

**EFFECT OF TOPSOIL AND CATTLE DUNG POTTING MEDIUM
ON DRY MATTER PRODUCTION AND THE YIELD OF
TIGERNUT (*Cyperus esculentus* L)**

BY

**Chioma Stephanie OKORO (Miss)
AGR1900224**

**DEPARTMENT OF CROP SCIENCE
FACULTY OF AGRICULTURE
UNIVERSITY OF BENIN
BENIN CITY**

FEBRUARY, 2025.

**EFFECT OF TOPSOIL AND CATTLE DUNG POTTING MEDIUM
ON DRY MATTER PRODUCTION AND THE YIELD OF
TIGERNUT (*Cyperus esculentus* L)**

BY

**Chioma Stephanie OKORO (Miss)
AGR1900224**

**A PROJECT REPORT SUBMITTED TO THE
DEPARTMENT OF CROP SCIENCE, FACULTY OF
AGRICULTURE, UNIVERSITY OF BENIN, BENIN CITY, NIGERIA,
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
AWARD OF THE DEGREE OF
BACHELOR OF AGRICULTURE (B. AGRIC.) IN CROP SCIENCE**

FEBRUARY, 2025.

CERTIFICATION

This is to certify that the work in this research titled “Effect Of Topsoil And Cattle Dung Medium On Dry Matter Production And Nut Yield Of Tiger Nut” was carried by Chioma Stephanie OKORO with matriculation number AGR1900224 in the Department of Crop Science, Faculty of Agriculture, University of Benin, Edo State, Nigeria.

Prof A.U. Osaigbovo
Project Supervisor)

Date

Prof K.E. Law-Ogbomo
Co Supervisor

Date

Prof. S.U. Ewansiha
Head of Department
(Crop Science Department)

Date

DEDICATION

This project work is dedicated to God Almighty, my helper, my source of strength, wisdom, and inspiration. And to my great and lovely family for their support all through my programme.

ACKNOWLEDGEMENTS

My earnest appreciation, goes to Almighty God, for giving me good health, strength, knowledge, and for keeping me alive and for guiding me throughout my course of study in the Great University of Benin.

I want to specially thank my supervisor, Prof. A. U. Osaigbovo and my co supervisor, Prof. K. E Law Ogbomo who through his fatherly disposition dispenses love, patience, sacrifice, kindness, understanding, great skill and expert knowledge, which made this project work a great success.

I wish to thank my Head of Department, Prof. S. U. Ewansiha, my course adviser, Mr. J. I. Osagie, for the mentorship and sense of direction I enjoyed under them.

To other lecturers and staff of the Department of Crop Science, Prof. A. T Adekunle, Prof. S. A. Ogedegbe, Prof. C. N. C. Nwaoguala, Dr. (Mrs) E. J. Falodun, Dr. J. I. Osagie, Miss. Idatsaba Ochuwa, Mr. John Imomoh, and Dr. A. Alamene, appreciate you all.

Special gratitude goes to my lovely parents, Mr. and Mrs. Ezeh Okoro for their love, care, support and understanding. My siblings, Okoro Adaku, Okoro Obinna, Okoro Chibueze, my friend Eseosa and other members of my family.

TABLE OF CONTENTS

Title Page	ii
Certification	iii
Dedication	iv
Acknowledgements	v
Table of Content	vi
List of Table	viii
Abstract.	ix
CHAPTER ONE	
INTRODUCTION	1
CHAPTER TWO	
2.0 LITERATURE REVIEW	4
2.1 Concept of potting media	4
2.2 Overview of topsoil	6
2.3 Overview of cattle dung	9
2.4 Cow dung as a component of potting media	10
CHAPTER THREE	
MATERIALS AND METHOD	12
3.1 Experimental site	12
3.2 Sources of planting Materials	12
3.3 Experimental Design	12

3.5	Experimental Procedure	13
-----	------------------------	----

3.6	The Data Collection	13
-----	---------------------	----

CHAPTER FOUR

RESULTS	15
---------	----

4.1	Dry matter production	15
-----	-----------------------	----

4.1.1	Nut dry weight (g)	15
-------	--------------------	----

4.1.2	Root dry weight (g)	15
-------	---------------------	----

4.1.3	Shoot dry weight (g)	15
-------	----------------------	----

4.1.4	Total dry weight (g)	15
-------	----------------------	----

4.1.5	Harvest index	19
-------	---------------	----

4.2	Nut yield	19
-----	-----------	----

4.2.1	Number of nuts	19
-------	----------------	----

4.2.2	Nut weight (g)	19
-------	----------------	----

4.2.3	Nut yield (t/ha)	19
-------	------------------	----

4.3	Correlation coefficient	21
-----	-------------------------	----

CHAPTER FIVE

5.0	DISCUSSION, CONCLUSION AND RECOMMENDATION	23
-----	---	----

5.1	Discussions	23
-----	-------------	----

5.2	Conclusion	23
-----	------------	----

5.3	Recommendations	24
-----	-----------------	----

References	25
------------	----

LIST OF TABLES

TABLES	Title	Page
1:	The routine properties of topsoil and cattle dung potting mixture	17
2:	Dry matter production of tiger nut as influenced by cattle dung admixed with topsoil potting medium	18
3:	Nut yield components of tiger nut as influenced by cattle dung and top soil potting medium	20
4:	Correlation coefficient of dry matter production and nut yield variables of tiger nut	22

