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Evaluation of Varietal Differences and Storage Materials on Some Fungal Diseases and Germination of Cowpea

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Abstract: Cowpea (*Vigna unguiculata* L.) pods or grains could be stored in warehouse, silos, cribs, steel drums, rombus, earthen ware pots, plastic or gourds. A test was conducted to evaluate storage materials and varietal differences on some fungal diseases and germination of cowpea. It was found that cowpea stored in earthen pot recorded lowest percentage occurrence of Anthracnose followed by those stored in jute, when those stored in plastic bag recorded highest. IAR1696 and IT89KD-374 recorded similar but low percentage occurrence of Anthracnose in all the storage materials investigated. These varieties recorded similar but lowest percentage germination in all the storage materials when IT89KD-374 and IT93K-452-1 recorded but highest percentage germination. Cowpea stored in jute recorded highest mean percentage germination (89.2), when those stored in plastic bag recorded lowest 75.8%. Cowpea variety IT89KD-288 recorded lowest percentages germination irrespective of the storage material used, when other varieties recorded higher but similar percentages germination which fall with the range of 83.6-85.4. Investigation revealed that storage materials influence some fungal diseases development as well as the viability of the seed as determined by its germination percentage. On the other hand there were varietal influences on the percentage occurrence of some fungal diseases as well as germination of cowpea.

Key words: Storage materials, fungal diseases, germination, cowpea, varieties

INTRODUCTION

Cowpea (*Vigina unguiculata* (L.) Walp) is a very important grain legume tropical crop. The introduction of exotic cowpea into Nigeria began from the Royal Botanical Garden at kew and other places. In Nigeria cowpea is grown extensively as intercrop with maize, millet, sorghum, Yam or sometimes in rotation with cotton. It is a warm weather crop and best grown between 20 and 35°C. It can be cultivated all year round in as much as there are enough moisture and matures 3-4 months depending on the variety. Cowpea pods or grains could be stored in warehouse, silos, cribs, rhombus, steel drums, earthen ware pots, plastics or gourds (Ogunwolu, 1991; Umeh, 1994).

Cowpea serves as a major source of indigenous plant protein in Nigeria, which is the world's leading cowpea producer. Cowpea is vulnerable to attack by fungal pathogens at all stages of its growth as well as at storage, thus resulting to low viability, germination, seedling mortality and yield reduction. (Echebe,1981, Singh and Allen, 1979, Abdelmonem and Rasmy, 2000 and Richardson, 1990). Heavy infection of the seeds by *Colletotrichum capsici*, *Macrophomina phaseolina*, *Fusarium* sp. *Phomopsis* sp. and *Phoma* sp. cause disintegration/decay of seeds and seedlings (rot). (Richardson, 1990).

The several practices followed in cowpea storage exploit three factors, normally, temperature, oxygen and mobility, to reduce microbial growth and respiration that result to production of heat leading to rapid disintegration of the tissues of the seeds. This also increase insect population growth, as well as damage. It also provide entry point for fungal pathogens and the insects on another point, act as vectors of these pathogens. Mobility of insect is restricted by packing pods/grains tightly in

storage container and by admixing ash or sand with pods/grain. Also hermetic sealing of storage bags/containers prevent replenishment of oxygen to insect, thereby increasing mortality rate (Auda and Anda, 2002; Ogunwolu, 1991).

The objective of the study is to determine the effects of storage materials as well as varietal influences on some fungal diseases and germination of cowpea.

MATERIALS AND METHODS

One hundred seeds each from pods of 5 Cowpea varieties namely IFe brown 82s-124, IT89KD-288,IAR1696, IT89KD-374 and IT93K-452-1 were stored with 5 storage materials namely; Gourd, jute, plastic bag, earthen pot and plastic container under storage for 6 months, were randomly selected and the percentage occurrence of fungal diseases such as Anthracnose, Scab and rot were determined. The number of seeds/pods affected by each of these diseases were expressed as a percentage of sampled seeds. The sampled seeds were taken to the Laboratory to determine their germination ability.

Seed Germination

Laboratory petri dishes and 9 cm Whatman No.1 filter paper was sterilized in oven at 130°C for 1 h. Ten representative samples of each of five cowpea varieties currently under storage with five different storage materials were collected and soaked in distilled water for 30 min. The experiment was replicated three times in a Completely Randomised Design in three replications. The soaked seeds were carefully placed in the Petri-dishes with the aid of a forceps, covered and moistened daily with sterile distilled water. After 7 days, the number of seeds germinated per Petri-dish were counted and expresses as a percentage of total seeds placed per Petri-dish. Germination percentage at 7 Days After Sowing (DAS)

Disease Incidence

The disease incidence was obtained by visual observation and scoring and it was expressed as a percentage of the sampled seeds per treatment level.

