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Vol. 10(35), pp. 3502-3506, 27 August, 2015
DOI: 10.5897/AJAR2015.9822
Article Number: 208591D55167
ISSN 1991-637X

http://www.academicjournals.org/AJAR

African Journal of Agricultural Research

Full Length Research Paper

Accelerated ageing test to study the relative storage potential of hybrid sunflower-RSFH-130 (*Helianthus annuus*)

Vijay K.[1], Lokesh G. Y.[2]*, Basave G.[3], Patil S. B.[4], Ganiger B. S.[5] and Rakesh C. M.[5]

[1]Department of SST, Agriculture College, Raichur, India.
[2]Seed Unit, UAS, Raichur, India.
[3]Special Officer (Seeds), UAS, Raichur, India.
[4]Department of SST, Agriculture College, Bheemarayanagudi, India.
[5]Department of SST, Seed Unit, UAS, Raichur, India.

Received 17 April, 2015; Accepted 21 August, 2015

Deterioration of oil seeds is more rapid when compared to the other crop seeds, the deterioration will depend on the chemical composition of the seed and also storage environment. Accelerated ageing (a.a) is one test to study the storage potential of the seeds where the seeds have been exposed to the artificial ageing conditions such as the different relative humidity and temperature. Sunflower hybrid seeds are exposed to different temperatures and relative humidity against the time. These accelerated aged seeds are stored for about 2 to 4 months and even after the 4 months of storage the seeds of the treatment T-1(a.a at 90 to 95% RH and 41°C for 48 h) showed the minimum seeds certification standards compared to all the treatments. There is a significant reduction in the germination as the accelerated ageing increases which corresponds to the increase in the temperature, relative humidity and timing. Seeds can be stored at this extreme temperature and relative humidity for about 4 months without losing the minimum seed certification standard germination.

Key words: Sunflower, RSFH-130, accelerated ageing, storage.

INTRODUCTION

Cultivation of the sunflower has been increased over the years due to its wide adoptability to climatic conditions and also its importance in consumption of the oil. The supply of the quality seeds to the farmers is also one of the main important factors the problem in the sunflower seeds is low storability and also the storage environment is also contributing for the storage of the sunflower seeds. The two most important environmental factors influencing the rate of deteriorative processes in seed ageing are the relative humidity of the air, which controls seed moisture content, and the temperature (McDonald, 1999). Accelerated ageing (a.a) technique is a widely used tool to test the seed quality. This ageing test of seed vigor can give better indications of probable field emergence for vegetable crop seeds than germination and growth tests (Pandey et al., 1999) a.a. Initially

*Corresponding author. E-mail: lokeshgy@gmail.com

proposed as a method to evaluate seed storability and later this test is considered as a rapid, inexpensive and simple technique study the relative storability of the seeds (Burris, 1980) a.a techniques have great potential for understanding the mechanism of ageing and associated deterioration processes of seeds (McDonald, 1999). Meanwhile, the process of deterioration under accelerated ageing conditions are essentially similar to those under normal conditions where we can predict the rate of deterioration of the seeds through the a.a test so that the relative storability of the seeds can be estimated (Aiazzi et al., 1996; Goel et al., 2002).

The sensitivity of seeds to accelerated ageing is dependent on temperature and on their moisture content. At a constant temperature, loss of seed viability is faster with increasing moisture content, seed moisture and storing temperature plays a key role in seed longevity (McDonald, 1999). At the cellular level, seed ageing is associated with various alterations including loss of membrane integrity, reduced energy metabolism, impairment of RNA and protein synthesis, and DNA degradation (Kibinza et al., 2006). During storage, a number of physiological and physicochemical changes occur, termed ageing (Sisman, 2005). The rate at which the seed ageing process takes place depends on the ability of seed to resist degradation changes and protection mechanisms, which are specific for each plant species (Sisman and Delibas, 2004; Mohammadi, 2011). In seed ageing damage at cellular membranes, decrease in mitochondrial dehydrogenises activities, chromosomal aberrations and DNA degradation increases. The sunflower hybrid RSFH-130 seeds are subjected to accelerated ageing test to know the relative storability of the seeds.

MATERIALS AND METHODS

The experiment was carried out by using the sunflower hybrid RSFH-130 which is one of the potential hybrids released from the University of Agricultural Sciences, Raichur, Karnataka, India. The seed production was taken in one of the Agricultural research station on the university the seeds are dried to the safe moisture storage. Seeds were sterilized using 5% sodium hypochlorite solution for 3 min and rinsed thoroughly in distilled water, then seeds were dried at room temperature for overnight in the laboratory and kept in room temperature until the study (Khan et al., 2003).

