

**EFFECTS OF PROPAGATION METHODS AND
FERTILIZER APPLICATION ON THE
GROWTH AND YIELD CHARACTER OF
TIGER NUT (*Cyperus esculentus*)**

BY

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BENIN CITY, NIGERIA**

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**A PROJECT REPORT SUBMITTED TO THE DEPARTMENT
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CERTIFICATION

This is to certify that the work in this report entitled “**Effects of Propagation Methods and Fertilizer Application on the Growth and Yield Character of Tiger Nut (*Cyperus esculentus*)**” was carried out by **Victory Ugbedeajo OTUBEJE** with Matriculation number **AGR1700215** of the Department of Crop Science, Faculty of Agriculture, University of Benin, Benin City, Edo State, Nigeria.

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DEDICATION

This work is dedicated to God Almighty whom through His grace and strength made this work possible and successful.

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ABSTRACT

The experiment was conducted at the Crop Science Research Farm in the Faculty of Agriculture, University of Benin, Benin City. Seeds were obtained locally from Ekosodin, Benin City, Nigeria. Poultry manure was obtained from University of Benin Farm project, while NPK fertilizer was procured from Ring road market. The experiment was laid out in a randomized complete block design (RCBD) in three replications consisting of propagation planting methods D (propagation by seed), T(propagated by seedling) and four fertilizer treatment F1 (control), F2 (400kg/NPK) ,F3 (poultry dropping 20 t/ha), F4 (poultry manure 10 t/ha and 200 kg/ha).Data on vegetative characteristics (plant height ,leaf length, stem diameter and leaf area) and reproductive characters (nut yield, herbage yield and number of nut) were taken. From the result of the experiment it was observed that plant height (98.35) and the leaf area (68.81) were significantly increased with direct sowing compared with the transplant, similarly plants that receive fertilizer were superior in plant and leaf area the control. However the effect of propagation methods and fertilizer application was not significant on the herbage and nut yield of Tiger nut. Therefore farmers in this locality can produce tiger nut using the direct sowing method with little to no fertilizer application.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Tiger nut (*Cyperus esculentus*) belongs to *Cyperaceae* and it is known by other names like chufa, yellow nutsedge, earth almond and ground almond. It is a perennial crop cultivated extensively in Asia, East Africa, parts of Europe particularly Spain as well as in the Arabian Peninsula (Abdelkader *et al.*, 2017).

Tiger nut is a crop of early domestication, its dry tubers have been found in tombs from predynastic times about 6000 years ago and it was an important food in Egypt where they used their tubers as sweetmeat (Zohary, 1986).

Tiger nut is erect, with yellowish-green leaves, triangular stem about 20 to 60 cm tall, superficial rhizomes that store proteins, starches and other nutrients to lead to the production of many tubers and golden-brown flower head. The plant forms a complex, shallow underground system composed of fine fibrous roots, thin scaly rhizomes (Abdelkade *et al.*, 2017). Because of its fast growing is often confused with weeds in some areas. It is ideally developed in well drained soils, sandy or loamy, with a pH range of 5.0-7.5 and grows best when temperatures over 20 °C (Dyer, 2009). Tiger nuts are appeared to have more prospective usage as nourishment and

industrial materials; it can be used to produce beverage, milk or yogurt, flour, nougat, jam, beer, chocolate, a feed source, edible oil and as soaps (Achoribo *et al.*, 2017).

Tiger nuts are rich in minerals such as phosphorus, potassium, calcium, magnesium, and iron. It's also rich in vitamins E and C, and a good quantity of vitamin B1 (Maduka *et al.*, 2018). Tiger nut assists in stabilizing the central nervous system and helps the body to adapt to stress (David, 2005). Moreover, it defends the internal mechanisms and prevents constipation and diarrhea (Maduka *et al.*, 2018).

In Nigeria, tiger nut is well grown in the middle belt and northern region (Oladele *et al.*, 2009), where it is sold locally and consumed uncooked. The tuber grows freely and is widely in Nigeria and other parts of West Africa, East Africa, parts of Europe particularly Spain as well as in the Arabian Peninsula (Adaejoh *et al.*, 2006).

Information regarding tiger nut fertilizer is little in published literature and fertilizer requirement of tiger nut were variable (IFA/FAO, 2000; Yarrow *et al.*, 2005). The application of farmyard manure is recommended in order to improve the biological, physical and chemical properties of soil. The use of inorganic fertilizer to enhance yield of crop has been found to be effective only within few years, demanding consistent use on long-term basis. The hazardous environmental consequences and high cost of inorganic fertilizers make them not only undesirable but also uneconomical and out of reach of the poor farmers who still dominate the Nigerian agricultural sector. This has led to increased use of organic manure, a readily

available alternative, which proves more environmentally friendly. Earlier research on crops propagated by vegetative means showed size of planting material to have had significant effect on the productivity.

