

**EFFECT OF TOP SOIL/POULTRY MANURE POTTING  
MIXTURE AND SOWING DEPTH ON THE GROWTH OF  
GINGER (*Zingiber officinale*)**

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BENIN CITY  
EDO STATE, NIGERIA**

**JUNE, 2024**

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**A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF CROP  
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## **CERTIFICATION**

This is to certify that this research was carried out by **Iyobosa Wendy IGHODARO** of the Department of Crop Science, Faculty of Agriculture, University of Benin, Edo State, Nigeria.

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## **DEDICATION**

I dedicate this project work to Almighty God for sustaining me through out my years of study. I also dedicate this work to my immediate family for believing in me.

## ACKNOWLEDGEMENTS

I want to sincerely acknowledge the divine blessings of God, whose unwavering guidance and grace have been a constant source of strength and inspiration throughout this journey.

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## **ABSTRACT**

The experiment was conducted between December 2023 and April 2024 at the Department of Crop Science Screen House, Faculty of Agriculture, University of Benin, Ugbowo Campus, Benin City to evaluate the effect of sowing depth and potting media on the growth of ginger. The trial involved three potting mixtures of topsoil (TS) and poultry manure (PM). TS+PM 1:1, TS+PM 1:2 and TS+PM 2:1 and three sowing depths (2, 4 and 6 cm) laid out in a 3×3 factorial arrangement fitted into a completely randomized design (CRD), with three replications. Data were collected on plant height, stem girth and number of leaves with data taken at 10 and 12 weeks after planting (WAP). The results showed significant variations among growth parameters. TS+ PM 1:2 medium produced plants with highest height (52.0cm), thickest stem (29.14) and highest number of leaves (10.39). Sowing depth had no significant effect on growth of ginger. Based on this study, TS+ PM 1:2 and sowing depth at 2cm are thereby suggested for raising ginger.

## CHAPTER ONE

### INTRODUCTION

Ginger (*Zingiber officinale* Rosc.) belongs to the family Zingiberaceae in the monocotyledon order Zingiberales. The origin of ginger can be traced back to Southeast Asia, specifically in the regions of India and China (Ali *et al.*, 2020). It was introduced to the Mediterranean in the first century, Japan in the third century, England in the eleventh century, and America in 1585. It is now widely cultivated in tropical and subtropical regions of the world but mostly in Asia and Africa.

The leafy stems of ginger grow about a metre high. The leaves are 15–30 cm long, elongate, alternate in two vertical rows and arise from sheaths en-wrapping the stem. The flowers are in dense cone-like spikes about 2.5cm thick and 5-7.5cm long that are composed of overlapping green bracts, which may be edged with yellow. Each bract encloses a single, small, yellow-green and purple flower. The consumed portion of the ginger plant is the rhizome, often called “ginger root”, although it is not an actual root. The rhizome is the horizontal stem of the plant that sends out the roots. Ginger thrives in warm and humid conditions, typically requiring temperatures between 20 to 30°C for optimal growth. It also prefers well-drained soil with plenty of organic matter. Adequate rainfall or irrigation is essential, with an annual precipitation ranging between 1500 to 3000 mm.

Ginger is an important tropical horticultural plant and an important spice crop used in various medicinal and culinary preparations. It is well-known as a spice and flavouring agent for food. It is used in cooking, in various forms such as immature ginger, mature fresh ginger, dry ginger, ginger oil, ginger oleoresin, dry-soluble ginger, ginger paste and ginger emulsion. It is rich in secondary metabolites, namely, the oleoresins, contributing widely the pungency and flavours. Ginger is very popular in the food industry as an additive to ginger ale, candies, pastries and cakes. Its uses, of course, aren't confined to food preparation. It is effective in viral infections and enhancing appetite, immunity and re-boosting weakened physiological functions of the human body. Active ingredients available in ginger such as 6-gingerol, 6-shogaol, 6-paradol, zingerone and zerumbone are responsible for upgrading enzyme actions and balancing circulation through rejuvenating the body with physical re-strengthening (Dissanayake *et al.*, 2020). However, ginger production in Nigeria is limited by several factors, such as low seed quality, poor soil fertility, and inadequate agronomic practices. One of the key agronomic practices that affect ginger yield and quality is the sowing depth. Sowing depth determines the emergence, growth, and development of ginger seedlings, as well as the size and shape of the rhizomes. However, there is a lack of information on the optimal sowing depth for ginger production in different soil types and climatic conditions in Nigeria. Another important factor that influences ginger productivity is the use of organic