Accelerated ageing treatment

The sunflower hybrid RSFH-130 seeds were given treatment to study the accelerate ageing with the following treatments T0(Control No AA), T1(a.a at 90 to 95% RH and 41°C for 48 h),T2(a.a at 90 to 95% RH and 41°C for 96 h), T3(a.a at 90 to 95% RH and 41°C for 144 h), T4(a.a at 90 to 95% RH, 41°C 192 h) and T5(a.a at 90 to 95% RH and 41°C for 240 h). The accelerated ageing was done with the accelerated ageing chamber for each treatment about one kilogram of hybrid seeds were treated and after the seed treatment initial observations such as the germination, vigour and field emergence was recorded and stored in room temperature for the storage studies after the treatment.

Germination

Germination test was conducted using between paper (BP) method with 100 seed per 3 replication and then the germination paper was kept in between plastic sheets to maintain the relative humidity. The sheets were rolled and placed vertically in a plastic beaker in a germinator (ISTA, 1993). Seeds were considered as germinated when radicals reached at 5 mm length.

Germination percentage = (No. of germinated seeds / Total No. of seeds sown) X 100)

Seedling vigor index

The seedling vigor index (SVI) = (Seedling length (cm) X Germinated percentage) / 100

Field emergence

The treated seeds at sown in the field to know the field emergence 100 seeds for each of the treatments are sown and counted after 10 to 15 days and expressed in percentage.

Storage

The treated seeds are stored for 2 to 4 months in the normal room temperature and studied the storability of the seed material.

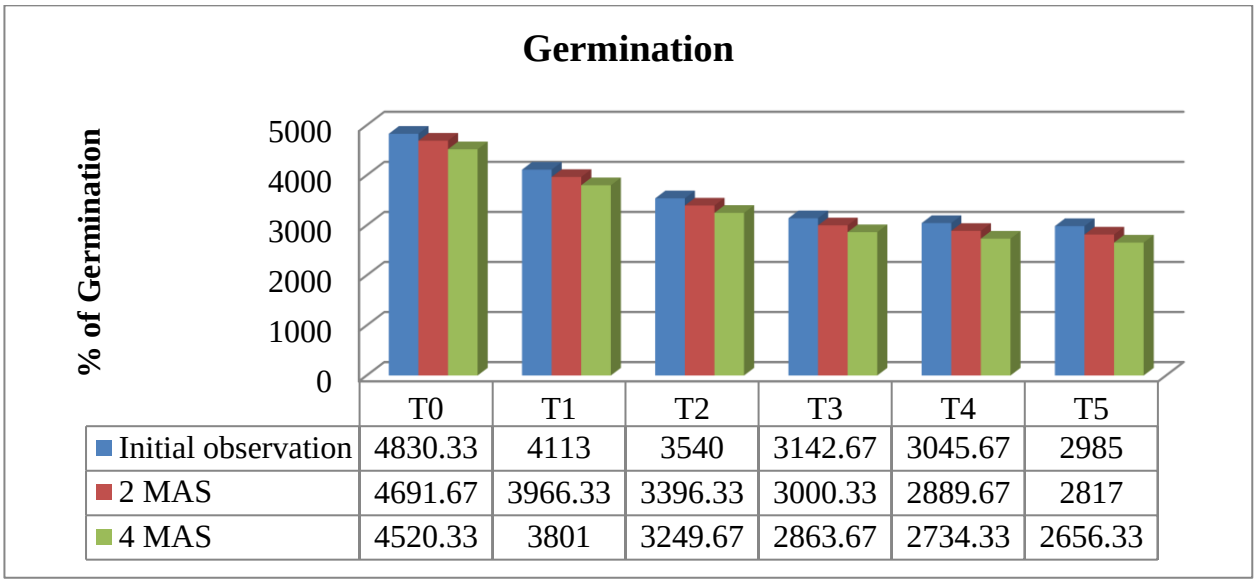
Statistical analysis

The experiment was statistically analyzed for its significance with complete randomized design.

RESULTS AND DISCUSSION

Germination

The initial germination percentage showed that the as accelerated ageing in hour's increases the germination percentage has been decreases. The possible reason of this reduction might be the lowering of biochemical activities in seeds. Ageing have damaging effect on enzymes that are necessary to convert reserve food in the embryo to usable form and ultimately production of normal seedling (Iqbal et al., 2002). Alternatively, the reduction in germination might be due to degradation of mitochondrial membrane leading to reduction in energy supply necessary for germination (Gidrol et al., 1998). The decline in shoot length, root length and seedling vigor index might be attributed to DNA degradation with ageing which leads to impaired transcription causing incomplete or faulty enzyme synthesis essential for earlier stages of germination (Kapoor et al., 2002) (Table 1).It also shows that during the storage period the germination was decreased significantly. The treatment T2 is showing the highest germination (77.36%) which is



	T0	T1	T2	T3	T4	T5
Initial observation	4830.33	4113	3540	3142.67	3045.67	2985
2 MAS	4691.67	3966.33	3396.33	3000.33	2889.67	2817
4 MAS	4520.33	3801	3249.67	2863.67	2734.33	2656.33

2 MAS: 2 Months after storage, 4MAS: 4 Months after storage.

Figure 1. Effect of accelerated ageing on the germination.

