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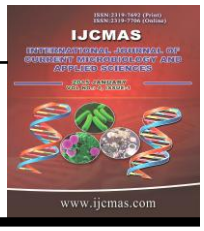


**Original Research Article**

# Comparative Efficacy of Different Species of Pepper (*Capsicum spp*) in the Control of Stored Groundnut (*Arachis hypogea L*) Damage by Pest of Groundnut amongst the TIV Speaking People of the North Central Nigeria

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**A B S T R A C T**

The preservation of groundnut (*Arachis hypogeal* L) using three species of chilli pepper (*Capsicum* spp) against storage pests of groundnut was investigated among the Tiv speaking people of North Central Nigeria. Experiments were set up using Completely Randomized Design (CRD) where mean weight losses of groundnut were analysed using Fishers Least Significant Difference (FLSD). The three species of pepper treatments showed varying degrees of efficacy in the storage of groundnut against stored groundnut pests. Groundnut treated with moderately hot pepper (*Capsicum frutesecen*) recorded the least loss in weight to the insect pest of groundnut during the 12 weeks of the experiment with mean value of 16.16g, followed by groundnut treated with very hot pepper (*Capsicum chinense*) with a loss of 22.58g. Groundnut treated with sweet pepper (*Capsicum annum*) had the highest value with mean weight loss of 31.8g. Based on this finding, all the three species of chilli pepper are potent preservatives for the storage of groundnut seeds against its pests (*Caryedon serratus* and *Tribolium castaneum*) though the moderately hot species of pepper is the most effective of the three. This natural and cheap biological method of seed preservation may help reduce or eradicate groundnut seed damage by insects without itself being reduced in quality. Therefore, it shall help the farmers preserve their seeds all year round while retaining their viability.

**Keywords**

Groundnut,
Pepper,
Pest,
Storage,
Preservation,
Viability

## Introduction

Groundnut (*Arachis hypogea L)* is a cultivated annual Herb grown in many tropical and sub-tropical countries and in the continental parts of temperate countries between $40^0$N and $40^0$S. This wide range can be attributed to its adaptability to a variety of soil and climatic conditions and its value as a food crop, oil source and animal feed. It is the thirteenth most important food crop and fourth most important oilseed crop of the world (Radha *et al.*, 2011). It is also called peanut. The cultivated groundnut or peanut originated in South America. It is thought to have originated in the eastern foothills of the Andes in southern Bolivia/North Western

Argentina. The early Spanish and Portuguese explorers of the new world found groundnut growing wide in the South America and the west India Islands.

There is no evidence for the spread of groundnut to the old world prior to the fifteenth century explorations. This crop was grown widely by native people of the new world at the time of European expansion in the sixteenth century and subsequently taken to Europe, Africa, Asia and the Pacific Islands.The genus *Arachis* has more than 70 wild Species of which only *arachis hypogea* is domesticated and commonly cultivated. China is the largest producer of groundnut followed by India, who together account for approximately 60% of the total world production.

Groundnut is the 4$^{th}$ most important oil seed crop in the world. It contains 48-50% oil, 26-28% protein and 11-27% carbohydrate, minerals and vitamin (Mukhtar, 2009). Presently, it provides significant sources of cash through the sales of seeds, cakes, oil and haulms (Olorunju *et al*., 1999). Groundnut is either cultivated sole or in mixture with other crops like maize, sorghum, millet or cassava. More than half of the production area, which accounts for 70% of the groundnut growing area fall under arid and semi-arid regions, where groundnuts are frequently subjected to drought stresses for different duration and intensities (Reddy *et al.,* 2003).

More than 100 insect species are known to live and feed on stored groundnuts (Nandagopal and Prasad, 2004). The most commonly reported insect pests of groundnut are groundnut bruchid (*Caryedon serratus*) and red flour beetle (*Tribolium castaneum*). Reports on damage seeds of legumes by these insects in storage as well as in the field from different parts of the world have been well documented (Cunningham and Walsh, 2002, Nandagopal and Prasad, 2004). These may affect the seed quality and pose serious threat to farmers and consumers. Seed quality in terms of seed viability may be expressed by percentage germination as an indication of the number of seedlings produced by a given number of seeds (Aguoru *et al.,* 2015). Vigour index value which is the totality of germination and seedling growth has been regarded as a good index to measure the vigour of seeds (Basavegowda *et al*., 2003; Reddy and Biradarpatil, 2012; Anjorin *et al.*, 2011; Aguoru *et al.,* 2015). Insects are known to cause damages through weight reduction in stored groundnut seeds. This work is aimed at investigating the efficacy of Capsicum species in the preservation of harvested groundnut seeds amongst the peasant farmers of Tiv speaking people of Benue State in North central Nigeria. The farmers grow both pepper and groundnut. If it turns out that pepper could help reduce some groundnut seed damage by insects without itself being reduced in quality, it shall help the farmers preserve their seeds all year round.