Hossain *et al.* (2011) reported that that the foliage coverage, plant height, stems/hill, number and weight of tubers/plant varied significantly due to variation of tuber size in potato. Information regarding tiger nut fertilizer is little in published literature and fertilizer requirement of tiger nut were variable (IFA/FAO, 2000; Yarrow *et al.*, 2005). It is on this background that this research was carried out to determine with the response of tiger nut (*Cyperus esculentus*) to fertilizer *application* and propagation methods.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Transplanting

Transplanting involves starting plants from seeds in a controlled environment, often in containers like pots or seedling trays, and then moving them to their final planting location once they have developed sufficiently. This approach offers several advantages. According to experts from the University of Maryland Extension, transplanting allows growers to provide protection against unpredictable weather, early-season pests, and diseases, leading to healthier seedlings (McDonough, 2021). It also enables growers to extend the growing season by initiating plant growth indoors, which is particularly valuable in regions with short growing seasons. One of the drawbacks of transplanting is the need for resources such as potting soil, containers, and space to nurture seedlings. Additionally, transplanting can occasionally result in transplant shock, a condition where seedlings struggle to adapt to the outdoor environment after being moved from a controlled indoor setting (Babik, 2020).

2.2 Direct Sowing

Direct sowing, on the other hand, involves planting seeds directly into the ground or their final growing location. This method is straightforward and cost-effective. The

University of Illinois Extension emphasizes that direct sowing is particularly well-suited for crops like beans, carrots, and radishes, which do not tolerate root disturbance well and establish strong root systems when sown directly into the soil (University of Illinois Extension, 2016). However, direct sowing has limitations. It depends on favorable outdoor conditions, including soil temperature and moisture levels. Seeds sown directly in the ground may also be vulnerable to pest damage, and the timing of planting is critical to align with the local climate and growing season. In conclusion, the choice between transplanting and direct sowing depends on various factors, and both methods have their place in horticulture and agriculture. Growers must consider the specific needs of the plants they are cultivating, the local environment, and their available resources to determine which method best suits their objectives

2.3 Effect of Propagation Method on the Growth of Tiger Nut

Tiger nut has great genetic variation and high seed production (Thullen *et al.*, 1979]. Transplanting can enhance crop uniformity and early growth stages by allowing for precise spacing between plants (Durojaiye *et al.*, 2015). Transplanting at wider intervals enhanced tuber yield compared to direct planting (Yahaya *et al.*, 2019). (Kiziloglu *et al.*, 2015) found that direct seeding often results in slower initial growth compared to transplanting but can catch up in later stage.

2.4 Effect of Fertilizer Application on the Growth and Yield of Tiger Nut

Poultry manure, sometimes called dung is an excellent soil amendment that provides nutrients for growing vegetable crops and also improves soil quality due to its high organic matter content combined with available nutrients for plant growth. Moreover, there is limiting information about the use of organic fertilizers for the cultivation of tiger-nut (Olugbemi *et al.*, 2018).

Inorganic fertilizers can promote vegetative growth in tiger nut plants, resulting in taller and more robust plants with increased leaf area, which can contribute to higher yields (Oniah *et al.*, 1991). Adequate nutrient supply from inorganic fertilizers can lead to improved root development in tiger nut plants, helping them better access soil nutrients and water (Udo *et al.*, 1996). The use of inorganic fertilizer to enhance yield of crop has been found to be effective only within few years, demanding consistent use on long-term basis (Adejuyitan *et al.*, 2009).

Inorganic fertilizers can help maintain consistent quality in tiger nut crops by ensuring a steady supply of nutrients required for the development of desirable tuber characteristic (Ojeniyi *et at.*, 2012). Combined application of poultry manure and NPK fertilizer may result in synergistic effects, as organic matter from poultry manure can improve the soil's ability to retain and release nutrients from the NPK fertilizer (Ojeniyi *et al.*, 2017).

It's important to note that while inorganic fertilizers can enhance tiger nut growth and yield, careful consideration should be given to proper fertilizer application rates,

timing, and soil conditions to prevent nutrient imbalances, environmental pollution, and sustainability concerns.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Experimental Site

The experiment was conducted at the Crop Science Research Farm in the Faculty of Agriculture, University of Benin, Benin City (6° 20' 21", 066° 0' N and 5° 37' 2, 8092° E) temperature at maximum was about 36°C with annual rainfall of 2300mm.

3.2 Source of Planting Materials

Seeds were obtained locally from Ekosodin, Benin City, Nigeria. Poultry manure was obtained from University of Benin Farm project, while NPK fertilizer was procured from Ring road market.