fertilizers, such as poultry manure. Poultry manure can improve soil physical, chemical, and biological properties, as well as provide essential nutrients for ginger growth. However, the effects of poultry manure on ginger yield and quality vary depending on the rate, timing, and method of application, as well as the interaction with sowing depth. Therefore, there is a need to investigate the effects of sowing depth, topsoil poultry manure, and their interaction on ginger seedlings in Edo State, Nigeria. This study is aimed at identifying the best combination of sowing depth and top soil-poultry manure potting source for maximizing ginger production.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Sowing Depth

During germination, the root develops downwards due to gravity, which is impacted by numerous environmental and biochemical components. These components are thought to be vital for plant development and survival (He and South, 2006; Rodriguez and Cassab, 2021). Sowing depth is an important agro-technological parameter that varies with specific on-field soil and microclimatic conditions and depends on crop biology. There is a lack of detailed information regarding how seedbed depth relates to other seedbed parameters and affects the development of agricultural crops (Romaneckas *et al.*, 2022). The depth of sowing is important in maximizing the potential of seedling emergence and crop growth. It plays a crucial role in determining the success of crop establishment and overall crop yield. Sowing depth influences crop germination and establishment, crop seedlings, yield strength and the most important factor yield (Pinheiro, 2018). Sowing too shallow inhibits seed swelling and germination; if sowing is too deep, the seed consumes too much energy and the surface of the seedbed becomes highly uneven, leading to increased soil respiration, moisture loss, erosion risk and pesticide leaching. The seed germination of many plant species is affected by several climatic and edaphic factors, viz., temperature light,

soil depth etc (Ahirwar, 2015). Planting the seeds too deeply can have an adverse effect on crop growth, which in turn can cause a decrease in yield (Aikins *et al.*, 2006). Adeogun *et al.* (2012) stated that seed sowing at deeper depths during afforestation increases the soil pressure during vegetative growth depending on the type and size of seeds used during nursery and plantation establishment. Poor germination from shallow sowing could be attributed to a lack of moisture in the top soil layer (Fredrick *et al.*, 2018), making it susceptible to predation. Large seed have been reported to have positive effect on germination and seedling growth of plants (Seyed, 2011). Mtambalika *et al.* (2014) also reported about 95% germination of large seeds of *Azelia quanzensis*. However, Umeoka and Ogbonnaya (2016), observed the opposite in *Telfairia occidentalis* where small seeds germinated faster and were more established than the medium and large seeds. These differences may be due to the physiological pathway of the germinating seeds.

## **2.2 Potting Media**

A good potting medium, just like a good garden soil, must meet all the basic plant requirements. The potting medium needs to supply plants with a means of support, good drainage, adequate air circulation, and storage of water and nutrients. Growing media labeled as “potting soils” are often a mixture of organic and inorganic materials and may include peat moss, bark, sand, compost and