ABSTRACT

The experiment was conducted between August to December, 2024 in the screenhouse of the Department of Crop Science, Faculty of Agriculture, University of Benin to evaluate the effect of top soil and potting media on the dry matter production and the yield of tiger nut. The trial five mediums (Top Soil (TS), Cow Dung (CD), TS + CD 1:1, TS + CD 2:1, and TS + CD 1:2) were laid out in a completely randomized design (CRD). Data were collected on shoot dry weight, root dry weight, matter dry weight, leave of index, number of nuts, nut weight and yield at 10 and 12 weeks after planting. Dry matter properties like nut dry weight (0.56 g), root dry weight (0.22 g), total dry weight (1.23 g), and harvest index (0.51 g) were highest in TS + CD 1:1, while TS performed poorly. Also, TS + CD 1:1 produced most number of nuts per plant (3.33), highest nut weight (1.29 g), and nut yield (0.86 t/ha), while TS + CD 2:1 performed poorly for yield components. Total dry weight was significantly correlated with stem girth, number of leaves, nut dry weight, nut yield, and shoot dry weight. Therefore, TS + CD 1:1 is recommended for production of tiger nut based on dry matter production and nut yield components.

CHAPTER ONE

INTRODUCTION

Tiger nut (*Cyperus esculentus* L) is an underutilized plant of the family Cyperaceae, which produces rhizomes from the base of the plant. It grows freely and widely consumed in Nigeria, other parts of West Africa, east Africa, parts of Europe particularly Spain as well in the Arabian Peninsula (Abaejoh *et al.*, 2006). It thrived well in a moderate climate with a temp between 20° and 30° in well-drained soil except saline soil with a pH range of 5.0-7.5.

It is perennial crop cultivated extensively as an annual crop. It is erect, with yellowish-green leaves, triangular stem about 20 to 60cm tall, superficial rhizomes that store protein, starch and other nutrient leading to the production of many tubers and golden brown flowers head.

The plant forms a complex, shallow underground system composed of fine fibrous roots, thin scaly rhizomes, and spherical tubers appear long or round with a dimension of 8 to 16mm (Abdelkader *et al.*, 2017) due to its fast growth it is often confused as weeds in some areas. The tubers are consumed in their natural form or after being soaked in water for some hours. Three forms of tubers, namely black, brown and yellow but only yellow

and brown are readily available in the Nigerian markets. However, yellow variety is preferred.

Tigernut are appeared to have more prospective usage as nourishment and industrial materials. It can be used to produce beverage, milk or yoghurt, flour, nougat, jam beer, chocolate, a feed source, edible oil and as soaps (Achorilo and Ong, 2017). Tigernuts are rich in minerals such as phosphorus, potassium, calcium, magnesium, and iron. It also rich in vitamin E and C and a good quality of vitamin B, (Maduka and Ire, 2018). Tigernut assist in stabilizing the central nervous system and helps the body to adapt to stress (David, 2005). The major factors that account for the chemical variation in tigernut are genetic makeup, production location, environment and growing conditions (Duman, 2019). It is a cheap source of nutrition for both the rich and poor. The health benefits reflect reduction of low density lipoprotein cholesterol, which is good for sports men and women and those intending to lose weight and it also serve as a cure for diarrhea, and as control against heart attacks, colon cancer, thrombosis etc.

The numerous importance of tiger nut necessitates studies into the best sources for propagation. Topsoil represents the most appropriate part of the soil used for plant cultivation and propagation (Darmody *et al.*, 2009). The successful production of quality plant seedlings in the nursery is largely dependent on the composition of the potting media (Osaigbovo and Orhue, 2012).

Dry matter production is equal to the light use efficiency and the amount of light intercepted by plants; it is also the dry weight of plant parts (Higashide, 2022). Yield is the mass of crop products harvested in a specific area of land, and could be influenced by several factors including technical know-how (agricultural practices, etc.), biological (diseases and pests), and environmental (climate, fertility, water, etc.) (Tandzi and Mutengwa, 2020). Estimating the dry matter and yield of tiger nut will be necessary to advice on the best potting media for propagation.

There is insufficient information on potting media and potting mixture used for effective propagation and overall yield analysis of tiger nut, hence this experiment was to evaluate the effect of topsoil and cattle dung potting medium on dry matter production and the yield of tiger nut (*Cyperus esculentus* L.).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Concept of potting media

Potting media is a composition of organic materials formulated to achieve desirable physical and chemical requirements of the crop in order for the crop to maximize its full potential (Osaigbovo *et al.*, 2010). Potting media is a combination of organic and inorganic material mixed in an appropriate or desired proportion depending on the demand of the research. It serves as a medium in which the species would grow and support the root of the species as it grows with the supply of the content nutrient. The nutrient content of a potting media is dependent on the research as each media can be modified or limited. The potting media needs to supply plant with a means of support, good drainage, adequate air circulation and storage of water and nutrient (Anozie *et al.*, 2022).

According to Anozie *et al.* (2020), good potting media management is essential to the production of quality tree seedlings, since vigorous growths needed to face the seasonal hazards encounter on the field. Plant requires favourable potting media for its growth. To achieve its function, growing media used should have light-weight, good porosity, well-drained but with good water holding capacity, contained required nutrients, slightly

acidic with good cation-exchange-capacity, able to maintain a constant volume when wet or dry, free of insects, diseases, and weed seeds, low in silt, clay and ash content, easily stored for long periods of time without changes in physical and chemical properties, and easily handled and blended.

Poor growth of seedlings in potting media had been attributed to poor physical composition of the growth source which may have impeded aeration resulting in poor water and nutrients utilization (Osaigbovo *et al.*, 2009). The development of a healthy, good root system

needs a media with these good physical properties. Any nutrient or chemical deficiencies in soil can be compensated or supplemented using good potting media. Germination is usually the growth of a plant contained within a seed (Anozie and Oboho, 2019), it led to the formation of a young seedling, it is also the process of reactivation of metabolic machinery of the seed resulting in the emergence of radicle and plumule (Anozie *et al.*, 2022).