## Materials and Methods

Groundnut seeds used for the experiment were the local variety obtained from different markets of twelve (12) Local Government areas where the Tiv speaking people of Benue State reside. The groundnut seeds were sorted to remove undersized and/or discolored seeds. The seeds were then sun dried for 24 hours and then rocked in an airtight plastic container.

The plant products tested for insecticide activities were dried pepper fruits (*Capsicum spp*).

Covered transparent one litre plastic containers were used. The central portion of each lid was perforated using a stainless pin

of 0.5mm in diameter with five holes. A bulk of infested groundnut seeds was collected they were thoroughly checked to remove dead insects. Single concentrated level of 20g of whole dried fruits each of pepper species and 500 seeds of groundnut seeds with the control were measured and mixed into one litre flat bottom plastic containers.

A total of ten (10) insect pests of groundnut (*Caryedon serratus* and *Tribolium castaneum*) were introduced to each container in equal proportion. Each pepper species and the control were replicated three times in completely randomized design and stored at a room temperature of ($30^0 \pm 2^0$c). Weight loss of stored groundnut seeds per treatment of each pepper species was recorded. For each species, the change in weight was calculated from the varietal weight reduction for every two weeks during the experimental period. From the initial weights the mean weight reduction of the groundnut were also calculated. Data collected were analyzed using Completely Randomized Design (CRD) and their mean separated by Fishers Least Significant Difference (FLSD).

## Result and Discussion

The three species of pepper treatments showed varying degrees of efficacy in the storage of groundnut against stored groundnut pests (figure 1 and 2). Groundnut treated with moderately hot pepper (*Capsicum frutesecen*) recorded the least loss in weight to the insect pest of groundnut with mean value of 16.16g, followed by groundnut treated with very hot pepper (*Capsicum chinense*) with a loss of 22.58g. Groundnut treated with sweet pepper (*Capsicum annum*) had the highest value with mean weight loss of 31.8g (table 1).

Hulmez and Buszewicz (1958) defined seed storage as the preservation of viable seeds from the time of collection in the field until they are required for sowing or when needed for other purposes. Local means of seed preservation is an age long practice among peasant farmers of Nigeria who prefer the most effective, readily available but cheap methods, but in most cases lack scientific proofs (Olorunju *et al*., 1999). The factors that may affect the quality of seed storage include the quality of packaging, natural seed tolerance or sensitivity to changes (genetic constitution), environmental conditions and moisture content as well as the biotic factors such as fungal and insect attack (Barton, 1961; Cogoni and Macino, 2000; Omoigui, 2014). Among these factors, insect attack still remains the most devastating (Barton, 1961). This is because insects and other pests are known to grow in a suitable energy source in a geometric fashion similar to bacterial growth pattern. The larvae of insects are known to have destructive activities on stored seeds through feeding (Cunningham and Walsh, 2002) which often biodeteriorate the seed and reduce its weight. The problem becomes more compounded under chemical treatments which may witness a phenomenon of pest resurgence (Taylor *et al*., 2007).

However, the common practice of using local pepper species among the Tiv speaking people of Nigeria has been scientifically confirmed to be potent and effective against both *Caryedon serratus* and *Tribolium castaneum* studied. It has also been established that the three species of pepper contain varying levels of potent active ingredients with insecticidal and biocidal effects but the most effective one is present in the moderately hot pepper (*Capsicum frutesecen*) (figure 1 and 2).

