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Effect of eco-friendly seed treatments and containers on storability of niger (*Guizotia abyssinica* L.f. Cass.) cv. Paiyur 1

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Abstract: Physiological and biochemical deterioration of seeds during storage is considered to be one of the major factors affecting seed germinability and vigour. Niger being an oilseed crop, the seeds undergo rapid deterioration during storage by membrane damage which was indicated by increased electrical conductivity of seed leachate. This biochemical process of seed deterioation during storage could be minimized by giving seed treatment either with chlorine based halogen formulation @ 3g kg^{-1} or with chilli powder @2g kg^{-1} of seed and packed in polylined cloth bag which maintained higher germination and vigour index after six months of storage. The treated seeds also recorded lower electrical conductivity than the control seeds packed in cloth bag.

Key Words: Guizotia abyssinica, eco-friendly seed treatments, control of seed deterioration.

Introduction

Seeds need to be stored from the day of harvest till the time of next sowing. It is also a general practice in India, to carry over a small quantity of seeds as a safeguard against natural calamities. Storage of seeds therefore, assumes paramount importance in a seed production programme. Physiological deterioration of seeds during storage is considered to be one of the major factors preventing seeds from normal germination and vigorous growth. The deterioration of physiological quality of seeds during storage is mainly attributed to periods of storage (Delouche and Baskin, 1973), containers (Kumar and Singh, 1984), seed moisture content (Roberts, 1986) and seed treatment (Basu and Rudrapal, 1980).

Niger is one of the oilseed crops being grown in Madhya Pradesh, Orissa, Maharashtra, Bihar, Karnataka, Andhra Pradesh and Tamilnadu in India. Niger seed oil is one of the good quality edible oil with pleasant nutty taste used for culinary purpose. The present study is undertaken to identify an effective, practicable, simple and eco-friendly seed treatment and a feasible packaging material for safe storage of niger seeds under ambient storage conditions.

Materials and Methods

Harvest fresh seeds of niger cv. Paiyur 1 were obtained from the maturation trial conducted at Tamil Nadu Agricultural University, Coimbatore, India during 2000. The seeds were cleaned and dried under sun to uniform moisture content of eight per cent. The seeds were graded using BSS 16 x 16 wire mesh sieve and were given with following treatments.

T_1 - Control (untreated)

T_2 - Halogen mixture @ 3 g kg^{-1} of seed ($CaOCl_2$, $CaCO_3$ and *Albizia amara* leaf powder @ 5:4:1 ratio)

T_3 - Chilli powder @ 2 g kg^{-1} seed

After the treatments, the seeds were packed in different containers *viz.*, cloth bag (C_1), 700 gauge polyethylene bag (C_2) and polylined cloth bag (fresh gada cloth bag lined with 300 gauge polyethylene sheet) (C_3). Then, the seeds were stored in laboratory under ambient conditions

Table 1. Influence of seed treatments, storage containers and period of storage on germination (%) of niger cv. Paiyur 1