Early growth of a plant begins after germination. The early stage of a plant is also known as

seedling stage, and it is one of the most critical phases during a plant's life history. Seedling survival not only exerts an important influence on the size, persistence, and genetic variability of plant populations, but also on the availability of required nutrients at the early stage of growth (Kitajima and Fenner, 2000).

2.2 Overview of topsoil

The topsoil is the most vital component of the soil profile, exhibiting high nutrient composition, organic matter content, and microbiological quality crucial for sustaining the ecosystem (Vasu *et al.*, 2020). Agricultural production in highly variable soils is a challenge, especially when those soils are shallow (Schreiner-McGraw and Baffaut, 2023).

Being integral to all functions of terrestrial ecosystem, soil is intended to produce food for feeding the growing population of the world. However, food security is facing threat from soil degradation occurring worldwide. Soils degrade due to the exerting pressure from various sectors of the society including urbanization and industrialization. The major driving forces of soil degradation are deforestation, change in land use, soil erosion, uncontrolled grazing, waste disposal, and unscientific land management (Vasu *et al.*, 2020).

Soil quality refers to the capacity of any soil to function within a natural or managed ecosystem to sustain plant and animal production, conserve environmental quality, and promote human health (El-Ramady *et al.*, 2014). Most notably, soil quality relates to the physical, chemical and biological properties of soils, including infiltration, aeration, soil pH, organic matter, and nutrient contents (Agbeshie and Awuah, 2024).

The poor management practices of soils generally led to the deterioration of the soil's physical, chemical, and biological qualities. Thus, the changes in topsoils could be related to its physical (e.g., soil structure, aggregate stability, bulk density) (Block *et al.*, 2020), chemical (organic matter, ammonium, and nitrate nitrogen, cations, etc.), and biological properties (microbial communities and biomass) (Birnbaum *et al.*, 2017; Quintela-Sabarís *et al.*, 2018; Valliere *et al.*, 2022). The degradation of soil quality presents a significant environmental challenge, especially in tropical areas, through increased compaction, loss of soil organic matter, and alteration in soil microbial characteristics (Fischer *et al.*, 2022).

Soils are dynamic ecosystems that support a diversity of life. Therefore, the concept of soil quality or health, like that of human health, is not difficult to understand or recognize when the system is viewed as a whole. The challenge is to manage soils such that they are able to perform the various uses they are put to without degradation of the soils themselves or the environment. While, this is simple in concept, there are definite complexities that make the idea of soil health difficult to quantify. Which soil functions should be considered, which soil properties are most important to measure, and how to best measure those properties are some of the tough questions that need to be considered when attempting to quantify soil health. The great challenge is to manage soils in a sustainable fashion so that they will provide for human needs in the future. However, the measurement of soil processes and of the soil properties linked to these also depend on

the use and location of the soil. When evaluating soil quality, it is therefore common to explore a range of soil physical, chemical, and biological properties. The single most important property determining the soil quality is the soil organic system because of the profound influence it has on soil physical, chemical, and biological properties. Therefore, many steps already taken to improve soil quality are dealing with improving soil organic matter status and hence, the vitality of the soil organic system. Some of the common ways to improve soil quality include: reduced tillage, use of green manure, application of animal manures, crop rotations, strip cropping, use of cover crops, application of sludge or bio-solids, and other additions of organic materials and nutrients. These management techniques enhance the activity of both the micro and macro-biological soil organic system, whose activities also improve properties such as soil aggregation, infiltration, and water holding capacity, decrease bulk density, penetration resistance and soil erosion, and increase cation exchange capacity. Management for soil quality can also lead to reduced need for agrochemicals and tillage, reduced fuel consumption by farm equipment, and increased sequestration of CO₂ in the soil, all of which benefit the environment. Modern agricultural science has the ability to correct many of the poor practices of the past and to maintain healthier soils that should sustain the uses they are put to (El-Ramady *et al.*, 2014).

2.3 Overview of cattle dung

With rising population, there is a tremendous pressure on agriculture to enhance food production to meet the demand. However, imprudent use of chemical fertilizers has led to the decline in soil fertility. Due to hike in prices of chemical fertilizer and their non-efficient role in long term sustainable production, the application of organic manure including cow dung is required for raising maximum productivity in sustainable way with better soil health. It is an effective tool to ameliorate physical, chemical and biological properties of the soil with higher yield of plants in sustained basis without altering the fertility of soil (Raj *et al.*, 2014).

Current intensive agriculture system faces a major challenge to achieve higher production while supporting soil health and biodiversity. From time in memorial, cow dung has been used for several purposes and served as a source of cheap fuel, housing material and insect repellent. Moreover, the cow dung possesses myriad batteries of microbes that exert their beneficial effects through production of metabolites. Cow dung has also been used as a vital source of organic fertilizer and in the production of biogas. However, with modern civilization, this natural bio-resource is forgotten and its exceptional qualities largely ignored (Mishra *et al.*, 2020).

Cow dung also serves as manure or agriculture fertilizer and escalates soil fertility significantly. Livestock waste composts along with minimum inorganic fertilizer as a soil

amendment in low-input intensive farming are a viable agricultural practice to enhance soil fertility and productivity and to further lessen soil degradation (Das *et al.*, 2017). With this background, it is evident that cow dung has been an indispensable and multifarious component in domestic agriculture (Mishra *et al.*, 2020).