The seeds affected by diseases were isolated and the micro-organisms responsible for the diseases were identified.

Isolation of the Pathogen

Five samples of seeds of each of the 5 cowpea varieties stored with 5 different storage materials that were affected by Antracnose, Scab and rot were examined and the pathogens isolated. The seeds were washed in running tap water and then rinsed in distilled water before they were cut into 5 mm segments where the pathogen was active. The segments were disinfected in 1% Sodium hypochlorite (NaOCL) solution for 3 min and rinsed in several changes of distilled water, dried in between sheets of sterile filter paper and then plated on fresh Potato Dextrose Agar (PDA) medium in 9.0 cm petri-dish. The dishes were incubated at 28°C for seven days. Three sub-cultures were made to obtain pure cultures of the pathogens. The pathogens were identified using the method adopted by Barnett and Hunter (1998). The treatment arrangement conformed with the Completely Randomized Design and data were analyzed using the Method of Steele and Torrie, 1981 and means separated using Fischer's Protected Least Significant Difference (LSD).

RESULTS

Results of the investigation revealed that cowpea stored in earthen pot recorded lowest percentage occurrence of Anthracnose (5.12) followed by those stores in jute (5.33) then gourd (6.28), followed by those in plastic container (6.38), when those stored in plastic bag was significantly high (7.06)

irrespective of the varieties (Table 1). Cowpea variety IT89KD-288 recorded highest percentage occurrence of Anthracnose followed by Ife-brown 825-124 erect while 1AR1696 and IT89KD-374 recorded similar but low percentage occurrence of the diseases, irrespective of the storage material used. Cowpea stored in Jute recorded highest percentage germination (89.2%) followed by those stored in Gourd (86.0%), then earthen pot (84.8%) when those stored in plastic container (79.2) and plastic bag (75.8%) recorded significantly low percentage germination, respectively. IT89KD-288 recorded significantly lower percentage germination 76.8% than any other variety investigated. However, the other four varieties recorded similar but high percentage germination irrespective of the storage material used (Table 2).

Investigation on the percentage occurrence of scab revealed that those stored with plastic container recorded significantly high occurrence of scab (7.34). This is in comparison with those stored in plastic bag (7.26) followed by those stored in Gourd (5.64) when those stored in earthen pot (3.80) and in Jute (3.66), respectively were low. IT89KD-288 recorded significantly high percentage occurrence of scab (7.96) irrespective of the storage material used. (Table 3). This is in comparison with Ife-brown 825-124 (5.18). Other three cowpea varieties recorded significantly similar but low percentage concurrence of scab irrespective of the storage material used (Table 3).

Result of the investigation conducted on pod rot revealed that cowpea stored in plastic container and plastic bag recorded significantly high pod rot 6.86 and 6.14, respectively. This is in comparison with those stored in gourd (5.90) and earthen pot (4.86), when those stored in Jute (3.58) were low

Table 1: Effects of storage condition on percentage occurrence of Anthracnose of cowpea varieties

	Storage material					
Cowpea varieties	J	EP	G	PC	PB	Mean
Brown 82-124	6.00	5.50	6.80	7.00	6.80	6.42
IT89KD-288	7.00	6.30	7.00	8.40	8.80	7.50
IAR 1696	4.40	4.80	6.20	6.80	6.40	5.72
IT89KD-374	4.00	4.60	5.80	5.20	6.50	5.64
IT93K-45-1	5.20	4.40	5.60	4.50	6.80	5.30
Mean	5.33	5.12	6.28	6.38	7.06	
$LSD_{0.05}$	1.50	0.92	1.10	0.85	1.01	

J = Jute, EP = Earthen Pot, G = Gourd, PC = Plastic Container, PB = Plastic Bag

Table 2: Effects of storage condition on Germination of cowpea varieties

	Storage material					
Cowpea varieties	J	EP	G	PC	PB	Mean
Ife brown 825-124	86.0	84.0	88.0	82.0	80.0	84.0
IT 89KD-288	82.0	76.0	82.0	74.0	70.0	76.8
IAR 1696	88.0	84.0	90.0	82.0	74.0	83.6
IT 89KD-374	94.0	86.0	86.0	80.0	80.0	85.2
IT93K-452-1	96.0	94.0	84.0	79.2	75.0	85.4
Mean	89.2	84.8	86.0	79.2	75.8	
$LSD_{0.05}$	4.2	5.8	6.4	7.8	6.8	

