

**EVALUATION OF THE GERMINATION OF X SEED TYPES STORED
UNDER HERMETIC CONDITIONS.**

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**A PROJECT SUBMITTED TO THE DEPARTMENT OF CROP SCIENCE, FACULTY
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AGRICULTURE (B. AGRIC) IN CROP SCIENCE**

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CERTIFICATION

This is to certify that the work in this report entitled "**EVALUATION OF THE GERMINATION OF X SEED TYPES STORED UNDER HERMETIC CONDITIONS**" was carried out by **Efosa Favour OKHUAROBO (AGR1810410)** in the Department of Crop Science, Faculty of Agriculture, University of Benin, Benin City, Edo State, Nigeria.

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Date

DEDICATION

This work is dedicated to God Almighty for His faithfulness and guidance all through the years of my academic sojourn. It is also dedicated to my parents, RTD MWO Paul Okhwarobo and Late. Dcns. Mrs Rosemary Okhwarobo.

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ABSTRACT

This study investigated the germination potential of 21 different seed types stored under hermetic room temperature conditions at the University of Benin, Nigeria for 3 years. Germination trials revealed that only one seed type, snake tomato (*Trichosanthes cucumerina*), exhibited successful germination at 83.3%.

CHAPTER ONE

INTRODUCTION

Good seed storage is vital for Agricultural productivity. At the United States central seed storage laboratory, some seeds have been in storage for over 50 years. Here at the Faculty of Agriculture, all seeds are stored under hermetic room temperature. Usually, seeds stored under such condition may not remain viable for many years even when no insect damage occurs during storage. Seed germination is a critical process in plant propagation and the establishment of new plant populations. It is influenced by various factors, including seed viability, storage conditions, and environmental factors (Bewley *et al.*, 2013). This project aimed to evaluate the germination potential of 21 different seed types stored under hermetic room temperature conditions at the University of Benin, Nigeria.

The storage of seeds plays a vital role in preserving their viability and ensuring successful germination. Hermetic storage, which involves sealing seeds in an airtight container, is a commonly employed method to maintain seed quality and prevent moisture loss or gain (Rao *et al.*, 2006). However, the effectiveness of this storage method may vary depending on factors such as seed type, storage duration, and environmental conditions (Hay *et al.*, 2015).

In this study, 21 different seed types were collected and stored under hermetic room temperature conditions at UNIBEN. Germination trials were conducted to assess the germination of these stored seeds. Interestingly, out of the 21 seed types evaluated, only one seed type, *Trichosanthes cucumerina*, germinated successfully.

The successful germination of *Trichosanthes cucumerina* is attributed to the fact that this particular seed was freshly obtained, indicating a higher viability compared to the other seed types that had been stored for a period of 3 years. Fresh seeds often exhibit superior

germination rates and vigor due to their inherent physiological state and lack of exposure to prolonged storage conditions (Copeland and McDonald, 2001).

This project aimed to investigate the germination potential of stored seeds under hermetic room temperature conditions and explore the factors that might have contributed to the observed germination outcomes. By evaluating the germination success of different seed types, insights can be gained into the efficacy of hermetic storage and the potential need for alternative storage methods or seed treatments to enhance germination success (Probert *et al.*, 2009).

1.1 Objective of study

The objectives of the current study were:

- (1) To determine the germination percentage of some stored seeds under hermetic conditions.
- (2) To reproduce the viable seeds to new seeds.

CHAPTER TWO

LITERATURE REVIEW

Seed germination is a fundamental process in plant life cycles, and understanding the factors that influence germination is crucial for successful plant propagation, conservation, and ecosystem restoration. Several studies have explored the effects of storage conditions, seed viability, and various treatments on germination success.

2.1 Storage Conditions and Seed Viability

Proper seed storage is essential for maintaining viability and ensuring successful germination. Hermetic (airtight) storage is a widely used method for seed preservation, as it helps regulate moisture content and prevent damage from insects and microorganisms (Rao *et al.*, 2006). However, the effectiveness of hermetic storage can vary depending on factors such as seed type, storage duration, and environmental conditions (Hay *et al.*, 2015).

Copeland and McDonald (2001) reported that seed viability and longevity are influenced by several factors, including initial seed quality, moisture content, temperature, and storage atmosphere. They emphasized the importance of maintaining optimal storage conditions to minimize viability loss during storage. In a study by Probert *et al.* (2009), the authors investigated the ecological correlates of *ex situ* seed longevity and found that seed traits, such as seed mass and climate of origin, significantly influenced seed longevity under various storage conditions.