2.4 COW DUNG AS A COMPONENT OF POTTING MEDIA

Cow dung is excreted by herbivore bovine animal species that consists of undigested residues of consumed matter which has passed through the cow's gastrointestinal system (Teo and Teoh, 2011) which is acted upon by ruminal microbes. Cow dung contains organic matter and fibrous material like cellulose, lignin and hemicellulose that has passed through the cow's digestive system (Rajeswari *et al.*, 2016; Munshi *et al.*, 2018). Generally, cow dung is composed of about 80% water and supports a matrix of undigested plant material that is rich in nutrients, microorganisms, and their by-products (Sharma and Singh, 2015). Cow dung is a mixture of dung and urine, usually in the ratio of 3:1 that encompasses crude fibre, crude protein, cellulose, hemicellulose and 24 types of minerals such as nitrogen (N), potassium (K), sulphur (S), traces of phosphorus (P), iron (Fe), cobalt (Co), magnesium (Mg), chlorine (Cl), manganese (Mn), etc. (Swain and Ray, 2009; Mishra *et al.*, 2020). Cow manure contains essential micro and macronutrients and considered as potential fertilizer for crop growth and it is an economic substitute for synthetic fertilizers

(Kiyasudeen *et al.*, 2015). Chomini *et al.* (2015) demonstrated that digested cow dung had the highest percentage increase for four major amino acids viz threonine, proline, glycine, alanine. Cow dung

contains diverse micro-flora that comprises of about sixty bacterial species including *Bacillus* sp., *Corynebacterium* sp., *Lactobacillus* sp., few fungal sp., (*Aspergillus* and *Trichoderma*), about 100 species of protozoa and 2 yeasts (Bhatt and Maheshwari, 2019).

CHAPTER THREE

MATERIALS AND METHOD

3.1 Experimental site

An experiment was conducted between August – December, 2024 at the Screen house of the Department of Crop Science, Faculty of Agriculture, University of Benin, Ugbowo Campus Benin City, Edo State, Nigeria. The area lies between latitude 6° 14' North and 7° 34' North longitude 5° 40' East and 6° 43', East in a high-humidity (80%), with an altitude of 162m above sea level, Benin City is in the rainforest zone of Nigeria characterized by a tropical or equatorial climate. The mean annual rainfall is 1761.00 and daily mean temperature of 26.5°C.

3.2 Sources of planting Materials

The top soil for this experiment was obtained from the Teaching Research farm of the faculty of Agriculture and transported to the Screen House for further use. A poly bags were obtained from Edaiken market . Cattle dung were from cattle market along Adolor College Road Benin City. Tiger nuts seeds were obtained from Uselu Market Road Benin City.

3.3 Experimental Design

The trial involved 5 potting media (Top soil (TS) only; Cattle dung (CD)only. TS+CD 1:1. TS+CD 2:1, TS+CD 1:2) with three replications. Each replications comprises 25 poly pots making it a total of 75 poly pots for the trial.

3.5 Experimental Procedure

The admixed topsoil and cattle dung were left for seven days with each being water with 100 ml of water everyday for stability. After which the tiger nut seeds were planted at three (3) seeds per polypots at a depth of two cm. The seeds were allowed to grow for two weeks after which seedlings were thinned to one (1) seedling per polypot. Irrigation took place daily, weeds and insect pest were done through hand picking.

3.6 The Data Collection

Data were collected at ten (10) and (12) weeks after planting on two randomly selected plants from each treatment in all replications for dry matter determination. After which they were cleaned of soil and weighed to obtain the fresh weight. They were splitted into aerial, nut, portions and root weighed separately wrapped separately with aluminum foil paper, labelled and oven dried at 60°C to a constant weight. After oven dried, the dried shoot and nut were reweighed and harvest index HI computed as the nut dry weight divided by the total dry weight

At harvest, number of fresh weight of nut (g), nut diameter (cm) and nut yield (t/ha) were determined. The uproot nuts were counted from the two randomly selected plants and average computed to obtain the number of nuts per plant.

The nut were weighed and average computed to obtain the nut weight per plant. The nut weight was divided by the number of nuts per stand to obtain the nut size (g). The nut yield was established from nut weight and thus;

$$\text{Nut yield} = \frac{w. 2000}{3 \times 1000 \times 1000} \text{ t ha}^{-1}$$

Where w- nut weight (kg) per plants of 3kg soil. .

Data Analysis ..

Data collected were subjected to analysis of variance using GENTSTAT statistical package and the significant difference treatment means were separate using least significant difference (LSD) at 5% level of significance.

CHAPTER FOUR

RESULTS

4.1 Dry matter production

Dry matter production of tiger nut as influenced by cattle dung admixed with topsoil potting medium is presented in Table 2.

4.1.1. Nut dry weight (g)

There was significant difference ($p < 0.05$) between the potting mixtures. TS + CD 2:1 (0.17 g) was significantly different from cattle dung (0.49 g) and TS + CD 1:1 (0.56 g), but was similar with TS (0.26 g) and TS + CD 1:2 (0.32g) (Table 2.)

4.1.2 Root dry weight (g)

TS (0.04 g), TS + CD 2:1 (0.04 g), and CD (0.06 g) were similar but significantly different from TS + CD 1:1 (0.22 g) (Table 2).

4.1.3 Shoot dry weight (g)

CD (0.32 g) was significantly different ($p < 0.05$) from other potting mixture. TS (0.45 g), TS + CD 1:1 (0.45 g), TS + CD 1:2 (0.45 g), and TS + CD 2:1 (0.66 g) were similar (Table 2).

