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Effect of Some Packaging Materials on Seed Viability of *Arachis hypogaea* L (Groundnut)

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Abstract

This study investigates the effect of various packaging materia
ls on the seed viability of Groundnut (*Arachis hypogaea*), SAMNUT 24 variety. Conducted at the Department of Biological Science laboratory, Ibrahim Badamasi Babangida University, the experiment employed a complete randomized design with five packaging materials:namel; polythene bag, paper bag, cloth bag, aluminum foil, and jute bag. Each material contained 1 kg of seeds, stored for six months. Post-storage, a germination test was performed using 20 seeds from each packaging type, with parameters including germination percentage, germination index, germination rate index, and vigor index assessed after seven days. Results indicated that packaging materials significantly affected seed quality, with aluminum foil demonstrating the highest germination percentage (98.34%) and vigor index (3423.06), followed closely by polythene bags. In contrast, cloth bags yielded the lowest values for both germination percentage (67.45%) and vigor index (987.45). These findings align with existing literature suggesting that effective packaging is crucial for preserving seed viability by protecting against environmental factors. The study underscores the importance of selecting appropriate packaging materials to enhance seed quality and agricultural productivity, with aluminum foil and polythene bags as the most effective in groundnut seed storage.

Key Words: *germination index, storage, polythene , paper cloth , aluminum foil, jute bag*

Introduction

Groundnut (*Arachis hypogaea* L.) is a leguminous oil seed plant grown in semi-arid and sub-tropical regions across the globe (Hussainy et al., 2020). The peanut (*Arachis hypogaea*), also known as the groundnut is a legume crop grown mainly for its edible seeds. It is widely grown in the tropics and subtropics, important to both small and large commercial producers. It is classified as a grain legume and, due to its high oil content, an oil crop (Variath and Janila 2017). The world's annual production of shelled peanuts was 44 million tonnes in 2016, led by China, which made up 38% of the world's total production (Variath and Janila 2017)..

Kebede, (2021) reported that groundnut enhances soil fertility through nitrogen fixation, increasing crop productivity when integrated into crop rotation or cereal farming systems. The limited success of groundnut cultivation in African nations can be attributed to a combination of factors (Mwalongo, et al., 2020). These include unreliable rainfall, predominantly rain-fed farming practices, traditional small-scale farming with minimal mechanization, occurrences of pests and diseases, the use of low-yielding varieties, continued cultivation on suboptimal lands, insufficient adoption of modern agronomic techniques, lack of extension services and poor storage of Groundnut seeds which result to low germination percentage.

Several factors are responsible for declining groundnut yield in Sub-Saharan Africa (Abady et al., 2019). This includes declining soil fertility, pest, and disease incidence as well as germination failure as a result of poor-quality seeds. Enyiukwu et al. (2020) reported that germination failure in groundnuts occasioned by inappropriate storage environments and packaging materials. It is expedient to ascertain the most appropriate packaging material for the preservation of groundnut seed quality.

As a result of poor storage of Groundnut (*Arachis hypogaea* L), farmers have been faced with the problem of low germination percentage, which leads to low yield. Therefore, this study will aim to evaluate the effects of some packaging materials on seed viability of groundnut (*Arachis hypogaea* L) as this will ensure long term storage of the crop.

Materials And Method

Experimental Site

The experiment was conducted at the Laboratory of Department of Biological Science Faculty of Natural Sciences, Ibrahim Badamasi Babangida University main campus, Lapai, Niger State, Nigeria which lies between the latitude of 9.0674ON and longitude 6.5618OE.

Samples Collection

Groundnut *(Arachis hypogeae)* SAMNUT 24 variety was obtained from the Seed Center, Joseph SarwuanTarka University Makurdi, Benue State

Experimental Design

The experiment consisted of one variety of groundnut, (SAMNUT 24) and five (5) packaging materials (polythene bag, cloth bag, paper bag, Aluminium foil, paper bag and jute bag). One kilogram (1kg) of the groundnut variety was measured and kept in each of the packaging materials and stored for duration of 6 months at room temperature

Seed Viability Tests of the groundnut samples

Germination test

After storage, 20 seeds from each of the packaging materials were placed in a petri-dish with filter paper. A total of 25 petri-dishes were used. 5 petri-dishes representing each of the 5 packaging materials and were arranged in a complete randomized design (CRD) in ttriplicates. The seeds in each of the petri-dishes were watered daily and the following parameters shall be calculated:

- $G\% = \frac{\text{Total no.of seedlings emerged}}{\text{Total no.of seeds sown}}$ x 100 (Fakorade and Ojo, 1981)
- $GI = \frac{number\ of\ germinated\ seeds}{days\ of first\ count} + \cdots + \frac{\text{number of germinated seeds}}{days\ of\ final\ count}$ (AOSA, 1983)
- $GRI = \frac{\text{EI}}{\text{E\% (in decimal)}}$ (Fakorade and Ojo, 1981)

Seedling vigor index I, was calculated by multiplying the germination percentage with the mean shoot and root length after 7 days of germination.