2.2 Seed Treatments for Germination Enhancement

Various seed treatments have been explored to enhance germination success, particularly for dormant or recalcitrant seeds. These treatments aim to break dormancy mechanisms or overcome physical barriers to germination.

Stratification, a process involving exposure to cold and moist conditions, has been shown to improve germination rates in many species (Baskin and Baskin, 2014). Similarly, scarification, which involves mechanically or chemically weakening the seed coat, can facilitate water uptake and promote germination (Kildisheva *et al.*, 2020). Priming, a controlled hydration process, has been demonstrated to enhance germination speed, uniformity, and overall germination percentage in various crop species (Parera and Cantliffe, 1994). Additionally, the use of plant growth regulator, such as gibberellic acid, was reported to promote germination in certain species (Kucera *et al.*, 2005).

2.3 Germination Studies and Species-specific Responses

Numerous studies have investigated germination responses of different plant species under various storage conditions and treatments. These studies highlight the species-specific nature of germination requirements and the importance of understanding the unique characteristics of each species.

For instance, *Trichosanthes cucumerina*, a member of the Cucurbitaceae family, has been reported to exhibit high germination rates when fresh seeds are used (Rajamanickam *et al.*, 2018). However, the long-term storage of these seeds and its impact on germination potential may require further investigation.

2.4 Factors Influencing Hermetic Storage Efficacy

While hermetic storage has shown promising results, its effectiveness may vary depending on several factors, including seed type, seed moisture content, and storage duration (Murdock and Baoua, 2014; Ng'ang'a *et al.*, 2016).

Seed Type: Different seed types may respond differently to hermetic storage conditions due to variations in seed coat composition, dormancy mechanisms, and physiological characteristics (Yaklich, 1985; Murdock and Baoua, 2014). Some seeds may be more

sensitive to the modified atmosphere created by hermetic storage, potentially affecting their germination and viability.

Seed Moisture Content: Appropriate seed moisture content is crucial for successful hermetic storage. High moisture levels can promote fungal growth and seed deterioration, while excessively low moisture levels may lead to desiccation and loss of viability (Murdock and Baoua, 2014; Likhayo *et al.*, 2018).

Storage Duration: The efficacy of hermetic storage may be influenced by the duration of storage. While hermetic conditions can effectively preserve seed viability in the short to medium term, prolonged storage periods may eventually lead to seed deterioration and reduced germination rates (Murdock and Baoua, 2014; Hay *et al.*, 2015).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Experimental Site

The Experiment was conducted during the rainy season at University farm at Ogida quater, Benin city. The temperature at maximum was about 37°C and with minimum near 21°C and an annual rainfall.

3.2 Source of planting materials

Twenty-one seed types representing a diverse range of crop species were selected for this study. The seed types included legumes (e.g., *Centrosema pascuorum*, *Aschynomene histrix*, Tamba, *Stylosanthes hamata*), vegetables (e.g., *Amaranthus*, egg plant, onion, melon, *Trichosanthes cucumerina*), and other economically important plants (e.g., maiwa, jute, Coriander, *Cassia alata*). The seeds were obtained from reputable sources, including local markets, agricultural research stations, and certified seed suppliers.

3.3 Land Preparation

Land was manually cleared and debris removed. The field was marked for laying out, direct seed sowing. With two *Trichosanthes cucumerina*. Each seed lots were replicated 3 times with 4 seed per replicate, gaining 36 and 72 seeds per seed lot.

NOTE: OF the 21 seeds, only snake tomato was viable and thus used for further study.

3.4 Fertilizer Application

The poultry manure used for the experiment was incorporated into the respective stands at 4 weeks after sowing to improve growth.

3.5 Weeding

The experimental plot was manually weeded by hand pulling at about 3 weeks after sowing.

3.8 Variable Measured

Data Collection was taken at 5 WAS

Vine length (cm): the germinated plant *Trichosanthes cucumerina* was measured with a meter rule from the base of the plant to the apical tip.

Number of leaves: The germinated plant leaves were counted at 5 WAS.

Days of Emergence

3.9 Statistical Analysis

Data collected were subjected to Analysis of variance (ANOVA) using SAS (statistical analysis software) and least significant differences (LSD).