Storage period (months)	C_1				C_2				C_3				P Mean
	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4	
0	92 (73.84)	92 (73.84)	92 (73.84)	92 (73.84)	92 (73.84)	92 (73.84)	92 (73.84)	92 (73.84)	92 (73.84)	92 (73.84)	92 (73.84)	92 (73.84)	92 (73.84)
1	89 (70.69)	90 (71.65)	90 (71.65)	90 (72.61)	90 (71.65)	91 (72.61)	90 (71.65)	91 (72.61)	90 (71.65)	92 (73.57)	90 (71.65)	91 (72.61)	91 (72.05)
2	86 (68.29)	89 (70.69)	88 (69.87)	88 (69.87)	88 (69.87)	90 (71.65)	89 (70.69)	90 (71.65)	88 (69.73)	91 (72.61)	90 (71.65)	91 (72.61)	89 (70.77)
3	83 (65.68)	87 (68.91)	86 (68.08)	86 (68.08)	86 (68.08)	89 (70.69)	87 (68.91)	88 (69.87)	86 (68.08)	89 (71.65)	88 (69.73)	90 (71.65)	87 (69.12)
4	80 (63.44)	85 (67.25)	83 (65.68)	84 (66.42)	84 (66.42)	88 (69.73)	85 (67.25)	87 (68.91)	85 (67.25)	89 (70.69)	87 (68.91)	88 (69.73)	85 (67.64)
5	78 (62.05)	83 (65.68)	81 (64.24)	82 (64.93)	82 (64.93)	86 (68.08)	84 (66.51)	85 (67.25)	83 (65.68)	88 (69.87)	86 (68.08)	87 (68.91)	84 (66.35)
6	75 (60.01)	82 (64.93)	79 (63.49)	81 (64.18)	80 (63.44)	85 (67.25)	82 (64.93)	84 (66.51)	81 (64.18)	87 (68.91)	84 (66.42)	86 (68.08)	82 (65.20)
Mean	83 (66.29)	87 (68.99)	86 (68.12)	86 (68.56)	86 (68.32)	89 (70.55)	87 (69.11)	88 (70.09)	86 (68.63)	90 (71.59)	88 (70.04)	89 (71.06)	87 (69.28)

	C_1	C_2	C_3	T	T_1	T_2	T_3	T_4
C Mean	86 (67.99)	87 (69.52)	88 (70.33)	Mean	85 (67.75)	89 (70.38)	87 (69.10)	88 (69.91)

	P	T	C	PxT	PxC	TxC	PxTxC
CD (P=0.05)	0.923	0.698	0.604	NS	NS	NS	NS

(Figures in parentheses indicate arc sine transformed values)

T_1 - Control (untreated); T_2 - Halogen mixture @ 3 g kg^{-1} of seed; T_3 - Chilli powder @ 2 g kg^{-1} seed
C_1 - Cloth bag; C_2 - Polyethylene bag; C_3 - Polylined cloth bag

Table 2. Influence of seed treatments, storage containers and period of storage on vigour index of niger cv. Paiyur 1

Storage period (months)	C1				C2				C3				P Mean
	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4	
0	2342	2342	2342	2342	2342	2342	2342	2342	2342	2342	2342	2342	2342
1	2199	2259	2241	2294	2250	2294	2261	2316	2257	2337	2259	2232	2266
2	2064	2198	2140	2156	2134	2250	2187	2254	2163	2268	2223	2266	2192
3	1934	2112	2043	2064	1989	2187	2106	2147	2073	2232	2147	2203	2103
4	1800	2034	1918	1980	1966	2138	2015	2097	2015	2190	2099	2138	2032
5	1701	1959	1835	1894	1628	2118	1958	2013	1934	2138	2040	2088	1942
6	1583	1903	1768	1839	1792	2014	1878	2023	1855	2088	1966	2038	1896
Mean	1946	2115	2041	2081	2014	2192	2107	2171	2091	2228	2154	2187	2111
C Mean	C_1	C_2	C_3		T	T_1	T_2	T_3	T_4				
	2046	2121	2165			2017	2178	2100	2146				
CD (P=0.05)	P	T	C		PxT	PxC	TxC	PxTxC					
	33.338	25.201	21.825		66.676	57.743	NS	NS					

T_1 - Control (untreated); T_2 - Halogen mixture @ 3 g kg^{-1} of seed; T_3 - Chilli powder @ 2 g kg^{-1} seed
C_1 - Cloth bag; C_2 - Polyethylene bag; C_3 - Polylined cloth bag

(Tempe-rature 30-32°C; RH 70-75 %). Seed samples were drawn at monthly intervals for quality evaluations up to six months.