3.3 Site History

The site was fallow prior to land preparation, with the main weeds jute (*Corchorus olitorius*) and spear grass (*Imperata cylindrical*).

3.4 Land Preparation

Nursery site was prepared August, 2023. The land was manually cleared, nuts were sown, and seedling raised in the nursery under light shade for three week. The plot

was marked and divided into beds measuring 1m x 1m and separated by 0.2m each replicate had 8 beds giving a total of 24 beds. Treatments were assigned to each experimental unit randomly. The plants were spaced at 20 cm by 20cm to give 25 plants per m², 200 plants per replicate and a total of 600 plants for the whole plot (12.5 x 5m).

3.5 Experimental Design and Treatments

The experiment was a 2 x 4 factorial ,the treatment was laid out in a randomized complete block design (RCBD) in three replications consisting of two planting methods D (propagation by seeds), T (propagated by seedling) and four fertilizer treatment F1 (control), F2 (400kg/NPK 15:15:15),F3 (poultry dropping 20 t/ha), F4 (poultry manure 10 t/ha and 200 kg/ha).

3.6 Transplanting

Three weeks old tiger nut seedling were transplanted at the spacing of 20cm by 20cm.

3.7 Weeding

The experimental field was weeded manual. Weeding was carried out at 3, 6 and 8 weeks. The plants were sprayed with insecticide known as experiment with the dosage of 10ml to 1litre of water.

3.8 Fertilizer Application

Poultry manure used for the experiment was incorporated and watered for 2 weeks before planting and fertilizer (N.P.K 15:15:15) was applied at the rate of 400kg/ha and 200kg/ha. While poultry manure was applied at 20t/ha and 10t/ha.

3.9 Parameter Measured

Four plants were randomly tagged per plot for data collection. Data were collected on:

Plant height(cm): This was measured using a measuring tape from the base of the plants to the leave tip and recorded.

Number of leaves: This was manually counted and recorded.

Leaf Area: This was measured using a meter rule and measuring tape and recorded.

Stem diameter: This was measured using a venier caliper and recorded.

Herbage fresh weight: This was measured using electronic scale and recorded.

Nut fresh weight: This was measured using electronic scale and recorded.

Nut diameter: This was measured using venier caliper and recorded.

Number of nuts: This was manually counted and recorded.

Nut yield: Was calculated using the formular $\text{plant nut yield} \times \text{number of plants per hectare}$ and recorded.

Herbage yield: Was calculated using the formular

$$\frac{\text{Nut yield}}{\text{Total yield}} \times \frac{100}{1} \text{ and was recorded.}$$

Harvest index: was calculated using plant nut yield x number of plants per hectare and recorded.

3.10 Statistical Analysis

The data collected was analyzed using SAS, the result gotten were presented in Tables.

CHAPTER FOUR

4.0 RESULTS

4.1 Effects of Propagation and Fertilizer Application on the Vegetative Character of Tiger Nut (*Cyperus esculentus*)

The effects of propagation methods on the vegetative character of tiger nut is represented in the Table 4.1. The result of the experiment shows that propagation method was significant on the plant height and leaf area of tiger nut (*Cyperus esculentus*). Direct sowing significantly raised the plant height above transplant, similarly direct sowing also increased the leaf area above the transplant, however the effect of propagation methods was not significant on the number of leaves and stem diameter. Number of leaves had no significant difference; however, the transplant had the highest cumulative mean with 10.73 and direct planting with lower (10.40). Stem girth was wider when planted (0.28 cm) and lowest at transplant (0.26 cm).

The effects of fertilizer application on the vegetative character of the plant height ranges from 76.54cm - 89.76cm. It was observed from the study that plant height was highest when 20t/ha of poultry manure was applied. The effects of fertilizer application on the vegetative character of tiger nut was significant on plant height and leaf area, however it was not significant on another vegetative parameter measured. There was an irregular increase in plant height due to fertilizer application.

Plant height which was highest (89.76cm) at, F3 decreased to (84.33cm) in F2 and further decreased to 83.53cm in F4 and finally 76.54cm in F1. The number of leaves were not significantly different from the result. With 13cm in F3 and decreased to 84.33cm in F2, further to 10.3cm in F4 and finally decreased to 9.43cm in F1. The stem diameter had no significant difference in the experiment result with 4.71cm in F3 and decreased to 0.75cm and further decreased to 0.74cm F1, finally to 0.72cm in F2. The result also showed that leaf area was significant. The leaf area ranges from 47.92-62.85cm² the highest leaf area was 62.85cm² and decreased to 56.71cm² and further decrease to 49.74cm² in F2 and finally 47.92cm² in F.

Table 4.1: Effects of Propagation Methods and Fertilizer Application on the Vegetative Character of Tiger Nut (*Cyperus esculentus*).