CHAPTER FOUR

RESULTS

TABLE 1: The germination percentage of the seeds preserved under room temperature for a period of 3 years.

S/NO	Name of Seeds	% germination
1	<i>Pennisetum glaucum</i> (Maiwa millet)	0
2	<i>Centrosema pascuorum</i> (Treated)	0
3	<i>Amaranthus cruentus</i> (Red Amaranth)	0
4	<i>Aeschynomene histrix</i> (Prickly joint-vetch)	0
5	<i>Centrosema pascuorum</i> (Untreated)	0
6	<i>Eleusine coracana</i> (Tamba millet)	0
7	<i>Corchorus olitorius</i> (Ewedu)	0
8	<i>Solanum melongena</i> (European Egg plant)	0
9	<i>Allium cepa</i> (Onion)	0
10	<i>Stylosanthes hamata</i> (Caribbean stylo)	0
11	<i>Solanum melongena</i> (Egg plant)	0
12	<i>Crescentia alata</i> (Calabash)	0
13	<i>Amaranthus viridis</i> (Green Amaranth)	0
14	<i>Coriandrum sativum</i> (Coriander)	0
15	<i>Cucumis melo</i> (Muskmelon)	0
16	<i>Cassia alata</i> (Candle bush)	0
17	<i>Tagetes erecta</i> (African marigold)	0
18	<i>Digitaria exilis</i> (Gero millet)	0
19	<i>Trichosanthes cucumerina</i> (snake tomato)	83.3

TABLE 2: Comparison of 2 seedlot of *Trichosanthes cucumerina* seed

Variables	Seedlot 1	Seedlot 2	P. Value	Significance
Number of days to emergence	5.35	7.32	0.010	**

Number of leaves(cm)	22.33	20.00	0.389	ns
Vine length(cm)	62.08	37.88	0.142	ns
** = for 1% level of significance			ns = not significant	

CHAPTER FIVE

DISCUSSION

The results of this study highlight the challenges associated with maintaining seed viability and promoting germination under hermetic storage conditions at room temperature, out of the 19 seed types evaluated, representing legumes, vegetables, and other economically important plants, only one seed type, *Trichosanthes cucumerina*, exhibited successful germination, because it was the only seedlot stored for 1 year.

The successful germination of *Trichosanthes cucumerina* seeds can be attributed to their freshly obtained status, indicating higher viability compared to the other seed types that had been stored for a period of 3 years. This observation aligns with previous research demonstrating that fresh seeds often exhibit superior germination rates and vigor due to their inherent physiological state and lack of exposure to prolonged storage conditions (Copeland and McDonald, 2001; Rajamanickam *et al.*, 2018).

The failure of the remaining 18 seed types to germinate following storage in hermetic room temperature storage conditions can be attributed to various factors. One potential factor could be the initial seed quality and viability, which can be influenced by environmental conditions during seed development, maturation, and post-harvest handling (Hay *et al.*, 2015). Additionally, the storage duration and the specific storage conditions, such as temperature and humidity levels, may have also contributed to the observed lack of germination (Rao *et al.*, 2006).

It is important to note that different plant species may have varying requirements for optimal storage conditions and germination stimuli. Some species may exhibit dormancy mechanisms or physical barriers that require specific treatments, such as stratification,

scarification, or the application of plant growth regulators, to promote germination (Baskin and Baskin, 2014; Kildisheva *et al.*, 2020).

Furthermore, the effectiveness of hermetic storage may vary among different seed types due to their inherent characteristics, such as seed size, composition, and physiological traits (Probert *et al.*, 2009). Some seeds may be more sensitive to prolonged storage conditions, leading to a decline in viability over time, even under hermetic conditions.

While hermetic storage is generally considered an effective method for seed preservation, the findings of this study suggest that it may not be sufficient for maintaining seed viability and promoting germination success across all seed types, especially when stored for extended periods or under suboptimal conditions.

Additionally, conducting viability tests prior to germination trials could provide valuable insights into the potential germination capacity of stored seeds and guide the selection of appropriate treatments or storage.

CONCLUSION

Improper seed storage conditions lead to catastrophic loss of seed viability exhibited by 0% emergence of tested seeds. *Trichosanthes cucumerina* was the only seed type that germinated following 1year under hermetic storage.

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