	75.43^{a}	21.05^{ab}	32.80^{a}	36.30^{a}	4.58^{a}	4.57^{ab}	3.75
NxS 001	31.25^{c}	57.08^{b}	20.35^{b}	26.25^{bcd}	31.28^{b}	4.05^{b}	4.82^{a}	4.50
NxS 003	67.08^{a}	74.58^{a}	24.80^{a}	32.73^{a}	36.08^{a}	4.13^{b}	4.33^{b}	4.13
Local	36.68^{c}	65.00^{ab}	20.28^{b}	28.52^{a-d}	34.25^{ab}	4.30	4.35^{b}	4.33
SE (±)	7.15	5.75	1.38	1.78	1.54	0.15	0.15	0.41
Poultry Manure (tha^{-1})								
Control	48.10	66.08	18.59	27.49	32.68	4.19	4.43	4.24
6 tha^{-1}	50.48	68.10	22.77	30.16	35.03	4.43	4.62	4.18
LSD (0.05)	11.1	12.9	2.15	2.77	2.40	0.24	0.22	0.64
Interaction								
V x PM	*	*	*	*	*	*	*	ns
C.V (%)	30.5	22.0	16.4	15.2	11.2	8.7	7.9	24.1

Means followed by same letters within a sampling period are not statically different at 5% level of probability using N-DMRT. C.V- Coefficient of variation, * - Significant at 5% level of probability.

Significant effect of varieties on growth characters have been reported by Tattiyakul, *et al.*, (2006) who asserted that long-term varieties are known to vary in response to nitrogen fertilizer with respect to corm yield as well as the taste and texture of corms. This is also supported by Temesgen (2017). Variation on establishment count, plant height has also been attributed to variation in the genetic make-up of varieties in response to specific environmental conditions Tewodros *et al.* (2013). Gerrano *et al.* (2018) and Angami *et al.* *(*2015) indicated the existence of variability among taro accessions including Denu and Kiyaq varieties. Similar variation in the number of leaves per plant among taro cultivars has been reported by Angami *et al.* (2015).

Table 3. Interaction of Cultivars x Poultry Manure on the Establishment count of Taro (*Colocasia esculenta*) at different sampling period in Anyigba, 2021 Cropping Season.

Sampling Periods	Poultry Manure	Cultivars						
		V_1	V_2	V_3	V_4	V_5	V_6	V_7
4WAP	Control	23.67[ab]	14.33[b]	18.33[ab]	24.80[ab]	12.67[b]	26.15[ab]	15.33[b]
	6 tha^{-1}	23.00[ab]	20.00[ab]	21.33[ab]	23.33[ab]	12.33[b]	27.33[a]	14.00[b]
	SE (±) = 0.04							
8WAP	Control	29.00[ab]	18.33[c]	18.67[c]	32.00[a]	21.67[bc]	30.00[ab]	29.00[ab]
	6 tha^{-1}	28.67[ab]	25.00[abc]	22.67[abc]	28.33[ab]	23.00[abc]	29.67[ab]	23.00[abc]
	SE (±) = 3.25							

Means followed by same letters within a sampling period are not statically different at 5% level of probability using N-DMRT. V1 *= NxS 002,* V2 *= NCe 003,* V3 *= NCe 002,* V4 *= Akirimgbawa,* V5 *= NxS 001,* V6 *= NxS 003 and* V7 *= Local.*

Table 4. Interaction of Cultivars x Poultry Manure on the Heights of Taro crops (*Colocasia esculenta*) at different sampling period in Anyigba, 2021 Cropping Season.