Moisture content was estimated by drying the seeds at 103 ± 2°C in a hot air oven for 16 hours and expressed in percentage on fresh weight basis. The germination test was carried out using four replicates of 100 seeds each in roll towel method (ISTA, 1999) and the vigour index was calculated using the formula of Abdul-Baki and Anderson (1973) by multiplying germination (%) x seedling length (cm). Electrical conductivity (EC) was recorded following the procedure of Presley (1958).

Results and Discussion

Seed moisture content

Irrespective of the treatments and containers, moisture content increased with increase in storage period (Figure 1). There is no much variation in moisture content among the treatments. The increase in moisture content was very rapid in seeds stored in cloth bag. In cloth bag, the moisture content increased from the initial value of 8.01 to 8.58 per cent at the end of storage period.

Sku and Tarar (1991) in sunflower observed increase in moisture content over period of storage. The increase in moisture content of the seeds stored in the cloth bag might

Table 3. Influence of seed treatments, storage containers and period of storage on electrical conductivity (dSm^{-1}) of niger cv. Paiyur 1

Storage period (months)	C_1				C_2				C_3				P Mean
	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4	
0	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061
1	0.076	0.071	0.074	0.073	0.075	0.068	0.073	0.073	0.068	0.064	0.067	0.066	0.071
2	0.090	0.078	0.087	0.083	0.088	0.075	0.084	0.079	0.076	0.070	0.074	0.072	0.080
3	0.104	0.087	0.097	0.094	0.097	0.082	0.091	0.089	0.083	0.076	0.081	0.078	0.088
4	0.117	0.094	0.110	0.105	0.108	0.087	0.101	0.097	0.092	0.083	0.089	0.085	0.097
5	0.128	0.102	0.118	0.115	0.117	0.094	0.110	0.105	0.100	0.090	0.096	0.093	0.106
6	0.140	0.110	0.129	0.124	0.130	0.104	0.120	0.113	0.110	0.096	0.103	0.099	0.115
Mean	0.102	0.086	0.096	0.093	0.096	0.082	0.091	0.088	0.084	0.077	0.082	0.079	0.088

C Mean	C_1 0.094	C_2 0.089	C_3 0.080		T Mean	T_1 0.094	T_2 0.082	T_3 0.090	T_4 0.087
CD (P=0.05)	P 0.0006	T 0.0004	C 0.0004			PxT 0.0012	PxC 0.0010	TxC 0.0008	PxTxC 0.0020

T_1 - Control (untreated); T_2 - Halogen mixture @ 3 g kg^{-1} of seed; T_3 - Chilli powder @ 2 g kg^{-1} seed
C_1 - Cloth bag; C_2 - Polyethylene bag; C_3 - Polylined cloth bag

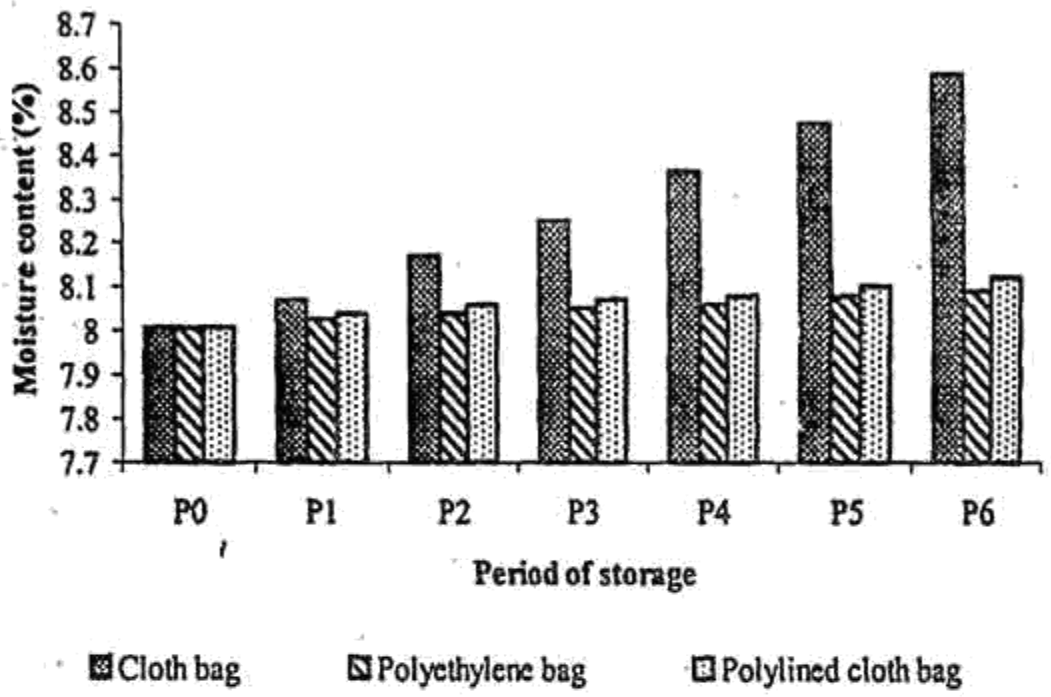
be due to the absorption of atmospheric moisture by the seeds and attainment of equilibrium with the differential moisture content of the atmosphere, while low increase in moisture content in polythene bag was due to the prevention of moisture entry into the container.