4.1.4 Total dry weight (g)

TS (0.75 g), TS + CD 1:2 (0.87 g), and TS + CD 2:1 (0.93 g) were similar and significantly different from TS + CD 1:1 (1.23 g) and CD (1.25 g) (Table 2).

Table 1: The routine properties of topsoil and cattle dung potting mixture

Potting media	pH (H₂O)	Total N (g/kg)	TOC (g/kg)	Avail P (mg/kg)	Ex. K (cmol/kg)	Ex. Ca (cmol/kg)	Ex. Mg (cmol/kg)	Ex. Na (cmol/kg)	Ex. H (cmol/kg)	Ex. Al (cmol/kg)	BD (g/ml)	Porosity (%)
Top soil (TS)	5.12	0.7	9.14	8.56	0.18	0.64	0.2	0.13	0.25	0.16	1	56
Cattle dung (CD)	5.46	0.91	23.4	20.8	0.31	1.02	0.34	0.16	0.2	0.1	1.2	50
TS + CD 1:1	5.45	0.83	15.2	12.8	0.24	0.78	0.26	0.17	0.2	0.1	1.1	54
TS + CD 2:1	5.23	0.78	12.6	10.4	0.22	0.72	0.21	0.14	0.2	0.12	1.1	54
TS + CD 1:2	5.53	0.91	23.4	20.8	0.31	1.02	0.34	0.16	0.2	0.1	1.1	53
LSD _(0.05)	0.140	0.072	5.186	4.664	0.047	0.140	0.054	0.013	0.02	0.02	0.06	1.8

Table 2: Dry matter production of tiger nut as influenced by cattle dung admixed with topsoil potting medium

Potting media	Nut dry weight (g)	Root dry weight (g)	Shoot dry weight (g)	Total dry weight (g)	Harvest index
Top soil (TS)	0.26 ^{ab}	0.04 ^a	0.45 ^b	0.75 ^a	0.26 ^a
Cattle dung (CD)	0.49 ^b	0.06 ^a	0.32 ^a	1.25 ^b	0.37 ^b
TS + CD 1:1	0.56 ^b	0.22 ^b	0.45 ^b	1.23 ^b	0.51 ^c
TS + CD 2:1	0.17 ^a	0.04 ^a	0.66 ^b	0.93 ^a	0.16 ^a
TS + CD 1:2	0.32 ^{ab}	0.16 ^{ab}	0.45 ^b	0.87 ^a	0.34 ^b
LSD (0.05)	0.288	0.120	0.214	0.496	0.121

4.1.5 Harvest index

TS + CD 2:1 (0.16) and TS (0.26) were similar but significantly different from TS + CD 1:2 (0.34) and CD (0.37) which was also similar. TS + CD 1:1 (0.51) was significantly different from other potting mixture (Table 2).

4.2 Nut yield

Nut yield components of tiger nut as influenced by cattle dung and top soil potting medium is presented in Table 3.

4.2.1 Number of nuts

Number of nuts showed no significant difference ($p > 0.05$) for the potting mixtures used in this experiment. TS + CD 1:1 (3.33) had more number of nuts, while TS + CD 2:1 (1.00) had the least number of nuts (Table 3).

4.2.2 Nut weight (g)

TS + CD 2:1 (0.34 g), TS (0.56 g), and TS + CD 1:2 (0.63 g) were similar but significantly different from TS + CD 1:1 (1.29 g) which had the heaviest nuts (Table 3).

4.2.3 Nut yield (t/ha)

TS + CD 2:1 (0.23 t/ha) was significantly different ($p < 0.05$) from TS + CD 1:1 (0.86 t/ha) but similar with TS (0.37 t/ha), and CD (0.71 t/ha) (Table 3).

Table 3: Nut yield components of tiger nut as influenced by cattle dung and top soil potting medium

Potting media	Number of nuts	Nut weight (g)	Nut yield (t/ha)
Top soil (TS)	1.33	0.56 ^a	0.37 ^{ab}
Cattle dung (CD)	2.33	1.07 ^{ab}	0.71 ^{ab}
TS + CD 1:1	3.33	1.29 ^b	0.86 ^b
TS + CD 2:1	1.00	0.34 ^a	0.23 ^a
TS + CD 1:2	2.00	0.63 ^a	0.54 ^{ab}
LSD (0.05)	Ns	0.720	0.483

ns – not significant at 0.05 level of probability

4.3 Correlation coefficient

Correlation coefficient of dry matter production and nut yield variables of tiger nut is presented in Table 4. Plant height was significantly correlated with stem girth (0.96), number of leaves (0.98) shoot dry weight (0.55), and total dry weight. Stem girth was significantly correlated with number of leaves (0.95) and total dry weight (0.51). Number of leaves (0.95) was significantly correlated with total dry weight (0.64). Nut dry weight was significantly correlated with nut weight (0.98), nut yield (0.980), and total dry weight (0.77). Nut weight was not correlated with root dry weight (0.05) and shoot dry weight (0.07), but was significantly correlated with nut yield (0.98) and total dry weight (0.74). Nut yield was significantly correlated with total dry weight (0.75), but was not correlated with root dry weight (0.11) and shoot dry weight (0.07). Root dry weight was not significantly correlated with shoot dry weight (0.33) and total dry weight (0.39). Shoot dry weight was significantly correlated with total dry weight (0.58) (Table 4).