Treatment	Plant height (cm)	Number of leaves	Stem diameter (mm)	Leaf area (cm²)
Methods of propagation:				
D	98.35 ^a	10.40 ^a	2.82 ^a	67.95 ^a
T	68.81 ^b	10.73 ^a	2.64 ^a	40.67 ^b
Significance	*	NS	NS	*
LSD	5.87	3.54	3.91	6.04
Fertilizer application:				
F1	76.54 ^b	9.43 ^a	0.74 ^a	47.92 ^c
F2	84.33 ^{ab}	9.49 ^a	0.72 ^a	49.74 ^{bc}
F3	89.76 ^a	13 ^a	4.71 ^a	62.85 ^a
F4	83.53 ^{ab}	10.3 ^a	0.75 ^a	56.71 ^{ab}
Significance	*	NS	NS	*
LSD	8.30	5.01	5.53	8.34

Means with the same letters are not significantly different.

D-Direct planting

T-Transplanting

F1-Control (no fertilizer)

F2-400kg /ha NPK 15:15:15

F3-20t/ha poultry manure

F4-200kg/ha NPK 15:15:15 +10t/ha poultry manure

4.2 Effects of Propagation Methods and Fertilizer Application on the Vegetative Character of Tiger Nut (*Cyperus esculentus*)

The effects of propagation methods and fertilizer application on the reproductive characters of tiger nut (*Cyperus esculentus*) is presented in Table 4.2. The data shows no significant difference for the method of propagation and fertilizer application. The data obtained reproductive characters showing non-significance for all the reproductive characters. Nut yield was higher when planted direct (1.8t/ha) and lower yield was observed at transplant (1.7t/ha).

The direct planting had highest herbage yield (1.76 t/ha) and lowest at transplant (1.73t/ha). Total yield revealed 3.5 t/ha for direct planting, transplant which had lower was 3.4t/ha. Harvest index was also higher at direct (52.0) and lower at transplant (50.33). From the data obtained there was no significance in the cumulative nut yield. Nut yield was (1.85) when 400kg /ha NPK 15:15:15 and 200kg/ha NPK 15:15:15+10t/ha poultry manure fertilizer was added (F2 and F4). While nut yield was lowest (1.53) when no fertilizer was used (F1). With F2 and F3 having the highest cumulative nut yield, although not significantly different from F1 and F3.

Table 4.2: Effects of Propagation Methods and Fertilizer Application on the Vegetative Character of Tiger Nut (*Cyperus esculentus*).

Treatments	Nut yield (t/ha)	Herbage yield (t/ha)	Total yield (t/ha)	Harvest index
Propagation methods:				
Direct planting	1.8a	1.76a	3.5a	52.0a
Transplant	1.7a	1.73a	3.4a	50.33a
Significance	NS	NS	NS	NS
Lsd	0.30	0.9	0.88	9.5
Fertilizer application:				
F1	1.53 ^a	1.31 ^a	2.84 ^a	53.8 ^a
F2	1.84 ^a	2.11 ^a	4.06 ^a	51.0 ^a
F3	1.75 ^a	1.6a	3.38 ^a	52.33 ^a
F4	1.85 ^a	1.91 ^a	3.8 ^a	47.5 ^a
Significance	NS	NS	NS	NS
LSD	0.43	1.27	1.24	13.48

Means with the same letters are not significantly different

F1-Control (no fertilizer)

F2-400kg /ha NPK 15:15:15

F3-20t/ha poultry manure

F4-200kg/ha NPK 15:15:15 +10t/ha poultry manure

CHAPTER FIVE

5.0 DISCUSSION

The significant increase in the plant height and leaf area of tiger nut (*Cyperus esculentus*) as a result of direct sowing could be due to the fact that the plant had quick and better establishment compared to the transplant. This is supported by Leskovar (1993), a report which states that direct sown plants maintained a more balanced distribution of root, stem, leaf, and dry matter than those grown by transplanting. . The result shows that a combination of organic and inorganic fertilizers had higher yield. This is because of the slow release of nutrient from the poultry manure this is supported by a report that organic fertilizer degrades gradually and they increase soil organic matter content (Sharkar *et al.*, 2003).

As expected the plant height, leaf area, nut yield, total yield was lower in transplant due to disturbance of the root system during transplanting of tiger nut .This agrees with the finding that transplanting can disrupt the root system of tiger nut plants, leading to stress, the initial shock can hinder nutrient and water uptake, which may negatively affect early growth and, consequently, yield (Rohrbach *et al.*, 2014).

5.1 Conclusion and Recommendations

Although the effect of fertilizer application was not significant in yield and yield components it was significant in some of the vegetative character. Similarly direct

sowing was found to be superior to transplants therefore farmers in this locality can propagate tiger nut using the direct method with little or no fertilizer.

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