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Seed deterioration in long lived sesame seeds under accelerated ageing conditions

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Abstract
Accelerated ageing has been used in predicting seed storability as it is known to reduce seed viability and vigour in many oil seed crops. This study was under taken to examine the effect of accelerated ageing on germinability, physical and physiological characteristics of sesame. Seeds were subjected to accelerated aging conditions by exposing the seeds at 40° C and 100 per cent relative humidity. The results suggested the oil seed deteriorate under accelerated ageing is closely related to a decrease in the physiological parameters seed germination, seedling length, dry matter production and vigour index.

Keywords: Accelerated ageing, seed viability, seedling length, vigour index, physiological parameters

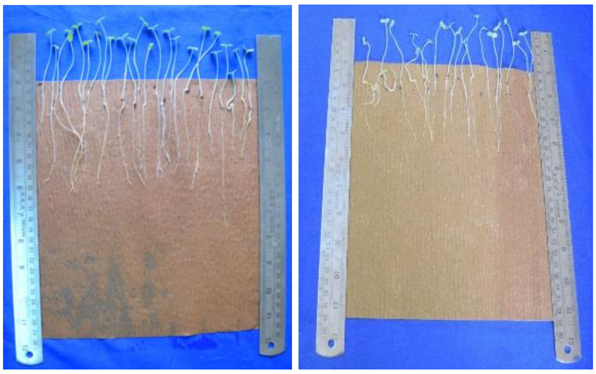
Introduction
Sesame (*Sesamum indicum* L.) is an important oilseed crop grown next to groundnut in India. It belongs to family Pedaliaceae. Generally, sesame is crop grown especially in tropical and temperate regions (Biabani, and Pakniyat, 2008) [9]. In world, 90 per cent of sesame produced is used as edible oil and ranks ninth among the other oil seed crops. Some antioxidative agents (sesamin, sesamolin, sesamol, and sesaminol glucosides) helps the oil highly stable with long shelf life (Suja *et al.* 2004) [37].
The oil seeds are very sensitive to adverse environmental conditions. The oil inside the seeds will get oxidized easily and deteriorate seed health during storage (Wilson and McDonald 1986) [44]. These deteriorative changes decline germinability (McDonald 1976) [28] and vigour (Copeland and McDonald 1995) [10] of seeds. Low vigour (aged) seed accelerated ageing (AA) (McDonald 1995; Tekrony 1995, 2005) [29, 40]. AA is recognized as an accurate indicator of seed vigour and storability; as it correlates with field emergence (Egli and Tekrony 1996) [13]. The seeds that exposed to AA condition generally show a marked reduction in germination (Hampton *et al*. 2004; McDonough *et al*. 2004) [19, 30].
AA also results in the increase in lipid peroxidation and a decrease in activities of antioxidant and several enzymes which were involved in scavenging free radicle and peroxide (Hsu and Sung 1997; Bailly *et al*. 1998) [20, 7]. This study was conducted to evaluate the underlying Physical and physiological factors due to AA of oil seed crops.

Materials and methods
Seed source
The seed of sesame variety TMV 7 were procured from experimental plots, laid by Tamilnadu Agricultural University (Department of oil seeds) – Coimbatore, India. In the study, the sesame seeds with 92 per cent germination was used.

Accelerated ageing
The seeds were kept under accelerated aging condition by exposing the seeds at 40° C and 100% relative humidity. The observation of accelerated aging were taken at daily intervals for 10 days to analyze physical, physiological parameters. Seed moisture content (ISTA 2013) [21], germination percentage (ISTA 2013) [21], speed of germination (Maguire, 1962) [27], root length (cm), shoot length (cm) (ISTA 2013) [21], dry matter (g/ 10 seedling) (Gupta, 1993) [16], Vigour (Abdul-Baki and Anderson, 1973) [1], Seed health (%) (ISTA, 2013) [21].

Result and discussion
The physical and physiological changes due to accelerated ageing of sesame seeds are presented in Table 1. Control seeds recorded 5.6 per cent moisture content and it was found to be increased and reached 10.4 per cent on 10th day of accelerated ageing. The increase in moisture content due to the increased in relative humidity of the storage environment. The result of this study was similar with Bharathi (1991) [8] in maize and Swan *et al.* (2012) [36] in wheat grains. Krishna

et al. (2004) [25] reported that soybean seed absorbed more moisture content than wheat seed at 45°C than at 35°C. The increased moisture content also leads to biochemical events take place such as increased hydrolytic enzyme activity and increased free fatty acid (Gomathi, 2009) [15]. The germination of the sesame seeds was 92 per cent and reached 83 per cent on 2nd day of accelerated ageing. After 10th day of accelerated ageing it declined and showed as 49 per cent (Fig 1). Germination was reduced 43 % under accelerated ageing then that of control. Ghassemi *et al*. (2010) [14] reported that decrease in germination per cent and other indices can be related to physiological changes during seed ageing. Tirusenduraselvi e*t al.* (2013) [41] observed a gradual decrease in germination, root length, shoot length and free radical scavenging activity in maize. Enhanced lipid peroxidation mediated by free radical and peroxide is considered to be one of the likely explanation for loss of seed viability during ageing (Sung 1996) [38].