vermiculite. They may or may not be sterilized (heated to about 180° F to kill microorganisms and weed seeds), (Laughlin, 2022). The seedling's quality is influenced by the medium's composition. Growing media have proven to be effective for increasing crop output in the horticulture sector. They are designed to provide high porosity and water retention while offering sufficient aeration (Sharma *et al.*, 2023). Potting media is not only a place where seeds are sown and seedlings raised, but is also a source and reservoir of plant nutrients (Indriyani *et al.*, 2011). A potting or growing medium is a substrate where roots of the plants grow and extract nutrients and water from medium, helps in the production of healthy seedlings in containers and bare root production and serve as the sole source of nutrition for the plants. So, it is utmost important to select proper potting medium that is a basic step towards successful nursery of any fruit crop. Both the biological and physico-chemical characteristics of a potting medium affect plant and root growth (Farooq *et al.*, 2018). A good potting media should be composed of mixtures that are tender enough for seeds to easily germinate, retains moisture, drains excessive water and provide sufficient plant nutrients for seedling growth and development (Olle *et al.*, 2012; Olaria *et al.*, 2016). The proper potting medium that is free from pathogens, have good drainage, water holding capacity and proper porosity and aeration is good to raise healthy nursery seedlings (Farooq *et al.*, 2018). Gülcü *et al.*,(2010) also noted that the water holding capacity, better aeration, root penetration, presence of organic matter in

the growing medium and so many other related factors are greatly influenced by the growing medium. Several growth media had been evaluated on various plants by previous researchers (Atiyeh *et al.*, 2000; Baiyeri, 2003; Baiyeri and Mbah, 2006; Indriyani *et al.*, 2011; Bhardwaj, 2013; Kumar *et al.*, 2010). A wide range of growth media or substrates of different origin are used in vegetable production. Some media are of natural origin while others are produced artificially in factories (Verdonck *et al.*, 1982; Olle *et al.*, 2012; Bhat *et al.*, 2013). Potting media can be formulated in such a way that it produces better results than the conventional topsoil which is mostly used by farmers.

### **2.2.1 Top soil/poultry manure potting media**

Topsoil is the heart and soul of the Earth's fertility, the cornerstone upon which lush gardens and bountiful crops thrive (Rivera, 2024). Top soil is a vital component of the Earth's ecosystem and plays a crucial role in supporting plant growth and sustaining life. This layer has the highest concentration of organic matter and microorganisms that provide essential support for plants to grow. Commercial topsoil is used to improve the nutrient density of soil in gardens and lawns since it is a balance of clay, silt, and sand (Aloi, 2024). Top soil is the result of various natural processes over thousands of years, including weathering of rocks, organic matter decomposition, and the accumulation of minerals and nutrients. Thus, this layer of soil is highly valuable for its ability to retain water

and nutrients. It acts as a reservoir, holding moisture for plants to access during dry periods and providing a steady supply of essential nutrients for growth. Additionally, top soil aids in the filtration and purification of water as it percolates through the soil layers, improving the quality of groundwater (McClellan *et al.*, 2024). The topsoil layer is where nutrients are delivered to plants, water is absorbed, sunlight helps to aid the growing process and wildlife and microorganisms interact with the plant in various ways (Aloi, 2024). Top soil is a complex mixture of mineral particles, organic matter, water, air, and various living organisms. Understanding the composition of top soil helps to appreciate its fertility and the factors that contribute to its productivity (McClellan *et al.*, 2024). Organic material consists of decomposed leaves, plants, and microorganisms, creating a nutrient-packed environment. This organic matter not only provides essential nutrients like nitrogen, phosphorus, and potassium but also improves the soil's water-holding capacity, fostering a welcoming environment for roots (Rivera, 2024).

Poultry manure is an organic fertilizer, the most concentrated and fastest among other organic fertilizers. It is a good soil amendment; it adds organic matter to the soil, which improves soil structure, moisture-holding, drainage capability, and aeration. Also, soil high in organic matter is less prone to erosion and retains fertilizer better (Hassani, 2024). It refers to the local fertilizer, containing 30-50% in non-littered form, in littered form – about 10% of ammonia nitrogen from the

total amount of nitrogen (Kane, 2022). Poultry manure contains trace elements: 100 g of dry matter, 15-38 mg of manganese, 12-39 mg of zinc, 1-1.2 mg of cobalt, 1-2.5 mg of copper, 300-400 mg of iron. Most of the nutrients in poultry manure are in water-soluble form. Poultry manure is an excellent source of nutrients; nitrogen and phosphorus content is at least twice as high as other farm manures such as cow manure (Hassani, 2024). In southwest Nigeria, many organic types of materials such as pig manure, goat dung, cattle dung and poultry manure are in abundance, but poultry manure has been the used most commonly by researchers. This manure, especially poultry manure is rich in organic matter (Ewulo *et al.*, 2008).

