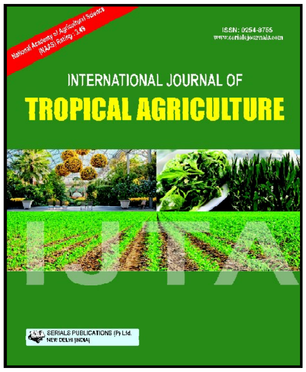

INTERNATIONAL JOURNAL OF TROPICAL AGRICULTURE

ISSN : 0254-8755

available at http: www.serialsjournals.com

Volume 37 • Number 1 • 2019

Non Chemical Methods of Storing Pigeon Pea Seeds

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Abstract: Pigeon pea is one of the important pulse crop, mostly grown in *kharif,* mainly under rain fed condition. The seed quality during storage is Affected by many biotic and abiotic factors and to manage this several chemical methods are available but we treat the seeds with chemicals of it is not used for seed for any reasons it cannot be used as food or feed and the entire seed has to be used for composting with an objective of identify the suitable nonchemical method of storing pigeon pea seeds. The present investigation was conducted to evaluate and identify the suitable packaging materials for storage of pigeon pea cv. TS-3R seeds under ambient conditions. Seeds packed in seven packaging materials *viz*.; gunny bag, polylined (700 gauge) gunny bag, HDPE bag with lamination, perdue improved crop storage (PICS) bag, grain pro bag, zerofly bag and the trial method under ambient storage conditions with initial seed moisture content less than 8.0%. The results revealed that after ten months of storage the pigeon pea seeds stored in PICS (perdue improved crop storage) bag, Grain pro bag, Zerofly bag and Trial method recorded higher seed quality parameters. Among these, trial method also found economical.

Keywords: Pigeon pea, Packaging materials, Storage, Seed quality.

INTRODUCTION

Pigeon pea (*Cajanus cajan*) is an important protein rich legume. It is a crop of the tropical and sub-tropical regions of the world and is considered to be native to Peninsular India. It is mainly cultivated and consumed in developing countries of the world. In India, it is cultivated in an area of about 3.85 m ha with a productivity of about 729 kg ha^{-1}. The major storage pests of pigeon pea during storage are bruchids (*Callosobruchus* spp.) these fast feeders have high fecundity under stored conditions, which results in drastic reduction in seed quality, prices in the markets and they become totally unfit for dal making and export. There is need to maintain seed longevity with no adverse effect on seed quality parameters. In view of above problem the present investigation is undertaken to study the effect of different packaging materials on seed quality of pigeon pea during storage.

Pigeon pea is one of the important pulse crop, mostly grown in *kharif,* mainly under rain fed condition. The seed quality during storage is effected by many biotic and abiotic features and to manage this several chemical methods are available but of we treat the seeds with chemicals of it is not used for seed for any reasons it cannot be used as food or feed and the entire seed has to be used for composting with an objective of identify the suitable nonchemical method of storing pigeon pea seeds the present investigation was taken.

MATERIALS AND METHODS

Freshly harvested seeds of pigeon pea Cv. TS-3R packed in six different packaging materials *viz*., C_1- Gunny bag, C_2- Polylined (700 gauge) gunny bag, C_3- HDPE bag with lamination, C_4- PICS (perdue improved crop storage) bag, C_5- Grain pro bag, C_6- Zerofly bag and C_7- Trial method under ambient conditions. The different observations on seed germination (%), seedling vigour index –I (germination per cent x seedling length), seedling dry weight (mg), seed moisture content, seed infection and electrical conductivity were taken at bimonthly interval by following ISTA procedure [1] The experiment was laid out using CRD and the critical differences between the treatments and containers were worked out at one per cent level of significance.

RESULTS AND DISCUSSION

Effect of packaging materials on seed quality: The seeds packed in PICS bag recorded the minimum seed moisture content (7.95%) which was on par with grain pro bag, Trial bag, and polylined (700 gauge) gunny bag (C_2) (7.97, 7.98 and 7.99%, respectively) followed by zerofly bag (C_5) and HDPE bag with lamination (8.25 and 8.33%, respectively) whereas, the maximum moisture content (9.09%) was recorded in gunny bag at the end of storage period.