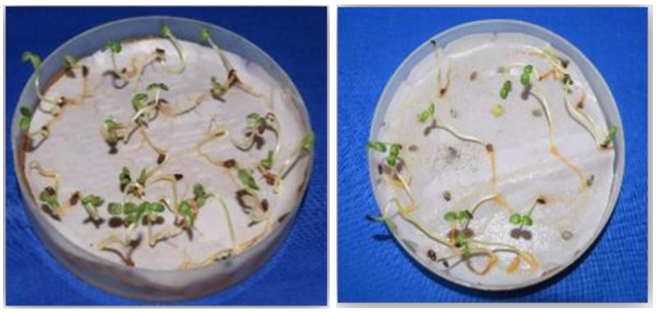


(a) (b)

Fig 1: Physiological quality of control (a) and accelerated aged conditioned sesame seeds (b)

The speed of germination of sesame seed was initially at 6.9 and reached 2.6 on 10th day of accelerated ageing [Table 1]. Speed of Germination was reduced 38 % under accelerated ageing then that of control. Lekic 2003, Tatic *et al*. 2008; Mosavi *et al*., 2011 [26, 39, 31] reported that loss of germination, reduced speed of germination, and poor seedling development due to accelerated ageing. The accelerated ageing result significantly reduction of seedling length. The root and shoot length were reduced from 0 to 10 days [(7.4 to 4.9 cm) and (6.0 to 4.6 cm)] respectively [Table 1]. Root and shoot was reduced 66 and 75 % under accelerated ageing then that of control. Similar result of decrease in seedling length was also reported by Roy *et al*. (1994) [35] in chickpea Preze and Arguello (1995) [34] in peanut, Kalpana and Madhav Rao (1995) [23] in red gram, groundnut (Nautiyal *et al*., 1997) [32] and Basra *et al*. (2003) [6] in cotton. When subjecting the sesame seeds to accelerated ageing, dry matter production and vigour index were drastically reduced from 0 to 10 days from 0.031 g (10 seedlings) to 0.22 g (10 seedlings) and 1239 to 465, respectively [Table 1]. Dry matter production and vigour index was reduced 71 and 38 % under accelerated ageing then that of control. Desphande and Mahadevappa (1994) [12] observed decrease in germinability and seedling vigour in rice. Verma *et al*. (1999) [42] also found that seedling vigour decreased with increase in age of seeds in rapeseed and mustard. Atici *et al*. (2007) [4] reported that aged seeds showed decreased vigour and produced week seedlings.

Storage environment with high relative humidity would lead to increase pathogen infection initially 2 per cent and reached 24 per cent on 10th day of accelerated ageing [Fig 2]. Awuha and Ellis, (2002) [5] reported that storage fungi influenced seed quality and decrease the germination potential of the seed. Jain (2008) [22] reported a rapid increase in concentration of free fatty acids in damaged seeds by fungal invasion.



(a) (b)

Fig 2: Seed health status of (a) and accelerated aged of sesame seeds (b)

Table 1: Physical and physiological changes due to accelerated ageing of sesame seeds

Accelerated Aging	Moisture content (%)	Germination (%)	Speed of germination	Root length (cm)	Shoot length(cm)	Dry matter (g/ 10 seedling)	Vigour index	Seed health test (%)
Control	5.6	92	6.9	7.4	6.0	0.031	1233	2
Day-1	5.8	88	5.0	7.0	5.8	0.029	1126	2
Day-2	6.2	83	5.2	6.6	5.6	0.028	1013	4
Day-3	7.0	78	4.8	6.1	5.4	0.027	897	5
Day-4	7.6	75	4.7	5.8	5.3	0.027	833	8
Day-5	7.9	73	4.5	5.7	5.2	0.026	796	8
Day-6	8.2	68	3.9	5.5	5.1	0.026	721	10
Day-7	8.8	62	3.5	5.4	4.9	0.025	639	16
Day-8	9.6	55	2.9	5.2	4.8	0.024	550	23
Day-9	10.3	52	2.8	5.0	4.6	0.022	499	24
Day-10	10.4	49	2.6	4.9	4.6	0.022	466	24
Mean	7.9	70.00	4.2	5.9	5.2	0.025	798	12
SED	1.13	4.17	0.36	0.22	0.18	0.003	16.60	0.28
CD(P=0.05)	2.34	8.48	0.73	0.45	0.37	0.006	34.44	0.58

Conclusion

The overall results showed that seed quality of sesame deteriorates due to accelerated ageing treatment. Accelerated ageing decreases the germination percentage, seedling length, dry matter production and vigour index were recorded after 10 days ageing. In conclusion the seed viability of sesame seeds under accelerated ageing conditions shows decreased with respect to increase in exposure time. Similarly, the physiological parameters also get reduced with accelerated ageing conditions.

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