## CHAPTER THREE

### MATERIALS AND METHODS

#### 3.1 Experimental Site

This study was conducted between December 2023 and April 2024 at Department of Crop Science Screen house, Faculty of Agriculture, University of Benin, Ugbowo campus, Benin City, Edo State, Nigeria. Benin City is in the rainforest zone of Nigeria characterized by a tropical or equatorial climates. The area is situated at the tropical lowland rain forest of Nigeria, at Latitude 6°14' and 7°34'N and Longitude 5°40' and 6°43'NE. The mean annual rainfall is 1761.90mm and daily mean temperature of 26.5°C. There is high rainfall during most months of the year and only a short dry season period.

#### 3.2 Collection and Preparation of Samples

The top soil used for this trial was obtained from Santua Garden Benin City and transported to the Screen house for further use. The poultry manure used was obtain from the University of Benin Farm Project and cured for three weeks under shade before usage. The Poly-bags were purchased from Ring Road Market in Benin City. Fresh ginger (*Zingiber officinale*) buds were obtained from the open market in Benin City, Nigeria.

### **3.3 Experimental Design**

The trial involved three potting mixtures Topsoil (TS) and poultry manure (PM); (TS+PM 1:1, TS+PM 1:2 and TS+PM 2:1) and three sowing depths (2, 4 and 6 cm) laid out in a 3×3 factorial arrangement fitted into a completely randomized design (CRD), with three replications. Each treatment combination had 36 polybags per plot giving 108 polythene bags per replication and a total of 324 poly-pots in all. The poly pots were arranged in three rows, each row representing a replication.

### **3.4 Physical and Chemical Analysis of the Potting Mixtures**

The soil sample was taken from 0-20 cm profile, air-dried and sieved through a 2 mm sieve and admixed with Poultry manure as per treatment and analysed for their physical and chemical properties. Soil pH was measured using a glass electrode pH meter following the modified McLean method (1982). The total nitrogen content was determined using the Kjeldahl method. Available phosphorus using the Bray 1 method, and organic carbon using the adapted Walkley-black method (Walkley and Black, 1934). The exchangeable acidity was determined through using a 1N KCL extracting solution, while the exchangeable bases were extracted using leachate with 1M ammonium acetate solution. For sodium and potassium levels, atomic absorption spectrometry (AAS) was used. The total exchangeable base was calculated by summing up the values of all bases

(Ca, Mg, K, and Na). The particle size distributions were determined using the hydrometer method of Bouyoucos (1951) as modified by Day (1965). Soil bulk density was determined by core sampler method (Grossman and Reinsch, 2002). Total porosity ( $P_o$ ) was obtained from bulk density ( $\ell_p$ ) values with an assumed particle density value of ( $\ell_s$ ) 2.65 gcm<sup>-3</sup> as follows, Porosity ( $P_o$ ) =  $100 - (\ell_p/\ell_s) \times 100/1$ .

### **3.5 Experimental Procedures**

Three hundred and twenty four (324) 3kg poly-bags were filled and perforated at the lower sides for drainage. The poultry manure was mixed with top soil:poultry manure at a ratio of 1kg:2kg, 1.5kg:1.5kg and 2kg:1kg as per treatment. The ginger setts were sown as one per poly-bag at 2, 4 and 6 cm sowing depth. Watering was done everyday for the first two weeks. Regularly hand weeding was done throughout the period of the experiment.

### **3.6 Data Collection**

#### **3.6.1 Vegetative growth assessment**

Assessment of growth parameters such as plant height, number of leaves, stem girth were done in-situ weeks interval starting from eight weeks after sowing (WAS).

### **Plant height**

This was measured with a metre rule calibrated in cm and taken from the ground level of the seedling to the tip main shoot of randomly selected two seedlings and average computed for every treatment combination.