The lower moisture content may be due to hermatic seal of PICS bags shielded the grain from changes in relative humidity, resulting in little impact on RH within seed mass or in seed moisture content [2] (Table-1). The results are in consistent with the [3] and [4]. Grain pro bag may be attributed to the impervious nature to moisture vapour and thus it has caused less fluctuation in seed moisture content and it eliminates deterioration and enhances the seed longevity. These findings were in conformity with findings of [5] in pigeon pea.

The data on seed germination differed significantly due to the influence of containers except for initial four months. The higher seed germination (95.17%) was recorded with seeds packed in PICS bag which was on par with grain pro bag and trial bag (94.67 and 94.50%, respectively) followed by seeds packed in polylined (700 gauge) gunny bag, zerofly bag and HDPE bag with lamination (93.67, 93.50 and 92.33% respectively). While, the lowest seed germination (91.00%) was recorded with seeds packed in gunny bag at the end of storage period (Table 2).

Among the containers, the moisture impervious containers like PICS bag, grain pro bag and trial bag were found superior in maintaining seed germination for longer period than the pervious containers. The prolonged quality of seeds depends on thickness and impervious nature of these containers. The superiority of these packaging materials in maintaining seed germinability for longer period might be due to inverse relationship between seed moisture content and germination percentage. Similarly [6] reported that maize seeds stored in hermatic bags (super grain bag) recorded highest germination (82%) and least for jute bags at the end of storage period. The present findings confirmed the reports of previous workers [7 and 8].

Table 1
Effect of seed treatment and containers on moisture content (%) of pigeon pea during storage

Treatment	*Months after storage*				
	2	*4*	*6*	*8*	*10*
C_1	8.44	8.70	8.54	8.37	9.09
C_2	7.98	8.02	7.97	7.97	7.99
C_3	8.03	8.12	8.02	7.99	8.33
C_4	7.94	7.96	7.93	7.93	7.95
C_5	7.95	7.98	7.95	7.94	7.97
C_6	8.01	8.07	7.99	7.98	8.25
C_7	7.97	7.99	7.96	7.96	7.98
Mean	8.05	8.12	8.05	8.02	8.22
S.Em±	0.02	0.03	0.02	0.01	0.02
CD at 1%	0.09	0.12	0.08	0.05	0.06

NS: Non Significant
Seed treatment (T): T_1: Control T_2: Thiram (2 g/kg seed) + Emamectin benzoate5SG (40 mg/kg seeds)

Containers (C): C_1: Gunny bag C_2: Polyline (700 gauge) gunny bag C_3: HDPE bag C_4: PICS bag C_5: Grain pro bag C_6: Zero fly bag C_7: Trial method

Table 2
Effect of seed treatment and containers on germination (%) of pigeon pea during storage

Packaging material	*Months after storage*				
	2	*4*	*6*	*8*	*10*
C_1	97.33(80.64)	96.00(78.62)	94.67(76.68)	92.83(74.48)	91.00(72.96)
C_2	97.67(81.26)	96.67(79.50)	95.50(77.77)	94.50(76.45)	93.67(75.48)
C_3	97.33(80.64)	96.33(78.98)	95.17(77.31)	93.50(75.24)	92.33(73.93)
C_4	98.00(81.87)	97.50(80.95)	97.00(80.03)	96.17(78.75)	95.17(77.35)
C_5	98.00(81.87)	97.50(80.95)	96.83(79.77)	95.50(77.80)	94.67(76.70)
C_6	97.33(80.64)	96.67(79.50)	95.50(77.77)	94.17(76.03)	93.50(75.30)
C_7	98.00(81.87)	97.17(80.33)	96.33(78.98)	95.17(77.38)	94.50(76.49)
Mean	97.67(81.26)	96.83(79.83)	95.86(78.33)	94.55(76.59)	93.55(75.40)
S.Em±	0.18	0.31	0.40	0.43	0.28
CD at 1%	NS	NS	1.57	1.70	1.10