Sampling Periods	Poultry Manure	Cultivars						
		V_1	V_2	V_3	V_4	V_5	V_6	V_7
8WAP	Control	19.87[bc]	14.33[d]	14.93[cd]	20.93[bc]	19.83[bcd]	22.83[abc]	17.37[cd]
	6 tha^{-1}	21.20[abc]	22.43[abc]	23.76[ab]	21.17[abc]	20.87[bc]	26.77[a]	23.20[ab]
	SE (±) = 1.95							
12WAP	Control	24.13[cd]	27.03[a-d]	22.63[d]	32.76[ab]	28.17[a-d]	30.83[abc]	26.90[bcd]
	6 tha^{-1}	27.70[a-d]	33.60[ab]	27.90[a-d]	32.83[a]	24.33[cd]	24.63[cd]	30.13[abc]
	SE (±) = 2.53							
16WAP	Control	30.20[b-e]	32.93[a-e]	28.63[e]	36.43[ab]	32.57[a-e]	35.57[a-d]	32.87[a-e]
	6 tha^{-1}	33.37[a-e]	38.60[a]	33.23[a-e]	36.17[abc]	30.00[cde]	38.20[ab]	35.65[a-d]
	SE (±) = 2.19							

Means followed by same letters within a sampling period are not statically different at 5% level of probability using N-DMRT. V1 *= NxS 002,* V2 *= NCe 003,* V3 *= NCe 002,* V4 *= Akirimgbawa,* V5 *= NxS 001,* V6 *= NxS 003 and* V7 *= Local.*

Table 5. Interaction of Cultivars x Poultry Manure on Number of leaves of Taro crops (*Colocasia esculenta*) at different sampling period in Anyigba, 2021 Cropping Season.

Sampling Periods	Poultry Manure	Cultivars						
		V_1	V_2	V_3	V_4	V_5	V_6	V_7
8WAP	Control	4.10[a-d]	4.43[abc]	4.37[abc]	4.50[ab]	3.67[d]	3.83[cd]	4.50[ab]
	6 tha^{-1}	4.60[ab]	4.33[abc]	4.43[abc]	4.67[a]	4.43[abc]	4.43[abc]	4.10[a-d]
	SE (±) = 0.22							
12WAP	Control	4.27[b]	4.60[ab]	4.27[b]	4.53[ab]	4.77[ab]	4.33[b]	4.27[b]
	6 tha^{-1}	5.03[a]	4.50[ab]	4.60[ab]	4.60[ab]	4.87[ab]	4.33[b]	4.33[b]
	SE (±) = 0.21							

Means followed by same letters within a sampling period are not statically different at 5% level of probability using N-DMRT. V1 *= NxS 002,* V2 *= NCe 003,* V3 *= NCe 002,* V4 *= Akirimgbawa,* V5 *= NxS 001,* V6 *= NxS 003 and* V7 *= Local.*

Effect of V x PM Interaction on Establishment count, Plant height and Number of leaves

V x PM Interaction on establishment count table 3 at 4 shows that NxS 003 cultivar numerically had the highest response to poultry manure giving an emergence rate of 27.33%, but not significantly different from its emergence (26.15%) at 0 t/ha poultry manure at 4WAP. this indicate that NxS 003 did not respond to PM fertilization. Other cultivars behaved alike except the Local cultivars which gave the least response to PM fertilization. At 8WAP, Akirimgbawa cultivar did not respond to PM fertilization, it had highest emergence rate of 32.00% at 0 t/ha PM, this was followed by NxS 003 and Local cultivar whose emergence were higher (30%, 29%) respectively at 0 t/ha PM fertilization. Other cultivars responded well to PM giving emergence rate that are significantly not different from each other.

V x PM Interaction on plant height (table 4) indicated that NxS 003 responded best to PM fertilization by producing the tallest plants (26.77 cm), this response was followed by cultivars NCe 002 and Local. Other cultivars behaved alike. NCe 003 had the poorest response by producing the shortest plants consistently (14.33cm) at 8WAP. similarly, Akirimgbawa responded well to PM fertilization at 12WAP, however, these was statistically at par with other cultivars. The least response was obtained with NxS 001 which produced shorter plants (24.33 cm) when fertilized with PM at 6 t/ha. At 16WAP, NCe 003 consistently produced taller plants (38.60 cm) at 6t/ha PM application, thus its said to have responded well. This response was not significantly different from other cultivars which behaved alike. Akirimgbawa cultivar did not respond to PM fertilization, it produced taller plants (36.43 cm) without PM.