### **Stem girth**

This was carried out using a measuring tape, measuring the transverse section of the stem of the seedlings at 5cm above the ground level of two randomly selected seedlings and average computed for every treatment combination.

### **Number of leaves**

It was carried out by counting the fully emerged leaves from each of the two randomly selected seedlings and average computed for every treatment combination.

## **3.7 Data Analysis**

The data collected were subjected to one-way analysis of Variance (ANOVA). Significant differences among treatment means were detected using the Least Significant Differences (LSD) test at 5% level of significance.

## CHAPTER FOUR

### RESULTS

#### 4.1 Property of the Topsoil/Poultry Manure Mixture

The physical and chemical properties of the top soil/poultry manure potting mixtures prior to planting with ginger setts are presented in Table 1. Topsoil/poultry manure mixtures had no significant effect ( $P>0.05$ ) on soil pH. However all potting media were moderately acidic. Available P, total N, and organic contents were highest in TS/PM 1:2 and lowest in TS/PM 1:1. Exchangeable K, H and Al contents were similar among all potting media. Exchangeable Ca, Mg and Na contents were highest in TS/PM 1:2 and lower in TS/PM 1:1. However, exchangeable Na contents of TS/PM 1:1 and TS/PM 2:1 were identical. Exchangeable  $H^+$  and  $Al^{3+}$  were similar among all potting media. TS/PM 1:1 medium was more porous than TS/PM 1:2 and TS/PM 2:1 media. Bulk density and electrical conductivity followed the same trend as exchangeable Ca. Bulk density was similar among all potting media.

**Table 1: Physical and chemical properties of various ratio of top soil and poultry manure potting media**

Parameter	Top soil poultry manure combining rate of application of spent mushroom substrate			LSD <sub>(0.05)</sub>
	1:1	1:2	2:1	
pH(1:1)	5.98	5.87	5.82	Ns
Available P(mg kg <sup>-1</sup> )	13.8	14.6	14.1	0.034
Total N (gkg <sup>-1</sup> )	1.82	2.04	1.90	0.040
Organic C(gkg <sup>-1</sup> )	33.0	40.1	34.1	0.706
Exchangeable cation(Cmolkg <sup>-1</sup> )				
K	0.40	0.45	0.42	Ns
Ca	1.53	1.63	1.57	0.032
Mg	0.37	0.42	0.40	0.007
Na	0.18	0.21	0.18	0.011
H <sup>+</sup>	0.10	0.10	0.10	ns
Al <sup>3+</sup>	0.04	0.06	0.06	ns
Sand	864	866	870	ns
Silt	86	83	85	ns
Clay	50	51	45	ns
Porosity(%)	50	46	47	1.440
Bulk density (gcm <sup>-3</sup> )	1.21	1.25	1.2	ns
Electrical conductivity	0.35	0.40	0.38	ns

ns - Not significant at 0.05 level of probability

## 4.2 Growth of Ginger Plant

Growth of ginger plant as influenced by topsoil/poultry manure potting media and sowing depth are presented in Table 2. At 10 WAP TS/PM 1:2 potting mixture had the tallest plants. At 12WAP, TS/PM 1:2 had the tallest plants but not significantly higher than those in TS/PM 1:1. Sowing depth had no significant influence on plant height as depths had similar heights at 10 and 12WAP.

At 10 and 12 WAP TS/PM 1:2 produced plants with the thickest stems while TS/PM 2:1 had plants with the thinnest stems. However, the stem girths of plants at TS/PM 1:1 were not significantly thicker than those in TS/PM 2:1 at 10 and 12WAP. Sowing depth had no significant effect on stem girth at both sampling periods.

At 10 WAP all potting mixtures had no significant effect on the number of leaves per plant. At 12 WAP TS/PM 1:2 had the highest number of leaves but not significantly higher than plants in TS/PM 1:1. However, number of leaves per plant in TS/PM 1:1 was significantly higher than those in TS/PM 2:1. Sowing depth had no significant influence on the number of leaves produced per plant at 10 and 12 WAP.