Seed germination and vigour index

Significant variation for germination percentage was observed due to period of storage, treatments and containers (Table 1). With advancement in the storage period, germination decreased gradually from 92 per cent (initial) to 82 per cent (at the end of storage period), irrespective of the treatments and containers. Seed treated with chlorine based halogen mixture and packed in polylined cloth bag maintained the highest germination of 87 per cent followed by red chilli powder treatment (86 per cent) at the end of storage period. Lowest germination was observed in untreated seeds (81 per cent). The untreated seeds stored in cloth bag lost their viability rapidly and reached below the minimum standard of germination (78 per cent) within five months. The vigour index also showed the similar pattern. (Table 2). The seeds treated with halogen mixture and stored in polylined cloth bags recorded higher vigour index value of 2088 compared to untreated seeds stored in cloth bag (1583) at the end of storage period.

The decline in germination and vigour during storage may be due to depletion of food reserves, decline in synthetic activity as reported by Roberts (1972) or may be due to the physiological ageing process accelerated by the interaction effect of increased seed moisture and storage period (Kovalenko *et al.* 1977). Bhattacharya *et al.* (1982)

Figure 1. Changes in moisture content of niger seeds during storage.



reported the decline in viability and vigour during storage in sunflower. The superiority of polylined cloth bag in maintaining higher germination followed by polythene bag in storage might be due to its moisture vapour proof nature and it is in conformity with findings of Rathnavalli (1998) in sunflower. The maintenance of higher germination and vigour of seeds treated with halogen mixture may be due to stabilization of double bonds in unsaturated fatty acid and reduction of lipid peroxidation (Rathinavel and Dharmalingam, 2000). Mandal *et al.* (2000) in soybean maintained the viability of seeds during storage by chilli powder treatment.

Electrical conductivity (dSm^{-1})

One of the earliest symptoms of ageing is loss of membrane permeability which is most likely caused by the breakdown of the lipoprotein membrane structure. The electrical conductance of the seed leachate is a good indicator of such damage (Matthews and Bradnock, 1968). The electrical conductivity of seed leachate increased with advancement in storage period (Table 3). The seeds showed an increase of 0.054 dSm^{-1} (from 0.061 dSm^{-1} to 0.115 dSm^{-1}) over six months of storage period. The highest value was recorded by untreated seeds in cloth bag (0.140 dSm^{-1}), while the lowest was registered by halogen mixture treated seeds packed in polylined cloth bag (0.096 dSm^{-1}). The stabilization of double bond in polyunsaturated fatty acids by halogen mixture treatment increased the membrane integrity and decreased the electrolyte leakage (Basu, 1994). During the later periods of storage the increase in electrical conductivity was higher irrespective of treatments and containers.

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