Table 4: Correlation coefficient of dry matter production and nut yield variables of tiger nut

	PH	SG	No. L	NDW	NW	NY	RDW	SDW	TDW
Plant height (PH)	1.00								
Stem girth (SG)	0.96*	–							
Number of leaves (No. L)	0.98*	0.95*	–						
Nut dry weight (NDW)	0.49	0.38	0.51	–					
Nut weight (NW)	0.44	0.30	0.44	0.98*	–				
Nut yield (NY)	0.45	0.32	0.47	0.98*	0.98*	–			
Root dry weight (RDW)	0.40	0.40	0.41	0.09	0.05	0.11	–		
Shoot dry weight (SDW)	0.55*	0.49	0.47	0.08	0.07	0.07	0.33	–	
Total dry weight (TDW)	0.64*	0.58*	0.61*	0.77*	0.74*	0.75*	0.31	0.58*	–

CHAPTER FIVE

5.0 DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussions

In this experiment, Tiger nut grown on cow dung, and the potting mixture of topsoil and cow dung of ratio 1:1 and 2:1 produced high dry matter.

The potting mixture of top soil and cow dung of ratio 1:1 which indicates 50 % each influenced tiger nut yield components in this experiment. This implies that cow dung is a good potting mix.

In the findings of Timon *et al.* (2019), there was significant positive correlation between tiger nut yield and plant growth parameters such as plant height and number of leaves. This finding is similar with the outcome of this experiment where tiger nut yield and dry matter were significantly correlated with plant growth parameters such as plant height, number of leaves, and stem girth.

5.2 Conclusion

Cattle dung and potting mixture of TS + CD 1:2 exhibited higher levels of routine potting mixture properties analysed. All potting media exhibited availability of routine properties needed for sufficient plant growth.

Based on dry matter production of tiger nut, TS + CD 1:1 exhibited better nut dry weight, root dry weight, total dry weight, and harvest index, while TS did poorly for nut, root, and total dry weight. This means that TS + CD 1:1 was the best potting medium for dry matter production of tiger nut.

For nut yield components, TS + CD 1:1 produced more number of nuts, had the highest nut weight, and nut yield, while TS + CD 2:1 exhibited poor performance for yield components analysed. This also means that TS + CD 1:1 was the best potting medium for nut yield components of tiger nut.

5.3 Recommendations

Potting mixture of TS + CD 1:1 is hereby recommended for production of tiger nut based on dry matter production and nut yield components. Other potting mixture should be experimented for tiger nut production.

References

- Abaejoh, R., Djomdi, I. and Ndojouenkeu, R. (2006). Characteristics of tiger nut (*Cyperus esculentus*) tubers and their performance in the production of a milky drink. *Journal of food processing and preservation*, 30:145-163.
- Abdelkader, H., Ibrahim, F., Ahmed, M. and El-Ghadban E. (2017). Effect of some soil additives and mineral nitrogen fertilizer at different rates on vegetative growth, tuber yield and fixed oil of tiger nut (*Cyperus esculentus* L.) plants. *Plant Production*. 8(1): 39-48.
- Achoribo, E.S. and Ong, M.T. (2017). Tiger nut (*Cyperus esculentus*): Source of natural anticancer drug? Brief review of existing literature. *EuroMediterranean Biomedical Journal*. 12: 91-94.
- Adejuyitan, J.A. (2011). Tigernut Processing: Its Food uses and Health Benefits. *American Journal of Food Technology*, 197-201.
- Agbeshie, A.A. and Awuah, R. (2024). Impact of fire-burn on soil geochemical, microbial biomass and carbon stocks in a dry tropical forest ecosystem. *International Journal of Environmental Science and Technology* 2024: 1-14.
- Anozie, E.L. and Oboho, E.G. (2019). The effects of seed source and different pre-sowing treatment on germination of *Canarium schweinfurthii* Engl. seeds. *Asian Journal of Research in Agriculture and Forestry* 4(4): 1-11.
- Anozie, E.L., Egwunatum, A.E. Ezenwenyi, J.U. and Okonkwo, C.I. (2022). Effect of different potting media on the germination and early growth of *Newbouldia laevis* (P.Beauv.) Seem. *Asian Journal of Research in Agriculture and Forestry* 8(4): 220-234.
- Anozie, E.L., Ibeh, K.G., Ndulue, N.B., Nwachukwu, A.L. and Ume, C.L. (2020). Growth response of *Dennettia tripetala* G. BAKER to different organic manure at early stage. *European Journal of Agriculture and Forest Research* 8(3): 17-26.
- Arafat, S.A. Said, A.M. (2019). Nutritional Value of Tiger Nut (*Cyperus esculentus* L.) Tubers and Its Products. *Journal of Biological Chemistry and Environmental Science*, 301-318.