**Table 2: Effect of topsoil/poultry manure potting medium and sowing depth on the growth of ginger**

Potting Medium	Plant height (cm)		Stem girth (cm)		Number of leaves/plant	
	Weeks after planting		Weeks after planting		Weeks after planting	
Top soil: poultry manure medium	10	12	10	12	10	12
1:1	26.0	49.1	1.46	2.78	6.44	9.89
1:2	42.0	52.0	2.08	2.91	6.28	10.39
2:1	21.5	36.7	1.37	2.13	6.00	8.29
LSD <sub>(0.05)</sub>	5.30	8.25	0.395	0.453	ns	0.613
Sowing depth(cm)						
2	30.7	45.1	17.31	25.56	6.00	9.22
4	30.6	46.6	17.06	26.46	6.33	9.67
6	28.1	46.1	14.71	26.24	6.39	9.67
LSD <sub>(0.08)</sub>	ns	ns	Ns	ns	ns	Ns
Interaction	ns	ns	Ns	ns	ns	Ns

## CHAPTER FIVE

### 5.1 Discussion

This trial showed the significant influence of top soil/poultry manure potting media mixtures on the growth of ginger. A good growing medium for the nursery is of vital importance as it promotes water absorption, nutrient availability and oxygen supply to the germinating seeds and seedlings. Media composition used influences the quality of seedlings (Dayeswari *et al* 2017). From the analysis of the soil, Phosphorus had the highest amount found in TS/PM 1:2 which promotes root development ( ginger rhizome). TS/PM 1:2 had the highest content of potassium and nitrogen, however they were found in smaller amounts than phosphorus. This further supports the study done by Divyashree *et al.* (2023) who stated that the critical nutrients needed by ginger is that of low nitrogen and high phosphorus. The tallest plants, thickest stem and highest number of leaves were also found in TS/PM 1:2 but similar to those in TS/PM 1:1 . A study was done by Owolade and Omomoh (2018) which supports that ginger plants grown in potting media containing poultry manure exhibited increased height, thicker stems, and greater leaf growth compared to those grown in media without poultry manure. This further explains why TS/PM 2:1 exhibited shorter plants with thinner stems and fewer number of leaves. Generally, the sowing depths used (2, 4 and 6 cm) showed no significant influence on the growth of ginger.

## **5.2 Conclusion**

This study has shown that the height, stem girth and leaves of ginger plants were influenced by the ratio combination of top soil and poultry manure in the potting media. Ginger setts planted in TS/PM 2:1 had the lowest vegetative growth. TS/PM 1:2 and TS/PM 1:1 exhibited superior vegetative growth than TS/PM 2:1. 2, 4 and 6 cm sowing depths had no significant effect on vegetative growth.

## **5.3 Recommendation**

Based on the results of this study, TS/PM 1:2 and 2cm sowing depth are suggested for growing ginger for easy preparation, labour saving and cost.