Table 5 presents the interaction of Cultivar x Poultry manure on nuber of leaves of taro, highest number of leaves was obtained with Akirimgbawa cultivar under 6 t/ha PM, this was however not significantly different from number of leaves obtained with other cultivars. NCe 003 and Local cultivar responses were equally poor as they had higher number of leaves (4.43 & 4.50) respectively under control treatments at 8WAP. Alternatively, NxS 002 had the highest number of leaves (5.03) under PM fertilization, this was statistically at par with other cultivars except NxS 003 and Local cultivars. Poor response was noticed with NCe 003 which produced more leaves (4.60) under control plots than fertilized plots. Significant effect of growth parameters measured also agrees with the findings of other workers who concluded that organic manure increases the vegetative growth and yield of crops. This is reflected in the significant effect of interaction observed with establishment count, plant height, number of leaves leaf area, number of suckers and die back leaves respectively.

Leaf area was significantly affected by Cultivars, PM and Interaction at 8, 12 & 16WAP. during this sampling period, NxS 003 cultivar consistently produced plants with the highest leaf area (684.03cm, 749.07cm and 778.48cm). Other cultivars produced leaf areas that are significantly indifferent. NCe 002 consistently produced the lowest leaf area (411.83cm, 416.08cm & 424.87 cm) respectively across these sampling periods. Onwudike *et al*., (2015), Ojeniyi *et al.*, (2013), Adekiya and Agbede (2016) also observed higher plant height and leaf area can be achieved in cocoyam with increased application of Poultry Manure up to 7.5t/ha.

PM fertilization at 6 t/ha of PM consistently produced taller plants than the control plots. similar result was obtained with leaf length. NxS 003 produced plants with the longest leaves (28.38cm) at 8WAP, Akirimgbawa had 30.65cm at 12WAP and 31.48 at 16WAP respectively. Across these sampling periods, other cultivars had leaf lengths which were statistically at par. However, NxS 001 produced plants with the shortest leaves consistently. Similarly, highest number of suckers (3.33) was obtained with NxS 003 which was not significantly different from Akirimgbawa (2.83) at 8WAP. this was followed by NxS 002, NxS 001 and Local which were also at par. The lowest number of suckers was obtained from NCe 003. At 12WAP, NCe 002 produced the highest number of suckers (5.11), which was not significantly different from those obtained with NxS 001, NxS 003 and Local cultivars, NxS 002 produced the lowest (3.58) nuber of suckers. At 16WAP, NxS 003 had the highest number of suckers (7.15), which was statistically at par with the Local cultivar (6.45). other cultivars also had significantly indifferent number of suckers with NCe 003 having the lowest suckers (5.00). Number of die back leaves was not significantly affected by cultivars, PM and interaction at 12 WAP, however, Akirimgbawa cultivar had the highest die back leaves

(30.17) with was significantly indifferent from those obtained with other cultivars except NCe 003 which produced 21.67 die back leaves. NCe 002 has the lowest number of die back leaves. Application of 6t/ha PM produced the longest leaves, highest number of suckers and die back leaves across all the sampling periods throughput the experiment. V X PM interaction was significant for these characters across all sampling periods.

These findings are consistent with the report of Tsedalu *et al.* (2014) who asserted that the amount of food reserves contained in planting material is one of the factors which determines quality of the material (Sitompul and Guritno, 1995). Higher leaf area is a resultant effect of early rate of establishment, taller plants, better canopy development, efficient capture of solar radiation and hence more vigor. This may imply a positive correlation between plant height and leaf area. It could also be added that increased leaf area observed in the best performing taro varieties resulted in increased production of photosynthates which is enhanced by the superior leaf surface area and this corroborates early findings (Pratiwi *et al*., 2014).

Table 6. Leaf Area, Leaf Length, Number of Suckers and Die Back leaves of Seven Cultivars of Taro *(Colocasia esculenta)* Under Poultry Manure Fertilization in Anyigba, during the 2021 Cropping Season.