- Asante, F.A, Saalia, F.K. Oduro, L, Ellis, W.O. (2014). Modelling of milk solids extraction from Tigernut (*Cyperus esculentus* L.) tubers using response surface methodology. *International Food Science and Nutrition* 4(3): 73-79.
- Baiyeri, K.P., Akachukwu, J.I., Okonkwo, O.J. and Ezugwu, U.I. (2024). Studies on the production of tigernut (*Cyperus esculentus* L.) in South-eastern Nigeria, I: Effect of seven complementary fertilizer treatments on growth and yield of tiger nut in pot. *Bio-Research* 22(1): 2302-2308.
- Bamishaiye E, Bamishaiye, o. (2011). Review article on tiger-nut: as a plant, its derivatives and benefits. *African Journal of Food. Agriculture*
- Bhatt, K. and Maheshwari, D.K. (2019). Decoding multifarious role of cow dung bacteria in mobilization of zinc fractions along with growth promotion of *C. annuum* L. *Scientific Reports* 9:14232.
- Birnbaum, C., Bradshaw, L.E., Ruthrof, K.X. and Fontaine, J.B. (2017). Topsoil stockpiling in restoration: Impact of storage time on plant growth and symbiotic soil biota. *Ecological Restoration* 35(3): 237-245.
- Block, P.R., Gasch, C.K. and Limb, R.F. (2020). Biological integrity of mixed-grass prairie topsoils subjected to long-term stockpiling. *Applied Soil Ecology* 145: 103347.
- CABI. 2020. Invasive Species Compendium. Wallingford, UK: CAB International. UsssssRL: www.cabi.org/isc. (access date: 26.6.2020). David AB. 2005. Tiger nut. A Dictionary of Food and Nutrition.
- Chomini, M.S., Ogbonna, C.I.C., Falemara, B.C. and Micah, P. (2015). Effect of co-digestion of cow dung and poultry manure on biogas yield, proximate and amino acid contents of their effluents. *IOSR Journal of Agriculture and Veterinary Science* 8(11):48-56.
- Darmody, R.G., Daniels, W.L., Marlin, J.C. and Cremeens, D.L. (2009). Topsoil: what is it and whocares? In: National Meeting of the American Society of Mining and Reclamation. Barnhisel, R.I. (Ed.). ASMR, Lerxington, KY. 237-269p.
- Das, S., Jeong, S.T., Das, S. and Kim, P.J. (2017). Composted cattle manure increases microbial activity and soil fertility more than composted swine manure in a submerged rice paddy. *Frontiers in Microbiology* 8:1702. <https://doi.org/10.3389/fmicb.2017.01702>

- David. A.B. (2005). Tigernut, A dictionary of food and nutrition. <https://www.encyclopedia.com/education/dictionaries>.
- Duman, E. (2019). Some physicochemical properties, fatty of two variety tigernut tubers and oils harvested from east acid compositions, macro-micro minerals and sterol contents mediterranean region. *Food Science* 39:610615
- Dyer, A.R. (2009). The ecology of chufa (*Cyperus esculentus sativus*)". Report from University of South Carolina Aiken. Columbia.
- El-Ramady, H.R., Alshaal, T.A., Amer, M., Domokos-Szabolcsy, É., Elhawat, N., Prokisch, J. and Fári, M. (2014). Soil quality and plant nutrition. *Sustainable Agriculture Reviews 14: Agroecology and Global Change* 2014: 345-447.
- Ezeh O, Gordon MH, Niranjana K. 2014. Tiger nut oil (*Cyperus esculentus* L.): A review of its composition and physico- chemical properties. *Eur J Lipid Sci and Tech*, 116(7): 783-794. Follak S, Belz R., Bohren C, De Gastro O, Del Guacchio E, Pascual- Seva N, Essl F. 2016. Biological flora of Central Europe: *Cyperus esculentus* L. *Plant Ecological Evolution System*, 23:33-51.
- Fischer, A.M., Van Hamme, J.D., Gardner, W.C. and Fraser, L.H. (2022). Impacts from topsoil stockpile height on soil geochemical properties in two mining operations in British Columbia: Implications for restoration practices. *Mining* 2(2): 315-329.
- Gambo A, and Da'u A. 2014. Tiger nut (*Cyperus esculentus*): composition, products, uses and health benefits. A review. *Bayero Journal of Pure and Applied Science*, 7: 56-61.
- Gene, D. W. (1987). Description of purple and yellow nutsedge (*Cyperus rotundus* and *Cyperus esculentus*). *Weed Technology*, 1(1): 2-9.
- Higashide, T. (2022). Review of dry matter production and growth modelling to improve the yield of greenhouse tomatoes. *The Horticulture Journal* 91(3): 247-266.
- Kareem, S.T, Adebowale, A.R.A., Sobukola, O.P., Adebisi, M.A., Obadina, O.A., Kajihansa, O.E. and Keith, T. (2015). Some quality attributes of high quality cassava-tigernut composite flour and its extruded snacks. *Journal of Culinary Science and Technology*, 13(3): 242-262.

- Kitajima, K. and Fenner, M. (2000). Ecology of seedling regeneration. In: Fenner M. (ed.) Seeds: the ecology of regeneration in plant communities. Wallingford, UK: CABI. Pp331-359.
- Kiyasudeen, S.K., Ibrahim, M.H.B. and Ismail, S.A. (2015). Characterization of fresh cattle wastes using proximate, microbial and spectroscopic principles. *American-Eurasian Journal of Agricultural and Environmental Sciences* 15(8): 1700-1709.
- Krichene D, Artieda DA, Zarrouk M, Astiasarán I. 2016. Review on *Cyperus esculentus*: from food safety to pharmacotherapeutics. *International Journal of Pharmacy*, 3(1): 211-216.
- Maduka, N. Ire, S.F. (2018). Tigernut plant and useful application of tigernut tubers (*Cyperus esculentus*) - A Review. *Current Journal of Applied Science and Technology*, 29(3): 1-23.
- Merrell, J.L. 1975). The effects of flooding on chufa (*Cyperus esculentus* L.). M.S. Thesis, Louisiana State University, Baton Rouge, USA
- Mishra, O., Pathak, R., Parmar, M.S. and Doneria, R. (2020). Cow dung an undeciphered boon: An overview. *The pharmacotherapeutics Innovation* 9(11): 84-89.
- Mohdaly AARAA. 2019. Tiger Nut (*Cyperus esculentus* L.) Oil. In: Ramadan MF, editor. Fruit Oils: Chemistry and Functionality. Egypt: Springer International Publishing: p. 243-269.
- Munshi, S.K., Roy, J. and Noor, R. (2018). Microbiological investigation and determination of the antimicrobial potential of cow dung samples. *Stamford Journal of Microbiology* 8(1): 34-37.
- Osaigbovo, A.U. and Orhue, E.R. (2012). Effect of potting media and water frequencies on the growth of pepper fruit (*Dennetia tripetala*) seedlings. *Bayero Journal of Pure and Applied Sciences* 5(2): 73-78.
- Osaigbovo, A.U., Nwaoguala, C.N.C. and Falodun, J. E. (2009). Influence of different potting media on the seedling growth of *Gambeya albida* (G.Don). *Journal of Sustainable Tropical Agriculture Research* 31: 77-81.
- Osaigbovo, A.U., Nwaoguala, C.N.C. and Falodun, J.E. (2010). Evaluation of potting media for the production of pepper fruit (*Dennetia tripetala*) seedlings. *African Journal of General Agriculture* 6(2): 47-51.

