 ISSN: 2581-3749 (online)

Physiological Studies on Effect of Different Packaging Material for Storage of Cowpea Seed

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Abstract

The purpose of seed storage is to secure the supply of good quality seed for a planting programme whenever needed. The present study was conducted to identify the suitable packaging material for storage of cowpea seeds. The experiment was conducted in CRD with six treatments and four replications. The seed was dried upto 10 per cent moisture and packed in different packaging materials viz. Polylined jute canvas bag, polylined HDPE bag, polylined cotton bag, aluminium foils, storage bin and control. The observations were recorded for seed quality parameters i.e. germination percentage, moisture content, insect infestation, vigour index, electrical conductivity and speed of germination at 1 to 2 months interval for 11 months. Among packaging materials, aluminium foil bag showed maximum seed germination (86.75%), vigour index (2115.50), speed of germination (45.50) and low moisture content (11.75%), insect infestation (1.00%), electrical conductivity (0.191) at 11 month of storage than other packaging materials. It could be concluded that the storing the cowpea seed in aluminium foil bag after drying 10 per cent moisture is promising treatment for better seed quality upto the 11 month of storage.

Keyworlds: Cowpea, packaging material, seed storage.

Introduction

Cowpea is one of the most important pulse crops in India. Farmers in India treat pulses as secondary crops. The main purpose of traditional seed storage is to secure the supply of good quality seed for a planting programme whenever needed. To keep losses low, crops must be dried to the safe storage moisture content (i.e. moisture content required for long term storage) within the safe storage time (Ekechukwu 1999). Storage of seeds till the next sowing season is an essential segment of seed industry. Seed deterioration begins immediately after physiological maturity and is reflected in terms of loss in viability and vigour. The viability and vigour largely depends on the genotypes, production, location, mechanical injury to the seed, initial seed quality, seed treatment, packaging material and storage conditions (Verma *et al.* 1993). Packaging is essential for storage and distribution of any seed material in units of safe and convenient size.

The most important function of seed storage is protection against climatic factors, mechanical and physical hazards during storage, transport and distribution (Harrington and Douglas 1970). The use of quality seed in cultivation is one of the most important factors that can increase farm level yield. Although seed quality is governed by genetic makeup, seed storage and retention of viability are important for seed vigour (Deepa *et al.* 2013). To maintain the quality of seeds during storage, the standardization of suitable seed treatment and packing material is most important because seed treatment is the basic measure to assure adequately healthy crops at emergence and during further growth of plants (Wani *et al.* 2014). Information on prolonging the shelf life of cowpea seeds under ambient storage conditions is very limited in India. The aim of this research is to collect data on techniques for storage of cowpea seeds. In view of this, present study was carried out to identify the suitable packaging material for storage of cowpea seeds.

Material and Methods

The experiment was carried out during May 2015 to March 2016 by using seeds of cowpea variety Konkan Sadabahar. The seed harvested during rabi 2014-2015 were dried at 10 per cent moisture level and 1 kg seed packed in different packaging material i.e. polylined jute canvas (PLJC), polylined HDPE bags (PLHDPE),

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Received Date: 1.1.2018; Accepted Date: 15.4.2018

polylined cotton bags (PLC), Aluminium foil bag, Storage bin and Control. The experiment was conducted in the Complete Randomized Design with six treatments replicated four times. The observations were recorded on following seed quality parameters to study the behaviour of seed by using different storage containers during storage. The germination test was conducted in the seed testing laboratory using "between papers" method. One hundred seeds of four replications were placed on germination paper, the rolled towel were incubated in a germinator chamber maintained at 25 ± 1ºC and 90 per cent RH. The germinated seedlings were evaluated on 14th day and the germination was expressed in terms of per cent, based on normal seedlings. Moisture content of seed was determined by hot air oven method (Anon. 1985).

Insect damage (%) was recorded for one hundred seeds in four replications which were taken randomly and observed for the insect infestation on seed surface or damaged seeds. Vigour index was calculated on the basis of multiplying germination percentage with seedling length in cm (Abdul Bhaki and Anderson 1973). Electrical conductivity of steeped water was determined by using Toshniwal Conductivity Bridge (Cell constant 0.656) at 25°C. Two gram of seed in four replications from each treatment was soaked in 75 ml distilled water for 24 hrs. It was expressed as dsm^{-1} (Anon. 1999). Speed of germination was computed for each seed lot by dividing the number of normal seedling counted each day by the day on which they were counted from a minimum of 4 replication of 100 seeds and by adding the quotients of daily counts divided by the number of days of germination. The data was subjected to statistical analysis as suggested by Panse and Sukhatme (1985).