**Table.1** The Total and Mean weight loss of Groundnut treated with different pepper species in grammes

| Treatments | Initial Weight | WK2 | WK4 | WK6 | WK8 | WK10 | WK12 | TOTAL | MEAN |
|---|---|---|---|---|---|---|---|---|---|
| **Sweet Pepper** | 278.34 | 2.6 | 2.9 | 28.7 | 41 | 54.6 | 61 | 190.8 | 31.8 |
| **Moderately Hot Pep** | 288.41 | 0.9 | 1.8 | 12.3 | 22.3 | 27.9 | 31.8 | 97 | 16.16 |
| **Very Hot Pepper** | 290.4 | 0.6 | 0.8 | 18.7 | 31.1 | 39.8 | 44.5 | 135.5 | 22.58 |

Legend: WK = week; Pep = pepper

**Fig.1** Bar Chart of Mean Weight loss of Groundnut Treated with Different pepper species

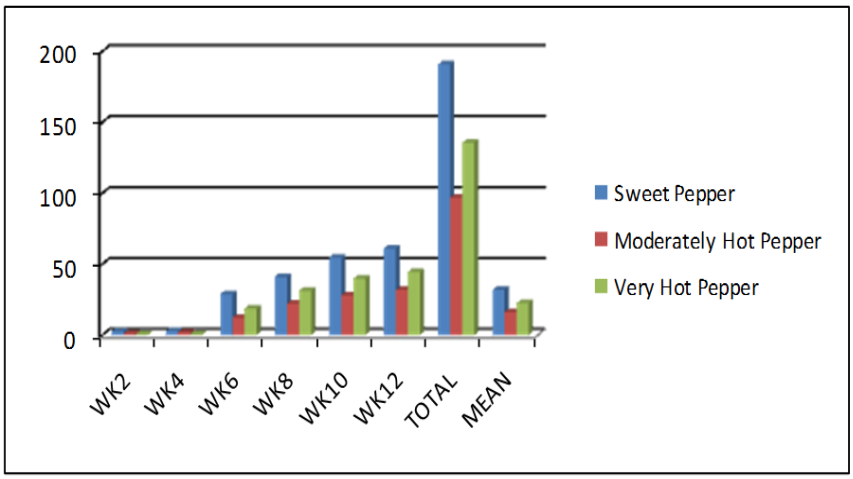
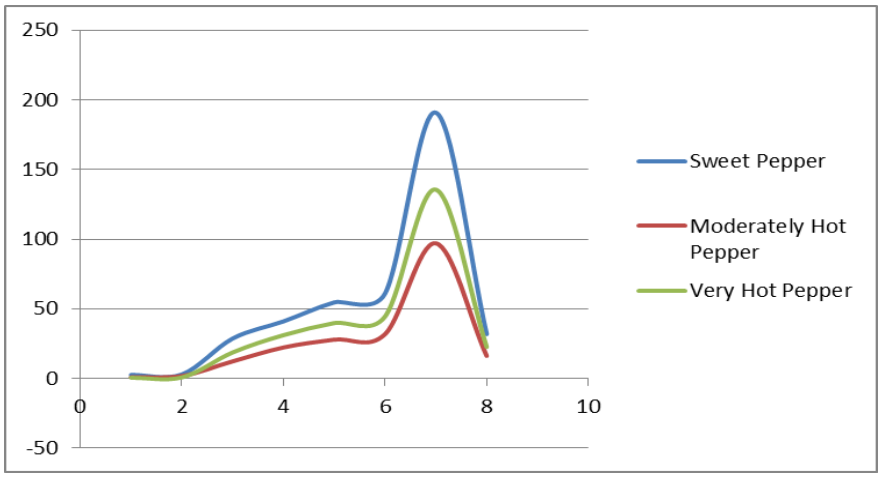



**Fig.2** Line graph of total and mean weight loss of Groundnut Treated with different pepper species



This biological biocide is particularly more advantageous over the chemical type being environmentally friendly, cheap, natural, non-toxic to human and specific. These properties therefore satisfy basic environmental laws as enacted by various national and global environmental agencies (FEPA, 2015). Due to the inimical and toxic effects of chemical preservatives (Taylor *et al*., 2007), preservation of seeds using pepper therefore provides a convenient and cheap natural alternative to farmers without side effect. The capsaicin content of the chilli pepper being an acrid and volatile alkaloid may therefore be responsible for this insecticidal action. It can be deduced that its sharp pungency acts as good repellant which could be toxic to insect larvae. This may therefore find application in insect autecological studies apart from seed preservation. Capsaicin may therefore be applied as a density independent growth regulator of controlling insect population growth.

In conclusion, the use of pepper as a natural insecticide may open a new window in the scientific method of handling groundnut seed which may be extended to other known seeds. However, all other conditions of good storage should be met (Reddy and Biradarpatil, 2012) while bearing in mind that seed longevity and viability vary from species to species even when given identical treatments and storage conditions (Aguoru *et al*., 2015). It is therefore suggested that more intensive research is required in this area to further elucidate the biocidal effect of species of pepper on different biotic agents of groundnut seeds such as bacteria, fungi and other known pests.

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