Treatments	Leaf Area (cm)			Leaf Length (cm)			Number of Suckers			Die Back leaves	
	Sampling Periods (Weeks After Planting)										
Cultivars (V)	8	12	16	8	12	16	8	12	16	12	16
NxS 002	545.03^{ab}	559.22^{ab}	564.73^{ab}	22.62^{ab}	29.53^{a}	30.95^{a}	2.58^{bc}	3.58^{b}	5..17^{bc}	14.17	28.00^{ab}
NCe 003	452.92^{ab}	463.25^{b}	462.02^{b}	23.98^{ab}	28.38^{ab}	29.80^{a}	2.17^{c}	3.92^{bc}	5.00^{c}	12.67	21.67^{bc}
NCe 002	411.83^{b}	416.08^{b}	424.87^{b}	23.15^{ab}	27.27^{ab}	28.70^{ab}	2.21^{c}	5.11^{a}	6.20^{bc}	14.33	20.67^{c}
Akirimgbawa	568.45^{ab}	581.62^{ab}	591.42^{ab}	26.93^{ab}	30.65^{a}	31.48^{a}	2.83^{ab}	3.98^{b}	5.82^{bc}	21.00	30.17^{a}
NxS 001	421.35^{b}	425.78^{b}	431.33^{b}	21.33^{b}	24.45^{b}	25.88^{b}	2.33^{bc}	4.28^{ab}	6.28^{b}	12.67	22.33^{bc}
NxS 003	684.03^{a}	749.07^{a}	778.48^{a}	28.38^{a}	29.33^{a}	30.62^{a}	3.33^{a}	4.68^{ab}	7.15^{a}	18.50	29.83^{ab}
Local	505.95^{ab}	510.95^{ab}	519.75^{b}	25.38^{ab}	27.60^{ab}	28.97^{ab}	2.23^{bc}	4.00^{ab}	6.45^{ab}	16.83	26.00^{ab}
SE (±)	64.27	77.39	81.48	1.44	1.25	1.28	0.21	0.27	0.42	2.25	2.30
Poultry Manure (tha^{-1})											
Control	440.32	448.37	454.74	23.66	27.28	28.68	2.35	4.04	5.77	15.43	26.43
6 tha^{-1}	585.27	610.48	623.15	26.64	29.07	30.29	2.74	4.40	6.25	16.05	27.24
LSD (0.05)	99.87	120.25	126.60	2.24	1.94	1.98	0.32	0.41	0.65	3.50	5.16
Interaction											
V x PM	*	**	**	*	*	*	*	*	*	ns	*
C.V (%)	30.7	35.8	37.0	14.0	10.8	10.6	19.9	15.4	17.2	35.1	30.3

Means followed by same letters within a sampling period are not statically different at 5% level of probability using N-DMRT. C.V- Coefficient of variation, * - Significant at 5% level of test.

Table 7. Interaction of Cultivars x Poultry Manure on Leaf Areas of Taro crops (*Colocasia esculenta*) at different sampling period in Anyigba, 2021 Cropping Season.

Sampling Periods	Poultry Manure	Cultivars V_1	V_2	V_3	V_4	V_5	V_6	V_7
	Control	503.50^{b}	347.83^{bc}	268.63^{c}	567.66^{ab}	386.40^{bc}	588.95^{ab}	419.30^{bc}
8WAP	6 tha^{-1}	586.57^{ab}	558.00^{ab}	555.03^{ab}	569.23^{ab}	456.30^{bc}	779.13^{a}	592.60^{ab}
	SE (±) = 90.89							
	Control	518.17^{bc}	365.03^{bc}	273.30^{c}	571.97^{bc}	391.70^{bc}	594.37^{bc}	424.07^{bc}
12WAP	6 tha^{-1}	600.27^{b}	961.47^{a}	558.87^{bc}	591.27^{bc}	459.87^{bc}	903.76^{ab}	597.83^{b}
	SE (±) = 109.44							
	Control	523.07^{b}	355.93^{b}	281.97^{b}	581.20^{b}	398.47^{b}	608.10^{b}	434.43^{b}
16WAP	6 tha^{-1}	606.40^{b}	568.10^{b}	567.77^{b}	601.63^{b}	464.20^{b}	948.87^{a}	605.07^{b}
	SE (±) = 115.23							