- Oyetero, A.O.A, Ogundipe, o.o., Adeyeye, S.A.O., Akande, E.A. and Akinyele AB. 2019. Production and evaluation of tigernut (*Cyperus esculentus*) milk flavored with moringa oleifera leaf extract. *Current Research in Nutrition and Food Science*, 7: 265-271.
- Pascual-Seva, N., San Bautista, A., López-Galarza, S., Maroto, J.V. and Pascual, B. (2016). Response of drip-irrigated chufa (*Cyperus esculentus* L. var. sativus Boeck.) to different planting configurations: Yield and irrigation water-use efficiency. *Agricultural Water Management*, 170: 140-147.
- Quintela-Sabarís, C., L'Huillier, L., Mouchon, L.C., Montargès-Pelletier, E. and Echevarria, G. (2018). Chemico-mineralogical changes of ultramafic topsoil during stockpiling: Implications for post-mining restoration. *Ecological Research* 33(4): 767-775.
- Raj, A., Jhariya, M.K. and Toppo, P. (2014). Cow dung for eco-friendly and sustainable productive farming. *International Journal of Scientific Research* 3(10): 201-202.
- Rajeswari, S., Poongothai, E. and Hemalatha, N. (2016). Antimicrobial activities of cow dung extracts against human pathogens. *International Journal of Current Pharmaceutical Research* 8(4):9-12.
- Roselló-Soto, E., Garcia, A., Fessard, A. Barba, F.J. Munekata, P.E.S., Jose, M.L. and Remize, F.2019. Nutritional and microbiological quality of tiger nut tubers (*Cyperus esculentus*), derived plant-based and lactic fermented beverages. *Ferment*, 5(1): 3.
- Schreiner-McGraw, A.P. and Baffaut, C. (2023). Quantifying links between topsoil depth, plant water use, and yield in a rainfed maize field in the US. Midwest. *Agricultural Water Management* 290(1): 108569.
- Sharma, B. and Singh, M. (2015). Isolation and characterization of bacteria from cow dung of desi cow breed on different morpho-biochemical parameters in Dehradun. *International Journal of Advances in Pharmacy, Biology and Chemistry* 4(2): 276-281.
- Suleiman M.S, Olajide J.E, Omale, J.A, Abbah, O.C. and Ejembi DO. (2018). Proximate composition, mineral and some vitamin contents of tigernut (*Cyperus esculentus*). *Clinical Investigation*, 8: 163-165.

- Swain, M.R. and Ray, R.C. (2009). Biocontrol and other beneficial activities of *Bacillus subtilis* isolated from cow dung microflora. *Microbiology Research* 164(2): 121-130.
- Tandzi, N.L. and Mutengwa, S.C. (2020). Factors affecting yield of crops. *IntechOpen* 90672. <https://doi.org/10.5772/intechopen.90672> 10/02/2025.
- Teo, K.C. and Teoh, S.M. (2011). Preliminary biological screening of microbes isolated from cow dung in Kampar. *African Journal of Biotechnology* 10: 1640-1645
- Timon, D., Zakawa, N.N., Yusuf, C.S. and Aisha, A. (2019). Growth and yield response of tiger nut (*Cyperus esculentus* L.) to different rates of NPK, cattle dung and poultry droppings in Mubi, Adamawa State, Nigeria. *Greener Journal of Agricultural Sciences* 9(3): 288-296.
- Valliere, J.M., D'Agui, H.M., Dixon, K.W., Nevill, P.G., Wong, W.S., Zhong, H. and Veneklaas, E.J. (2022). Stockpiling disrupts the biological integrity of topsoil for ecological restoration. *Plant Soil* 2022: 1-18.
- Vasu, D., Tiwary, P., Chandran, P. and Singh, S.K. (2020). Soil quality for sustainable agriculture. *Nutrient Dynamics for Sustainable Crop Production* 2020: 41-66.
- Wilma AM, Chester O. 1986. CHUFA (*Cyperus esculentus*). US Army Corps of Engineers Washington, DC 20314-1000: 3-5.
- Yu, Y., Lu, X., Zhang, T., Zhao, C., Guan, S., Pu, Y. and Gao, F. (2022). Tiger nut (*Cyperus esculentus* L.): nutrition, processing, function and applications. *Foods* 11:601.
- Zheng, X., Liu, J., Cheng, Z., Sun, Y., Li, L. and Wang, J. (2024). Improving tuber yield of tiger nut (*Cyperus esculentus* L.) through nitrogen fertilization in sandy farmland. *Plants* 13:1063.
- Zohary D. 1986. The origin and early spread of agriculture in the Old World. In: Barigozzi C, editor. The origin and domestication of cultivated plants. Amsterdam: Elsevier; p. 3-20.