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Comparative Assessment of Yield Performance of Neglected Cocoyam *(Colocasia esculeta* (L.) Schott) Parts as Planting Materials in the South Western Nigeria

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Abstract

Hitherto, there is scarcity of information on the usefulness of neglected small corms and cormels of cocoyam in the South West Nigeria. A 9 (nine) months trial was conducted to compare the growth and yield performance of different types of cocoyam planting materials with treatment consisting of T_1; sprouted small cocoyam cormels, T_2, trimmed out lower parts of harvested cocoyam corm and T_3; moderate sized corm of 50-100g (control) arranged in a Randomised Complete Block Design (RCBD) with three replicates. Data on the number of leaves and plant height was taking at 4 week interval for 24 weeks while data on number and weight of harvested cormels was taking at 9 months after planting (MAP). The data collected were subjected to a univariate General Linear Model (GLM) two ways Analysis of Variance (ANOVA) using IBM SPSS software statistical package 21. Significance mean differences were separated using Duncan Multiple Range Test (DMRT) at 0.05 level of significance. The result showed that the highest mean number of leaves and plant height was obtained from treatment T_1 (10.22) and T_2 (92.83) respectively at 24 weeks after planting (WAP). While both treatment T_1 and T_3 collectively had the highest mean number of consumable cormels of 9.0 in which treatment T_3 has the highest mean weighed of (3.202 kg). There was no significant difference (P>0.05) in both the number of leaves produced and plant height among the different cocoyam planting materials utilised at 24 (WAP). Similarly, there was no significant difference (P>0.05) in the number and weight of cormels produced by the different treatments at 9 months after planting (MAP). The study therefore concluded that both sprouted small cocoyam cormels, trimmed out corms during planting compared favourably with moderate sized corm of weight 50-100g commonly used as planting material in term of yield potential and therefore recommended to be schedule for demonstration to cocoyam farmers in the study area for adoption.

Keywords: Cocoyam; Sprouted small cormel; Corm; Neglected corm and cormels.

1. Introduction

Red Cocoyam (*Colocasia esculeta* (L.) Schott) is a perennial root crop that belongs to Araceace family. It is widely grown in the tropic including Nigeria specificallally in the South South, South East and South Western parts. Nigeria is the largest producer in the world accounting for more than 40% of the world output [1]. As reported by Chukwu [2], Nigeria has approximately 86.27 x 10^6 million hectares of suitable arable land to massively increase cocoyam production.

Medically, Cocoyams are the cheapest, good and moderate source of carbohydrate in meals. Base on these characteristic feature, it is usually recommended for aged people, diabetics, convalescents and patient with gastro-intestinal disorder. It has a good carbohydrate base for infant foods on the account of their small-sized starch grains which are easily digested compared to yam Adekiya and Agbede [3]. It also supply protein, vitamin C, thiamine, riboflavin, niacin and significant amount of dietary fiber [4].

The present high cost of staples such as rice, yam flour, garri and other food stuff is getting higher and the masses are desperately searching for alternative to subdue this current economic crunch. In this respect, one of the

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crops gaining attention presently is cocoyam because the crop is presently being consumed by all cadres unlike in the past when only less privilegesd do consider it as a means of livelihood especially during hatch economic situation [5]
.

In Africa, specifically in Ghana the average yields for cocoyams (tannia and taro) has been reported to be 6.7 metric tons per hectare and 9.5 metric tons per hectare which is said to be much below the actual yields of 8.0 mt/ha and 12.0 mt/ha respectively [6]. This assertion might be as a result of insufficiency in the needed planting material and other factor that may be related to cultural practices and environmental factors.

The persistence increase in population in the country and the need to increase cocoyam cormel production requires attention for a paradigm shift from the usual subsistence cocoyam production to large scale approach. The report of Offor and Onyewuchi [7], had confirmed the potential of cocoyam as tool for poverty alleviation in the rural communities. Thus, attempt to take this part and meet up with the aforementioned calls for strategies to make more cocoyam planting material needed as well as authentic information for improved establishment more available to farmers at low cost become paramount.

The need to educate rural people on the production and better nutritional qualities of cocoyam has been recommended base on the findings that no awareness programme on the crop utilization was mounted by any agency in southwestern Nigeria [8].