Means followed by same letters within a sampling period are not statically different at 5% level of probability using N-DMRT. V1 = *NxS 002,* V2 = *NCe 003,* V3 = *NCe 002,* V4 = *Akirimgbawa,* V5 = *NxS 001,* V6 = *NxS 003 and* V7 = *Local.*

Table 8. Interaction of Cultivars x Poultry Manure on Leaf Length of Taro crops (*Colocasia esculenta*) at different sampling period in Anyigba, 2021 Cropping Season.

Sampling Periods	Poultry Manure	Cultivars V_1	V_2	V_3	V_4	V_5	V_6	V_7
	Control	26.93^{ab}	21.37^{bc}	19.10^{c}	27.43^{ab}	21.03^{bc}	26.76^{ab}	23.00^{bc}
8WAP	6 tha^{-1}	26.30^{ab}	26.60^{ab}	27.20^{ab}	26.53^{ab}	21.63^{bc}	30.43^{a}	27.77^{ab}
	SE (±) = 2.04							
	Control	29.93^{ab}	26.13^{abc}	24.67^{bc}	30.87^{a}	24.53^{bc}	29.10^{abc}	25.43^{bc}
12WAP	6 tha^{-1}	29.13^{ab}	30.33^{a}	29.87^{ab}	30.43^{a}	24.36^{c}	29.57^{ab}	29.77^{ab}
	SE (±) = 1.76							
	Control	31.27^{ab}	28.13^{abc}	26.23^{bc}	31.71^{a}	26.10^{bc}	30.43^{abc}	26.80^{bc}
16WAP	6 tha^{-1}	30.63^{abc}	31.47^{a}	31.17^{ab}	31.20^{ab}	25.66^{c}	30.80^{abc}	31.13^{ab}
	SE (±) = 1.80							

Means followed by same letters within a sampling period are not statically different at 5% level of probability using N-DMRT. V1 *= NxS 002,* V2 *= NCe 003,* V3 *= NCe 002,* V4 *= Akirimgbawa,* V5 *= NxS 001,* V6 *= NxS 003 and* V7 *= Local.*

Table 9. Interaction of Cultivars x Poultry Manure on Number of Taro (*Colocasia esculenta*) suckers and Die back leaves at different sampling period in Anyigba, 2021 Cropping Season.

		Cultivars						
Sampling Periods	Poultry Manure	V_1	V_2	V_3	V_4	V_5	V_6	V_7
8WAP	Control	2.00^{b}	2.00^{b}	2.26^{b}	2.33^{b}	2.00^{b}	3.33^{a}	2.50^{ab}
	6 tha^{-1}	3.17^{ab}	2.33^{b}	2.17^{b}	3.33^{a}	2.67^{ab}	3.33^{a}	2.17^{b}
				SE (±) = 0.29				
12WAP	Control	3.00^{d}	3.50^{cd}	4.23^{bc}	3.70^{cd}	4.33^{bc}	5.33^{ab}	4.17^{c}
	6 tha^{-1}	4.17^{c}	4.33^{bc}	6.00^{a}	4.23^{bc}	4.23^{bc}	4.03^{cd}	3.83^{cd}
				SE (±) = 0.37				
16WAP	Control	5.00^{bcd}	4.53^{cd}	4.40^{d}	5.27^{bcd}	6.67^{ab}	8.33^{a}	6.17^{bc}
	6 tha^{-1}	5.33^{bcd}	5.47^{bcd}	8.00^{a}	6.37^{b}	5.90^{bcd}	5.97^{bcd}	6.73^{a}
				SE (±) = 0.59				
				Die back leaves				
		V_1	V_2	V_3	V_4	V_5	V_6	V_7
16WAP	Control	5.00^{bcd}	4.53^{cd}	4.40^{d}	5.27^{bcd}	6.67^{ab}	8.33^{a}	6.17^{bc}
	6 tha^{-1}	5.33^{bcd}	5.47^{bcd}	8.00^{a}	6.37^{b}	5.90^{bcd}	5.97^{bcd}	6.73^{a}
				SE (±) = 4.69				