Table 3: Effects of storage condition on the frequency of occurrence of scab of cowpea varieties

	Storage material					
Cowpea varieties	J	EP	G	PC	PB	Mean
Ife brown 855-124	3.50	3.80	5.00	7.10	6.50	5.18
IT89KD-288	6.00	6.20	8.60	9.20	9.80	7.96
IAR9KD-1696	3.00	3.20	4.40	7.00	6.80	4.88
IT89KD-374	3.00	3.60	5.00	6.60	6.20	4.88
IT93K-452-1	2.80	3.20	5.20	6.80	7.00	4.80
Mean	3.66	3.80	5.64	7.34	7.26	
$LSD_{0.05}$	0.95	0.82	1.40	1.28	1.18	

Table 4: Effects of storage condition on the frequency of occurrence of rot on cowpea varieties

	Storage material					
Cowpea varieties	J	EP	G	PC	PB	Mean
Ife brown 825-124	4.60	6.00	7.00	7.80	6.40	6.38
IT89KD-288	5.00	6.30	8.50	8.00	7.80	7.12
IAR 1696	2.50	5.00	5.00	6.20	6.00	4.94
IT89KD-374	3.00	3.80	4.80	5.80	6.50	4.78
IT93K-452-1	2.80	3.20	4.20	6.50	4.00	4.14
Mean	3.58	4.86	5.90	6.86	6.14	
$LSD0_{0.05}$	0.90	0.85	1.12	0.72	1.02	

(Table 4). IT89KD-288 recorded highest rotten pods (7.12), followed by Ife-brown 825-124(6.38) when IAR1696, IT89KD-374 and IT93K-452-1 recorded significantly similar but low percentage occurrence of rotten pods 4.94, 4.78 and 4.1, respectively (Table 4).

DISCUSSION

The lowest occurrence of Anthracnose disease in cowpea stored in Earthen pot, may be attributed to the unfavorable condition for the pathogen created by the earthen pot. It reduce moisture and relative humidity, wall-off the pathogens for attack and spread of anthracnose in agreement with Auda and Anda (2002), who proposed that moisture and temperature, reduce insect mobility, microbial growth and respiration. This is contrary to highest occurrence of the diseases recorded by cowpea stored in plastic bag irrespective of the varieties. The intense heat generated by the plastic bags reduce the normal biochemical activities of the stored cowpea thereby, increasing the microbial activities. They destroyed the tissues of cowpea, soften them and encourage further the activities of the pathogens. These activities led to the lowest percentage germination recorded by those stored in plastic bags, since tissue destruction and hence disease infestation lowers seed viability in line with Abdelmonem and Rasmy (2000), who proposed that low viability or germination, seedling mortality and yield reduction are as a result of the activities of the pathogens as well as Singh *et al*. (1990).

The highest percentage germination recorded by cowpea stored in Jute followed by gourd and earthen pot, may be attributed to the ideal storage condition provided by these storage materials. The storage materials provided unfavorable condition for plant pathogens penetration, attack and symptom manifestation. The seeds were intact, healthy and uninfected. This is in agreement with Richardson (1990) who proposed that the microbial activities result in decay of seeds and seeding as well as pre- and post-emergence mortality. Thus, reduction in the activities of micro organisms improve viability and germination. IT93-4521 and IAR1696 record of lowest occurrence of the diseases investigated, but highest percentage germination, may be as a result of inbuilt characteristics peculiar of this varieties. They possess the ability to withstand the pathogenic penetration and symptom manifestation.

The undisturbed biochemical and metabolic activities of these varieties encouraged viability hence high germination. This is in comparison with IT89KD-288 record of highest of the diseases investigated but lowest percentage germination. The higher the disease occurrence, the lower the percentage germination, as propose by Abdelmonem and Rasmy (2000). The high resistance of IT93KD-4521 and IAR1696 with IT89D-288 being the lowest may be due to inherent characteristics peculiar to these varieties. Such as protein anti-metabolites like lectins and amylase inhibitors, in line with Gatehouse *et al*. (1990) and IT89KD-288 is the most susceptible variety of cowpea.

In conclusion, IT89KD-288 recorded highest occurrence of all the fungal diseases investigated but lowest percent germination of cowpea, while IT93K-452-1 recorded lowest occurrence of all the fungal diseases investigated, but highest percentage germination. Cowpea stored in jute recorded lowest occurrence of most of the fungal diseases investigated, but highest percentage germination. While those stored in plastic bag had the highest occurrence of most of fungal diseases investigated but lowest percentage germination.

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