Cocoyam just like any other plant has the ability to develop roots, sprout and expose leaves for increased area of assimilation and produce consumable cormels when exposed to favourable environmental conditions [9]. But at farm level, these planting materials are considered as a waste and ignored in which in most cases are allowed to grow and assume the status of weed in the farm. It is interesting to note that these left-overs initiate sprouts which if not disturbed results into sizable cocoyam plant with productive potential. The report of Aynalem, *et al.* [10], had confirmed a higher yield of (47.07 Mt/ha) at population of 60606 plants per hectare using seed corms of size 51-100 g size.

By usual practice, farmers in an attempt to neat up cocoyam corms as materials to be planted are of the habit of trimming out the lower parts of the harvested plant material which consequently sprout on the farm in clusters but being ignored.

In term of value addition enjoyed by the crop, cocoyam corms and cormels are now made into flour in an attempt to remove the drudgeries of pounding. This is pointing to the fact that more interest is being developed by stake holders to harness the current value attached to the crop. Other utility attached to cocoyam include boiling for consumption, fried into ships and roasted just like sweet potato [11]. In the south western part of Nigeria, numerous constrains impeded the tendency for increased crop productivity among which is bush clearing, stumping, packing of debries, etcetera. It is then interesting to know that cocoyam is a root crop that has the capacity to yield better even with minimum tillage [12].

The non availability of information concerning the productive potential of these cocoyam left- over as planting materials to cater for commercial cultivation has been suspected to be one of the bottle neck hindering commercial cocoyam plantation establishment generally.

In the South East, the potential of cocoyam cormel has been exploited by Chukwu, *et al.* [13]. Despite the numerous advantages of cocoyam farming and its potential for poverty alleviation, compared to other root crops, little research effort has been devoted the crop. Consequently, the potentials of cocoyam as an important staple food crop and its associated yield potential, nutritional and health advantages remain under-exploited [14] Although, several research efforts has been directed towards cocoyam planting material, but there is dearth of information on the productive potential of some neglected part which can easily serve as planting materials especially around the study area.

This has therefore prompted this research in a bid to provide authentic information to farmers on the productive capacity of these neglected planting materials thereby stimulate more interest of farmers in commercial cocoyam production and reduce the gap between expected supply and demand. The objective of this study therefore is to compare the yield performance of neglected cocoyam plant parts liable of being utilised as planting materials.

2. Material and Method

2.1. Experimental Site

A field experiment was conducted between June 2017 and February, 2018 at the training and research farm of Bioresources Development Centre (BIODEC), Owode- Yewa South which is an outreach zonal centre of National Biotechniology Develppment Agency Nigeria. Owode - Yewa town lies between latitude 6^0 48^1 N, 2^0 57^1 E and longitude 6.8^0 N 2.95^1 E [15]. Specifically the Biodec centre has a geospatial coordinate of N 06^0 43.712^1 E 002^0 59.531^1, obtained from field survey 2015 via the use of hand-held GPS receiver, (model etrex, legend H, Germin) [16]. The study area lies in the rain forest agro ecological zone. The zone is characterised by two phases of rainfall pattern usually from February to July and September to November.

2.2. Land Preparation and Lay out of Experimental Site

The site was cleared with cutlass; debris was packed while hoe and shovel were used to remove stumps. The plot was pulverised and levelled prior to the commencement of the trial. The cleared site was laid-out and pegged into nine (9) experimental plots of 1 m x2.5m each with one (1) meter buffer zones between plots.

2.3. Sources of Planting Material

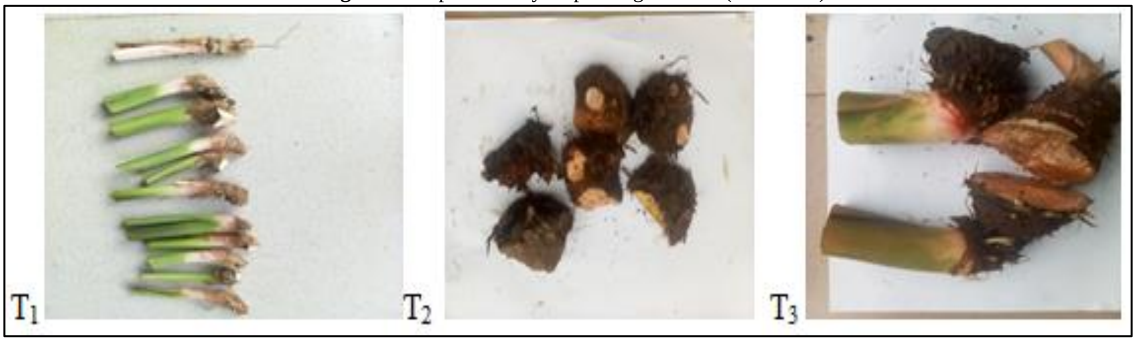
The planting materials which included T_1; The sprouted small cocoyam cormels was collected from within the premise of Bioresources Development (BIODEC) Centre while T_2; trimmed out and neglected lower parts of harvested cocoyam corm as well as T_3 moderate sized corm of weight 50-100g which is usually considered as best planting material that served as control were collected from a nearby cocoyam farm at Irinja-ile a village closer to the centre (Figure 1).