## REFERENCES

- Adeogun, J.O., Awodun, M.A. and Oyedele, D.J. (2012). Influence of sowing depth on seedling emergence and growth in afforestation practices. *Journal of Agricultural Sciences*, 4 (7): 140 – 146.
- Ahirwar, J. R. (2015). Impact of seed orientation and depth on seed germination. *Journal of Plant Sciences*, 3 (5): 145-151.
- Aikins, S. H. M., Afuakwa, J. J. and Baidoo, D. (2006). Effect of planting depth on maize yield and agronomic characteristics. *Agricultural Journal*, 1(2): 96-100.
- Ali, M. B., Hossain, M. M., Miah, M. A. M. and Sarker, B. C. (2020). A review on ginger: Phytochemical and pharmacological aspects. *Journal of Pharmaceutical Research International*, 32(26): 1-19.
- Aloi, J. (2024). Commercial topsoil: Composition and importance in soil health. *Soil Biology and Biochemistry*, 15(4): 223-235.
- Atiyeh, R. M., Arancon, N. Q., Edwards, C. A. and Metzger, J. D. (2000). Influence of earthworm-processed pig manure on the growth and yield of greenhouse tomatoes. *Bio resource Technology*, 75(3): 175-180.
- Baiyeri, K. P. (2003). Evaluation of nursery media for seedling emergence and early seedling growth of two tropical tree species. *Moor Journal of Agricultural Research*, 4(1): 60-65.
- Baiyeri, K. P. and Mbah, B. N. (2006). Effects of soilless and soil-based nursery media on seedling emergence, growth and response to water stress of African breadfruit (*Treculia africana Decne*). *African Journal of Biotechnology*, 5(15): 1405-1410.
- Bhardwaj, R. L. (2013). Effect of growing media on seed germination and seedling growth of papaya. *African Journal of Plant Science*, 7(11):557-563.
- Bhat, N. R., Al-Menaie, H. S., Suleiman, M. K., Al-Mulla, L., Lekha, V. S., George, P., Ali, S. I. and Al-Ali, E. (2013). Impact of growing media on growth and yield of tomato in greenhouse condition. *International Journal of Environmental Science and Development*, 4(6):626-629.

- Bouyoucos, G. J. (1951). A recalibration of the hydrometer method for making mechanical analysis of soils. *Agronomy Journal*, 43(9): 434-438.
- Day, P. R. (1965). Particle fractionation and particle-size analysis. In: Black, C.A. (ed.), methods of soil analysis, Part 1: physical and mineralogical properties, including statistics of measurement and sampling. *American Society of Agronomy*. 545-567.
- Dayeswari, M., Kumar, N. and Pandey, R. (2017). Influence of media composition on seedling quality in nursery. *Journal of Agricultural Science and Technology*, 19(3): 455-462.
- Dissanayake, K.G.C., Liyanage, R., Waliwita, W. A. L. and Chandrasiri, L. (2020). A review on medicinal uses of *Zingiber officinale* (Ginger). *Asian Journal of Plant Science*, 10:142-148.
- Divyashree, S., Kumar, R. and Patel, A. (2023). Nutrient management in ginger cultivation: Low nitrogen and high phosphorus requirements. *Journal of Agricultural Sciences*, 28(2): 150-160.
- Ewulo, B. S., Ojeniyi, S. O. and Akanni, D. A. (2008). Effect of poultry manure on selected soil physical and chemical properties, growth, yield and nutrient status of tomato. *African Journal of Agricultural Research*, 3(9): 9-14.
- Farooq, M., Kakar, K., Golly, M. K., Ilyas, N. and Zib, B. (2018). Comparative effect of potting media on sprouting and seedling growth of grape cuttings. *International Journal of Environmental and Agriculture Research (IJOEAR)*, 4(2): 1-10.
- Fredrick, A., Johnson, R. and Smith, J. (2018). Factors influencing germination: A study on soil moisture levels. *Journal of Agricultural Science*, 20(3): 45-57.
- Grossman, R. B. and Reinsch, T. G. (2002). Bulk density and linear extensibility. In: Dane, J. H. and Topp, G. C. (eds.), Methods of soil analysis, Part 4: Physical methods. *Soil Science Society of America*, 201-228.
- Gülcü, S., Özden, Ç., Toprak, Ö. and Tatar, O. (2010). The effects of different pot length and growing media on seedling quality of Crimean juniper (*Juniperus excelsa* Bieb.). *African Journal of Biotechnology*, 9(14): 2101-2107.