* Figures in the parentheses are arc sine transformed values **NS: Non Significant**
Seed treatment (T): T_1: Control T_2: Thiram (2 g/kg seed) + Emamectin benzoate5SG (40 mg/kg seeds)
Containers (C): C_1: Gunny bag C_2: Polyline (700 gauge) gunny bag C_3: HDPE bag C_4: PICS bag C_5: Grain pro bag C_6: Zero fly bag C_7: Trial method

The highest seedling dry weight (Table 4), seedling vigour index (Table 3) was recorded in seeds packed in PICS bag which was on par with the seeds packed in grain pro bag, trial method and followed by polylined (700 gauge) gunny bag, zerofly bag, HDPE bag with lamination. Whereas, the lowest seedling dry weight, seedling vigour index-I were recorded in gunny bag at the end of the storage period. The seedling dry weight decreased as the storage period progressed irrespective of the type of packaging material used. Reduction of seedling dry weight was always greater when the seeds were stored in moisture pervious container, which is mainly due to increased seed deterioration there was decreased seedling dry weight due to loss of viability [9].

The seed infection (Table 5) varied less in the seeds stored in PICS bag which was on par with grainpro bag, trial bag, polylined (700 gauge) gunny bag, zerofly bag followed by HDPE bag with lamination. Whereas, more seed infection was recorded in gunny bag. The fluctuations in moisture content of seeds stored in cloth bag may also contribute for higher infections, fungi are generally active when the seed moisture content was above 8-9 per cent [10]. Further, the low moisture content in impervious containers also prevents activity of storage fungi. Therefore, it is evident from the results and supported reviews of literature that seeds stored in pervious containers have more seed infection than the moisture impervious containers and the results are in conformity with [11] in pigeon pea and [12] in cotton.

The seeds packed in PICS bag reported lower electrical conductivity (Table 6) which was on par with the seeds packed in grain pro bag and Trial bag which was followed by polylined (700 gauge) gunny bag, zerofly bag and HDPE bag with lamination. Whereas, the higher electrical conductivity was recorded in seeds stored in gunny bag. Measurement of electrical conductivity of seed leachate gives an indication of the extent of damage caused to cell

Table 3

Effect of seed treatment and containers on seedling vigour index-I of pigeon pea during storage

Treatment	*Months after storage*				
	2	*4*	*6*	*8*	*10*
C_1	2562	2406	2256	2078	1891
C_2	2621	2528	2393	2293	2140
C_3	2596	2488	2332	2219	2051
C_4	2666	2592	2474	2373	2211
C_5	2661	2585	2462	2350	2191
C_6	2608	2525	2387	2278	2129
C_7	2657	2573	2443	2334	2181
Mean	2624	2527	2392	2275	2113
S.Em±	27	25	23	22	9
CD at 1%	NS	NS	90	84	34

NS: Non Significant

Seed treatment (T): T_1: Control T_2: Thiram (2 g/kg seed) + Emamectin benzoate5SG (40 mg/kg seeds)

Containers (C): C_1: Gunny bag C_2: Polyline (700 gauge) gunny bag C_3: HDPE bag C_4: PICS bag C_5: Grain pro bag C_6: Zero fly bag C_7: Trial method

Table 4

Effect of seed treatment and containers on seedling dry weight (mg) of pigeon pea during storage

Treatment	*Months after storage*				
	2	*4*	*6*	*8*	*10*
C_1	81.03	80.17	79.13	78.37	76.98
C_2	81.20	80.60	79.90	78.91	78.56
C_3	81.09	80.38	79.70	78.66	77.90
C_4	81.32	80.93	80.20	79.58	78.92
C_5	81.28	80.89	80.16	79.54	78.83
C_6	81.13	80.49	79.87	78.88	78.49
C_7	81.25	80.79	80.12	79.51	78.80
Mean	81.19	80.61	79.87	79.06	78.35
S.Em±	0.22	0.22	0.11	0.17	0.07
CD at 1%	NS	NS	0.43	0.69	0.27

NS: Non Significant

Seed treatment (T): T_1: Control T_2: Thiram (2 g/kg seed) + Emamectin benzoate 5SG (40 mg/kg seeds)