Figure-1. Unprepared cocoyam planting materials (Treatments)

2.4. Preparation of Planting Materials and Experimental Design

The gathered planting materials were prepared by trimming out the roots and leaves (Figure 2). These was then planted 10 cm deep at a distance of 0.75m x 0.25m equivalent to 53,333.33 plants per hectare. The entire treatment was laid-out in a Randomised Complete Block Design (RCBD) replicated three times.

Figure-2. Prepared cocoyam planting material (Treatment)



2.5. Management Practices

Cocoyam multiple sprout was experienced in the experimental plots which was then thinned by uprooting to remain one (1) plant per experimental unit. Weeding was done with hoe and hand as at when needed to avoid weed competition with the crops.

2.6. Data Collection and Statistical Analysis

Each experimental plot was planted with a total of nine (9) planting materials in each respect out of which two-third equivalent to six (6) plants per experimental plot was randomly selected for data collection. The variable measured were number of leaves produced, plant height in (cm), number of cormels harvested and weight of cormels harvested in (kg).

The number of leaves was counted every four weeks from the old to newly emerged leaves. The last counts of new leaves were marked with string to ensure continuity of counting and avoid repeated counting. The plant height was measured from the base to the apex of the longest leaves using string and meter rule at four weeks interval for twenty four (24) weeks after planting (WAP). At the end of the experiment which was 9 nine months after planting (MAP), the sampled plants were harvested and the number of cormel produced was carefully detached from the mother corms and measured by counting while the weight was measured using digital sensitive balance (CAMRY, Model EK 5055) in kilogram (kg). Data collected were subjected to General Linear Model (GLM) univariate two way Analysis of Variance (ANOVA) using IBM SPSS software statistical package 21. Duncan Multiple Range Test (DMRT) was employed to separate the means at 0.05 level of significant.

3. Results and Discussions

3.1. Number of Leaves Produced

The results of the mean number of leave produced by different cocoyam materials were presented in Table 1. There was a variation in the number of leaves produced by different treatments across the 24 weeks of measurement. The highest number of leaves 3.055 was recorded for treatment T_1 at 4 weeks after planting (WAP), 5.780 for treatment T_3 at 8 (WAP), 8.942 for treatment T_1 at 12 (WAP) and 11.83 for treatment T_1 at 16 (WAP). Others were

14.67 for treatment T_1 at 20 (WAP) while 17.50 was the highest number of leaves produced by treatment T_1 at 24 (WAP) respectively. However, there was no significant difference (P>0.05) in the number of leaves produced by the various planting material 'treatment' utilised for the study across the 24 weeks of measurement after planting. This implies that treatment T_1 and T_2 compete favourably with treatment T_3 (control) in term of number of leaves produced for photosynthetic activities which may have resultantly culminated into greater cocoyam cormels yield by the treatments. This is in line with Priadkina, *et al.* [9], that the photosynthetic apparatus of plant dictate the yield of crop plant provided they have affinity with needed environmental factors.

Table-1. Mean number of leaves produced by different cocoyam planting materials weeks after plating (WAP)

Weeks after planting (WAP)							
Cocoyam Planting materials	4	8	12	16	20	24	Mean
T_1	3.055[a]	5.330[a]	8.942[a]	11.83[a]	14.67[a]	17.50[a]	10.22
T_2	2.444[ab]	5.610[a]	7.720[a]	11.11[a]	13.94[ab]	16.83[a]	9.610
T_3	2.777[a]	5.780[a]	8.388[a]	11.00a	13.44[a]	16.22[a]	9.600
Mean	2.759	5.573	8.350	11.31	14.02	16.85	
C.V%	9.452	4.713	10.05	4.489	3.595	3.486	
F-value	4.147	2.216	1.595	2.351	4.45	3.547	
P-value	0.106	0.225	0.310	0.208	0.96	0.130	
SEM	0.087	0.087	0.280	0.169	0.168	0.195	