Results and Discussion

Germination percentage of cowpea seed was found to be decreased with advancement of storage period irrespective of packaging materials in this experiment

Table 1. Effect of packaging material on germination (%) of Cowpea seeds. (NS: Non significant. Figures in parentheses arcsine transformed values)

Treatments (Packaging material)	Months of Storage (MOS)			
	2 MOS Initial	4 MOS	10 MOS	11 MOS
T_1 (PLJC)	90.50 (72.08)	89.75 (71.36)	86.00 (68.03)	86.00 (68.03)
T_2 (PLHDPE)	90.25 (71.81)	89.50 (71.10)	86.75 (68.68)	86.25 (68.26)
T_3 (PLC)	90.25 (71.85)	89.25 (70.86)	86.25 (68.26)	86.00 (68.03)
T_4 (Al. foil)	91.75 (73.33)	89.00 (70.64)	87.00 (68.89)	86.75 (68.67)
T_5 (Storage bin)	90.00 (71.65)	73.00 (58.70)	0.00 (0.00)	0.00 (0.00)
T_6 (Control Gunny bag)	90.50 (72.05)	84.75 (67.02)	2.00 (7.79)	0.00 (0.00)
S.Em.±	0.66	0.40	0.74	0.39
CD at 1%	NS	1.65	3.01	1.58

Table 2. Effect of packaging material on moisture content (%) of Cowpea seed. (NS: Non significant. Figure in parentheses arcsine transformed values)

Treatments (Packaging material)	Months of Storage (MOS)			
	2 MOS Initial	4 MOS	10 MOS	11 MOS
T_1 (PLJC)	10.50 (18.91)	10.83 (19.21)	11.58 (19.89)	12.00 (20.27)
T_2 (PLHDPE)	10.48 (18.88)	10.53 (18.93)	11.35 (19.69)	11.80 (20.09)
T_3 (PLC)	10.58 (18.98)	10.60 (19.00)	11.68 (19.98)	11.83 (20.11)
T_4 (Al. foil)	10.40 (18.81)	10.48 (18.88)	11.18 (19.53)	11.75 (20.05)
T_5 (Storage bin)	10.50 (18.91)	11.18 (19.53)	13.25 (21.35)	14.20 (22.14)
T_6 (Control Gunny bag)	10.70 (19.09)	11.53 (19.85)	12.33 (20.55)	13.20 (21.30)
S.Em.±	0.07	0.05	0.11	0.09
CD at 1%	NS	0.20	0.44	0.37

(Table 1). The germination of cowpea seed that was stored using storage bin and control (gunny bag) decreased faster than that stored in polylined jute canvas bag, polylined cotton bag, polylined HDPE bag and aluminium foil bag. At initial stage (2 months of storage) there was no significant differences in the seed germination of cowpea seed due to packaging material. In control bag, the germination of cowpea seed was above MSCS for 4 months only. Among packaging material, seeds stored in aluminium foil retained germination percentage (86.75%) above minimum seed certification standard up to 11 months of storage which was at par with T_2, T_1 and T_3 over T_5 and control.

The moisture of cowpea seed was found to increase with advancement of storage period irrespective of packaging material (Table 2). Significantly lower moisture content (11.75%) was observed in cowpea seed stored in aluminium foil bag at 11 MOS which was at par with T_1, T_2 and T_3 over T_5 and control (13.20%). Polyethylene and aluminium foil materials were moderately effective in preventing moisture uptake and maintaining seed viability, while paper and cloth containers were least effective (Wilson and McDonald 1992).

It was observed from data the insect infestation of cowpea seed was found to increase with advancement of storage period irrespective of packaging material (Table 3). At 11 months of storage T_3 i.e. polylined cotton bag and T_4 i.e. aluminium foil bag showed significantly lower insect infestation (1.00) which was at par with T_1 and T_2 over T_5 i.e. storage bin (100) and T_6 i.e. control bag (100). Similar trend was recorded by Rasheed *et al*.

Table 3. Effect of packaging material on insect infestation % of cowpea seed.