Means followed by same letters within a sampling period are not statically different at 5% level of probability using N-DMRT. V1 *= NxS 002,* V2 *= NCe 003,* V3 *= NCe 002,* V4 *= Akirimgbawa,* V5 *= NxS 001,* V6 *= NxS 003 and* V7 *= Local*

V x PM interaction on Leaf area at 8WAP shows that NxS 003 had the best response to PM by producing plants with extended leaf canopies (779.13 cm^2). This response was however not significantly different from those of other cultivars except NxS 001 which consistently gave the least response (456.30 cm^2). Similarly, at 12WAP, response of NCe 003 cultivar was though highest but statistically at par with NxS 003. Other cultivars did not respond to PM fertilization because leaf area obtained at 0 t/ha and 6 t/ha were also at par. At 16WAP, NxS 003 also gave the highest response to PM, this was significantly different from other cultivars. Other cultivars did not respond to PM fertilization because leaf area obtained at 0 t/ha PM were significantly indifferent with those at 6 t/ha pm application (table 7).

Length of leaves were significantly affected by interactions. At 8WAP, NxS 003 Produced the longest leaves (30.43 cm) under 6t/ha PM fertilization. Other cultivars behaved alike. However, NxS 002 did not respond to PM (control plots gave longer leaves than 6 t/ha PM). Similarly, at 12WAP, Akirimgbawa had longest leaves (30.87 cm) though but did not respond to PM, NxS 002 and NxS 002 also behaved the same way. NCe 003 had the best response to PM giving longer leaves at 6t/ha. Similar trend was observed at 16WAP (table 8). Iwuagwu *et al* (2017) obtained higher number of leaves, taller cocoyam plants, higher leaf areas and number of suckers with application of Cow dung at the rates of; 30, 20, 20 and 20 t/ha respectively. This is also reflected in our result for cultivar, and V x PM interaction respectively.

NxS 003 had the highest number of suckers though, but it did not respond to PM fertilizer. Same trend was observed with other cultivars except Akirimgbawa which gave the best response to PM fertilization. At 12WAP, NCe 002 gave the best response to PM with the highest number of suckers (6.00) under 6t/ha PM. NxS 003 and NxS 002 also responded well t PM. At 16WAP, Local cultivar had the best response to PM, followed by NCe 002. Other cultivars did not respond accordingly (table 9). Number of die back leaves were affected by interactions. NCe 002 had the highest number of die back leaves at 6t/ha PM, Local cultivar also responded to PM. Other cultivars behaved alike by not responding to PM fertilization at 16WAP (table 9). Significant Interaction effects obtained on growth characters coincides with the works of Kang (2004) and Miyasaka *et al.* (2003) who observed significant fluctuations in growth due to the response of genotypes to environmental factors.

CONCLUSION

From this experiment, it is very obvious that cultivars, poultry manure fertilizer and V x PM interaction had significant effect on the growth of taro crop in Anyigba. NxS 003 and Akirimgbawa performed best amongst others in terms of Establishment count, Plant height, Leaf Area, Leaf Length, Number of Suckers, Die Back leaves. NxS 001 cultivar though has the highest number of leaves but significantly indifferent with Akirimgbawa and others. Overall interaction results showed that NCe 002 cultivars responded best to PM fertilization in most of the characters measured; plant height, leaf area, leaf length, number of suckers and die back leaves. similarly, no response was observed with emergence. NxS 001 & NxS 001 performed best on number of leaves. This research therefore concludes that NxS 003 and Akirimgbawa cultivars are best for optimum growth in Anyigba environment.

ACKNOWLEDGMENT

We are highly grateful to the Prince Abubakar Audu University for the unwavering support throughout this research. We are also thankful to the Head, Department of Crop Production (Prof. Musa, U. T) for guidance and direction to see the success of this work. Authors declare that this research was self-financed and as such no external funding in effect.

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