3.2. Plant Height (cm)

There were notable differences in the effect of different cocoyam planting materials utilised for the study in term of plant height Table 2. The greater plant height was recorded for treatment T_2 (44.66cm) at 4 weeks after planting (WAP), 62.06cm for treatment T_2 at 8 (WAP), 86.39cm for treatment T_2 at 12 (WAP), 108.55cm for treatment T_1 at 16 (WAP) as well as 123.78cm at 20 (WAP). While 137.52cm was recorded for treatment T_2 at 24 weeks after planting respectively. Statistically, there was no significant difference (P>0.05) in the effect of different planting materials utilised in the study in term of plant height across the 24 weeks after planting (WAP). The fact that insignificant variation recorded in all the cocoyam planting materials may be attributed to the removal of all the old growth apparatus 'roots' which may have facilitated the development of new active roots that can easily and quicly absorb nutrient that will enhance speedy growth.

Table-2. Mean plant height (cm) by different cocoyam planting materials weeks after plating (WAP)

Weeks after planting (WAP)							
Cocoyam Planting materials	4	8	12	16	20	24	Mean
T_1	35.67[a]	52.42[a]	85.22[a]	108.55[a]	121.47[a]	135.76[a]	89.85
T_2	44.66[a]	62.06[a]	86.39[a]	102.62[a]	123.78[a]	137.52[a]	92.83
T_3	42.94[a]	62.74[a]	83.92[a]	95.03a	113.20[a]	129.04[a]	87.81
Mean	41.09	59.07	85.18	102.07	119.5	134.1	
C.V%	14.80	8.847	6.975	7.563	5.342	6.164	
F-value	1.847	3.818	0.129	2.313	2.272	0.878	
P-value	0.270	0.118	0.882	0.215	0.219	0.483	
SEM	2.027	1.706	1.980	2.573	2.128	2.756	

3.3. Number of Cormels Produced

The mean number of cormel harvested as presented in Table 3 indicated that treatment T_1 and T_3 produced same number of cormels of 9.00 while treatment T2 yielded the least 6.945 at 9 months after planting (MAP). Statistical analysis indicated that there was no significant difference (P>0.05) in the mean number of cormels produced by the treatments at the end of the trial 9 months after planting (MAP). The implication of this is that both treatments T_1 and T_2 compares favourably with each other and with T_3 the control which is usually considered as best planting material.

Table-3. Mean number and weight of harvested cormels 9 months after planting (MAP)

Months after planting (MAP)		
Cocoyam Planting materials	Number of harvested cormels	Weight of harvested cormels (kg)
T_1	9.00[a]	2.946[a]
T_2	6.945a	2.716[a]
T_3	9.002a	3.202[a]
Mean	8.315	2.955
C.V%	18.26	16.05
F.value	1.834	0.880
P-value	0.272	0.515
SEM	0.506	0.158

3.4. Weight of Harvested Cormels (kg)

Still from the same Table 3, treatment T_3 ‘control’, had the highest weight of 3.202 kg (equivalent to 12.808 metric tons per hectare) at 9 months after planting (MAP). This was followed by treatment T_1 2.946 kg (equivalent to 11.784 Metric tons per hectare) and lastly treatment T_2 2.716 kg (equivalent to 10.864 Metric tons per hectare). There was no significant difference (P> 0.05) in the weight of harvested cormels among the treatments at the end of the study period 9 (MAP). This implies that the different cocoyam plant parts utilised as planting material has the ability and potential to yield better compared with T_3 which was the control. This may be related to the fact that no weed was allowed to invade the plants. This is in line with the report of Mulugeta, *et al.* [17], that different planting materials are liable of producing more cormel and resultantly yield more dry matter.

4. Conclusion

The study revealed that different cocoyam planting materials compared favourably with each other in both growth and cormel yield. From this findings, therefore, it was concluded that the sprouted small cocoyam cormels, trimmed out neglected lower parts of harvested cocoyam corm and moderate sized corm of weight 50-100g collectively have the potential of bumper yield. It is therefore recommended that;

i. Effective on-farm trial demonstration of the potentials of these cocoyam planting materials should be arranged to boost cocoyam production in the study area.

ii. More awareness campaign with reinforced media channels is needed to sensitize farmers on the usefulness of these planting material ‘sprouted small cormels and trimmed out lower parts of harvested corm’ which are usually ignored and neglected during plating.

iii. The neglected small cormels should be collated and preserved as planting materials to be used during next farming season for sustainable cocoyam production and also to encourage expansion the production scale.

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this article.

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