Vigor index I = germination percentage × seedling shoot + root length in cm (Beedi et al., 2018).

Data Analysis

Data collected on all the parameters was subjected to analysis of variance (ANOVA) using the Minitab 2017 version and significant means will be separated using Fischer's Least Significant Difference (F.S.L.D) at 5% level of probability.

Results

Mean Squares from Analysis of Variance for Seed Quality of Groundnut

The mean squares from the analysis of variance for the physiological seed quality of groundnut is shown in Table 1. The table showed that packaging materials had a highly significant ($p \leq 0.01$) effect on germination percentage and germination index. On the other hand, packaging material was significant ($p \leq 0.05$) for germination rate index and vigor index.

Table 1. Mean Squares from Analysis of Variance for Seed Quality of Groundnut

SOV	DF	Germination %	Germination Index	Germination Rate Index	Vigor Index
Replication	2	234.23	12.01	651.80	11.56
Packaging Material	4	112.23**	131.92**	121.89*	123.90*
Error	4	36.34	23.46	67.10	38.12

Mean Effect of Packaging Materials on Seed Quality of Groundnut

The result of the mean effect of packaging materials on physiological seed quality of groundnuts is indicated in Table 2. The result of this table showed that seeds stored with aluminium foil recorded the highest germination percentage (98.34), although not significantly higher than those stored in polythene bag (95.97) but were significantly different from seeds stored in paper bag (76.34), cloth bag (67.45) and jute bag (79.52). Seeds stored in cloth bag recorded the lowest germination percentage. Similarly, the germination index was significantly highest in seeds stored in aluminium foil (34.45) but it was not statistically different from seeds stored in polythene bag (34.94). However, both were significantly different from the paper bag (23.78), jute bag (24.82), and cloth bag (25.52).

The lowest germination index was recorded by seeds stored in paper bag. A similar observation was recorded germination rate index where seeds stored in aluminium foil producing the highest germination rate index (401.02) and seeds stored in cloth bag producing the lowest germination rate index (267.98). The vigor index also was observed to follow a similar trend with aluminium foil and polythene bag producing significantly highest vigor index 3423.06 and 3211.90 respectively. Seeds stored in cloth bag were observed to produce the least vigor index (987.45).

Table 2. Mean Effect of Packaging Materials on Seed Quality of Groundnut

Packaging Material	Germination %	Germination Index	Germination Rate Index	Vigor Index
Polythene Bag	95.97	34.94	398.23	3211.90
Paper Bag	76.34	23.78	287.89	1000.40
Cloth Bag	67.45	25.52	267.98	987.45
Aluminum Foil	98.34	35.45	401.02	3423.06
Jute Bag	79.52	24.82	301.02	1343.22
FLSD (P<0.05)	2.12	4.56	3.67	5.12

Discussion

The results of study reveals the significant impact of packaging materials on key seed quality parameters, including germination percentage, germination index, germination rate index, and vigor index. This underscores the critical role of packaging choices in influencing the overall quality of groundnut seeds. This falls in agreement with (Tiwari *et al*., 2022; Dadlani et al., 2023) who also maintained that adequate packaging can additionally safeguard the seeds against environmental factors (temperature and relative humidity) that cause seed deterioration, thereby preserving the integrity of their quality while in storage. Notably, different packaging materials exert varying levels of influence on these parameters, emphasizing the importance of making informed decisions regarding packaging materials to optimize seed quality.

Specifically, the study demonstrates that seeds stored in aluminium foil and polythene bags exhibit the highest germination percentages, which are essential for successful crop establishment. Conversely, seeds stored in paper bags, cloth bags, and jute bags show significantly lower germination percentages. Similarly, Haque, (2014) reported that polythene bags surpassed other storage materials excluding aluminium foil, in terms of achieving superior outcomes regarding germination rates, field emergence, and vigor index. This could be attributed to the fact that polythene prevents the influence of the seed and its external environment thereby preserving its quality.

Furthermore, the vigor index, a comprehensive measure of seed quality, indicates that aluminium foil and polythene bags excel in maintaining seed vigor, while cloth bags yield the lowest vigor index. This suggests that seeds stored in aluminium foil and polythene bags are more likely to produce robust and healthy plants, reinforcing the importance of packaging materials in achieving optimal seed quality. In support of this finding, Affognon et al., (2017) reported that aluminium foil as one of the best packaging materials for viable and vigorous seeds. Similarly, Mutungi et al., (2019). Also agrees with this findings.

These results have practical implications for agricultural practices and seed storage. Farmers and seed producers can use this information to make informed decisions about the choice of packaging materials for groundnut seeds. For optimal seed quality and crop performance, aluminium foil and polythene bags are more effective options compared to paper bags, cloth bags, or jute bags.

Conclusion

The research reveals that the seed viability of groundnuts, indicated that packaging materials have a significant role as far as the seed quality of groundnuts is concerned. Aluminium foil produced the highest seed quality in terms of generation percentage, germination index, germination rate index and vigor index. On the other hand, cloth bag gave the lowest seed quality.

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