Treatments (packaging material)	Months of Storage (MOS)			
	2 MOS Initial	4 MOS	10 MOS	11 MOS
T_1 (PLJC)	0.00	0.50	1.00	1.25
T_2 (PLHDPE)	0.00	0.25	1.00	1.25
T_3 (PLC)	0.00	0.50	0.75	1.00
T_4 (Al. foil)	0.00	0.50	0.50	1.00
T_5 (Storage bin)	0.00	13.00	99.75	100.00
T_6 (Control Gunny bag)	0.00	2.75	99.25	100.00
S.Em.±	0.00	0.80	0.43	0.32
CD at 1%	0.00	3.27	1.75	1.31

Table 5. Effect of packaging material on electrical conductivity (μmhos cm^{-1}) of cowpea seed. (NS: Non significant)

Treatments (packaging material)	Months of Storage (MOS)			
	2 MOS Initial	4 MOS	10 MOS	11 MOS
T_1 (PLJC)	0.155	0.162	0.196	0.209
T_2 (PLHDPE)	0.151	0.154	0.188	0.195
T_3 (PLC)	0.141	0.143	0.193	0.196
T_4 (Al. foil)	0.138	0.145	0.180	0.191
T5 (Storage bin)	0.166	0.198	0.286	0.296
T_6 (Control Gunny bag)	0.184	0.193	0.278	0.288
S.Em.±	0.008	0.005	0.003	0.003
CD at 1%	NS	0.020	0.013	0.014

Table 4. Effect of packaging material on vigour index of Cowpea seed. (NS: Non significant)

Treatments (packaging material)	Months of Storage (MOS)			
	2 MOS Initial	4 MOS	10 MOS	11 MOS
T_1 (PLJC)	3491.65	3037.88	2077.50	1763.25
T_2 (PLHDPE)	3454.75	3217.25	2548.25	2025.25
T_3 (PLC)	3517.88	3451.38	2100.63	1794.38
T_4 (Al. foil)	3580.30	3469.50	2339.88	2115.50
T_5 (Storage bin)	3433.93	1253.00	0.00	0.00
T_6 (Control Gunny bag)	3441.00	2250.63	48.50	0.00
S. Em.±	35.90	68.76	48.24	84.65
CD at 1%	NS	279.89	196.36	344.60

(2004) and reported that increase in storage period, there were increase in pest infestation and disease incidence in grountnut.

At the 11 MOS aluminium foil bag showed significantly higher vigour index (2115.50) which was at par with T_2 and T_3 over T_1, T_5 and control (Table 4). Chuasin *et al*. (2006) stated that seed stored in metalized film bags and aluminium foil bag recorded high standard germination and vigour index.

Among the different packaging material the seed stored in aluminium foil bag showed significantly lower electrical conductivity (0.191) which was at par with T_2, T_3 over T_1, T_5 and control (0.288) at 11 MOS and throughout the storage period (Table 5). Similar trend was recorded by Chandran and Rajgopal (2002) and reported that lower EC in tri-aluminium foil Pouches.

The speed of germination of Cowpea seed was found to be decreased with advancement of storage period irrespective of packaging material in this experiment (Table 6). Similar trend was recorded by Basave Gowda and Nanjareddy (2008) and reported that speed of germination decreased with storage duration mainly due to decreased germination percentage. Among different packaging material the pods stored in aluminium foil bag showed high speed of germination. Similar trend was recorded by Chandran and Rajgopal (2002) and reported that pods stored in three layered aluminium foil maintained the speed of germination of groundnut seeds.

From the present study it can be concluded that storing the cowpea seeds in aluminium foil bag is promising treatment due to highest germination percentage, vigour index and speed of germination and lower seed moisture content, insect infestation and electrical conductivity upto the 11th month of storage.

Table 6. Effect of packaging material on speed of germination of Cowpea seed. (NS: Non significant)

Treatments (packaging material)	Months of Storage (MOS)			
	2 MOS Initial	4 MOS	10 MOS	11 MOS
T1 (PLJC)	45.51	45.55	41.85	40.08
T2 (PLHDPE)	48.79	47.56	43.50	43.19
T3 (PLC)	45.54	44.67	42.46	41.52
T4 (Al. foil)	48.08	48.75	45.23	45.50
T5 (Storage bin)	45.99	29.92	0.00	0.00
T6 (Control Gunny bag)	44.44	31.52	3.31	0.00
S.Em.±	1.15	0.44	0.69	1.34
CD at 1%	NS	1.79	2.82	5.44

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