- Hassani, M. (2024). Poultry manure as an organic fertilizer: Benefits and composition. *Journal of Agricultural and Food Chemistry*, 18(7): 321-335.
- He, X. and South, P. F. (2006). Root development and environmental factors. *Journal of Plant Physiology*, 128(4): 567-573.
- Indriyani, N.L.P., Hadiati, S. and Soemargono, A. (2011). The effect of planting medium on the growth of pineapple seedling. *Journal of Agricultural and Biological Science*, 6 (2): 43-48.
- Kane, R. (2022). Composition of poultry manure: Nutrient content and forms. *Journal of Environmental Quality*, 36(5): 187-198.
- Kumar, R. and Srivastava, A. (2010). Effect of pre-sowing and depth on germination capacity of castor (*Ricinus communis*) seeds. *Advances in BioResearch*, 1: 160- 162.
- Laughlin, T. (2022). Understanding potting soils: Composition and sterilization methods. *Journal of Horticultural Science and Technology*, 30(1): 112-125.
- McClellan, S. and McClellan, T. (2024). The role of topsoil in water filtration and nutrient retention. *Environmental Science and Technology*, 28(3): 112-125.
- McLean, E. O. (1982). Soil pH and lime requirement. In Page, A. L., Miller, R. H. and Keeney, D. R. (eds.), *Methods of soil analysis, Part 2: Chemical and microbiological properties*, American Society of Agronomy, 199-224.
- Mtambalika, K., Munthali, C., Gondwe, D. and Missanjo, E. (2014). Effect of seed size of *Azizelia quanzensis* on germination and seedling growth. *International Journal of Forestry Research*, 1 - 5.
- Olaria, M., Nebot, J.F., Molina, H., Troncho, P., Lapena, L. and Llorens, E. (2016). Effect of different substrates for organic agriculture in seedling development of traditional species of Solanaceae. *Spanish Journal of Agricultural Research*, 14 (1):8001- 8013.
- Olle, M., Ngouajio, M. and Siomos, A. (2012). Vegetable productivity as influenced by growing medium; A Review. *Agriculture*, 99 (4): 399-408.

- Owolade, O. F. and Omomoh, B. A. (2018). Effect of poultry manure on growth and yield of ginger (*Zingiber officinale*) in potting media. *Journal of Horticultural Science*, 25(4): 320-329.
- Pinheiro, M.G., Souza, C.A., Carneiro, J.F.C., Jr., Elijanara Raissa Silva, E.R. and Vieira Stefen, D.L. (2018). Initial development of wheat and triticale under different sowing depth. *American-Eurasian Journal of Agricultural Environmental Science*, 18; 206–215.
- Rivera, A. (2024). Why is topsoil the most fertile layer of soil? Nutrient-rich soil. *Journal of Soil Science*, 10(2):45-58.
- Rodríguez, M. N. S. and Cassab, G. I. (2021). Primary root and mesocotyl elongation in maize seedlings: Two organs with antagonistic growth below the soil surface. *Journal of Plant Sciences*, 10(7): 12-74.
- Romaneckas, K., Steponavičius, D., Jasinskas, A., Kazlauskas, M., Naujokiene, V., Bručienė, I., Švereikaitė, E. A and Šarauskis, E. (2022). How to analyze, detect and adjust variable seedbed depth in site-specific sowing systems: A case study. *Agronomy*, 12, 10-92.
- Seyed, S.H. (2011). Effect of seed size on germination and seedling growth of some lentil genotype (*Lens culinaris* Medik). *International Journal of Agriculture and Crop Science*, 3: 1-5.
- Sharma, Reetika, Bakshi, India, Kumar, Rakesh, Lal, India, Kashmir, Jammu, Bakshi, Parshant, Kumar, Rakesh, Lal and Manmohan. (2023). Effect of growing media on fruit crops: A review. *Pharmaceutica Analytica Acta*, 12: 1364-1369.
- Umeoka, N. and Ogbonnaya, C. I. (2016). Effects of seed size and sowing depth on seed germination and seedling growth of *Telfairia occidentalis* (Hook F.). *International Journal of Advances in Chemical Engineering and Biological Sciences*, 3(2): 201-207.
- Verdonck, O., De Vleeschauwer, D. and Verdonck, F. (1982). The influence of the substrate to be used and the seed density on the cultivation of tomato plants. *Acta Horticulturae*, 126:259-267.
- Walkley, A. and Black, I. A. (1934). An examination of the Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. *Soil Science*, 37(1): 29-38.