Containers (C): C_1: Gunny bag C_2: Polyline (700 gauge) gunny bag C_3: HDPE bag C_4: PICS bag C_5: Grain pro bag C_6: Zero fly bag C_7: Trial method

Table 5
Effect of seed treatment and containers on seed infection (%) of pigeon pea during storage

Treatment	*Months after storage*		
	6	*8*	*10*
Containers (C)			
C_1	3.3 (10.47)	5.0 (12.92)	11.7 (20.00)
C_2	0.0 (0.00)	1.7 (7.49)	1.7 (7.49)
C_3	1.7 (7.49)	3.3 (10.47)	6.7 (15.00)
C_4	0.0 (0.00)	0.0 (0.00)	1.7 (7.49)
C_5	0.0 (0.00)	0.0 (0.00)	1.7 (7.49)
C_6	0.0 (0.00)	0.0 (0.00)	1.7 (7.49)
C_7	0.0 (0.00)	1.7 (7.49)	1.7 (7.49)
Mean	0.7	1.7	3.8
S.Em±	0.9	1.1	1.3
CD at 1%	NS	NS	4.8

* Figures in the parentheses are arc sine transformed values
NS: Non Significant
Seed treatment (T): T_1: Control T_2: Thiram (2 g/kg seed) + Emamectin benzoate5SG (40 mg/kg seeds)
Containers (C): C_1: Gunny bag C_2: Polyline (700 gauge) gunny bag C_3: HDPE bag C_4: PICS bag C_5: Grain pro bag C_6: Zero fly bag C_7: Trial method

Table 6
Effect of seed treatment and containers on electrical conductivity (dSm^{-1}) of pigeon pea during storage

Treatment	*Months after storage*				
	2	*4*	*6*	*8*	*10*
C_1	0.463	0.518	0.579	0.649	0.697
C_2	0.446	0.490	0.532	0.615	0.643
C_3	0.455	0.505	0.556	0.634	0.666
C_4	0.419	0.468	0.507	0.586	0.622
C_5	0.422	0.476	0.512	0.591	0.627
C_6	0.449	0.492	0.534	0.618	0.647
C_7	0.426	0.479	0.518	0.597	0.631
Mean	0.440	0.490	0.534	0.613	0.648
S.Em±	0.011	0.011	0.006	0.008	0.001
CD at 1%	NS	NS	0.025	0.029	0.004

NS: Non Significant
Seed treatment (T): T_1: Control T_2: Thiram (2 g/kg seed) + Emamectin benzoate5SG (40 mg/kg seeds)
Containers (C): C_1: Gunny bag C_2: Polyline (700 gauge) gunny bag C_3: HDPE bag C_4: PICS bag C_5: Grain pro bag C_6: Zero fly bag C_7: Trial method

membranes during storage. Higher electrical conductivity of seed leachate implies more damage to cell membrane and thus reduced vigour. Many workers reported negative correlation between EC and seed quality [13] in lablab, [14] in marigold.

Among the best packaging materials, the cost of trial bag was lowest (104.00 Rs/quintal) followed by grain pro bag (240.00 Rs/quintal) and PICS bag (275.86 Rs/quintal) (Table 7).

Table 7
Per cent improvement in seed parameters over control in pigeon pea after 10 months storage

Packaging materials	*Improvement in Germination (%) over control*	*Vigour index*	*Insect damage (%)*	*Cost of bag (Rs/q)*	*Cost for one year (Rs/q)*
C_1 (control)	-	-	-	70=00	35=0
C_2	2.9	13.16	-14.5	181=00	90.5
C_3	1.46	8.46	-57.26	45=00	22.5
C_4	4.58	16.92	-14.52	320.86	160.4
C_5	4.03	15.86	-14.52	305=00	152.5
C_6	2.74	12.58	-14.52	184.28	92.1
C_7	3.84	15.33	-14.52	159=00	79.5

CONCLUSION

The results revealed that after ten months of storage the pigeon pea stored in PICS (perdue improved crop storage) bag, Grain pro bag, Zerofly bag and trial method among these trial method found most economical.

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