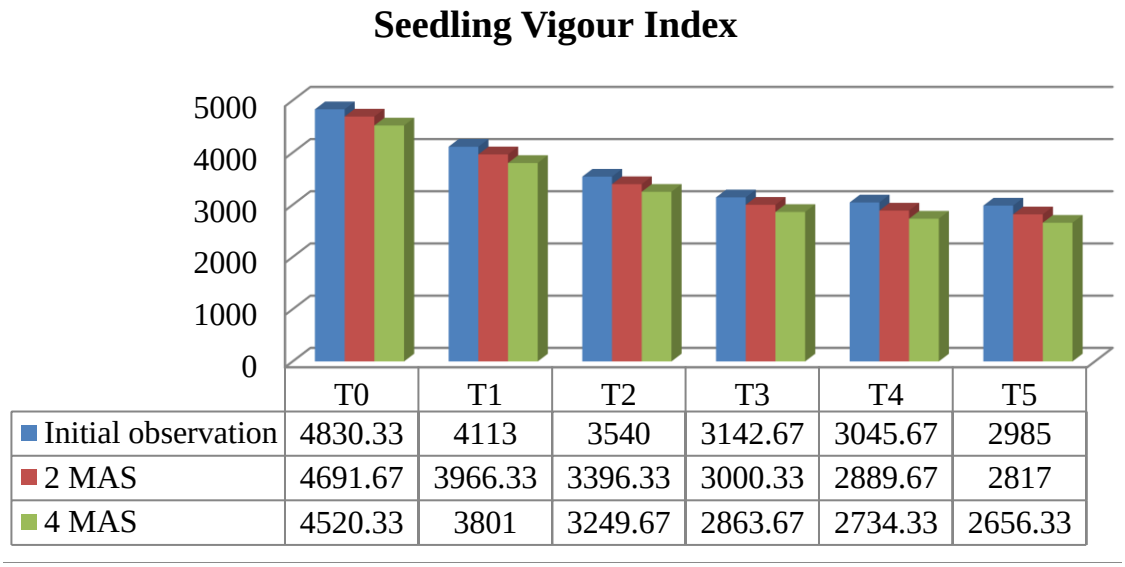


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Figure 2. Effect of accelerated ageing on the vigour index.

statistically superior and significant (Figure 1).

Seedling vigour index

Testing of vigour index is the measure in which seeds can produce the normal seedlings in the adverse situation in the field. The vigour index is another aspect related to viability found to decrease gradually in all the treatments combinations with increase in storage period. The a.a and vigour are negatively correlated to each other as the a.a increases the viability decreases (Figure 2).

This result could be explained by when sunflower RSFH-130 seeds are submitted to accelerated ageing for 2 days, the plasma membrane remains undamaged.

Table 1. Showing the results of accelerated aged seeds after the 4 months after the storage.

Treatment	Germination			Vigour Index			Field emergence		
	Initial observation	2 Months after storage	4 Months after storage	Initial observation	2 Months after storage	4 Months after storage	Initial observation	2 Months after storage	4 Months after storage
T0	96.74(79.60)	93.43(75.15)	90.0(71.58)	4830.33	4691.67	4520.33	91.67	89.67	86.33
T1	84.01(66.43)	80.7(63.94)	**77.36(61.59)**	4113.00	3966.33	3801.00	75.00	73.00	69.33
T2	73.97(59.33)	69.67(56.59)	66.36(54.55)	3540.00	3396.33	3249.67	66.33	62.67	60.33
T3	66.32(54.53)	62.68(52.35)	59.68(50.58)	3142.67	3000.33	2863.67	63.67	56.33	53.33
T4	61.34(51.55)	59.01(50.19)	57.0(49.02)	3045.67	2889.67	2734.33	57.67	55.00	51.67
T5	61.01(51.36)	57.0(49.02)	53.33(46.91)	2985.00	2817.00	2656.33	54.00	50.67	47.67
Average	75.71(60.47)	71.71(57.87)	68.26(55.7)	3609.44	3406.22	3304.22	68.66	64.56	61.44
SEm±	1.01	1.70	1.87	56.44	51.84	65.41	2.28	2.92	2.83
CD at 1 %	3.19*	5.38*	5.93*	178.89*	164.31*	207.31	7.22*	9.27*	8.97*
CV	1.67	2.95	3.41	1.62	1.84	2.42	4.10	5.55	5.64

These results suggest that, at least within the first 2 days of treatment, the lipid reserve in sunflower seeds might act as a detoxifying trap, protecting membranes from excessive damage (Gidrol et al., 1998). Finally, sunflower seed deterioration during accelerated ageing is closely related to a decrease in the activities of detoxifying enzymes and to lipid peroxidation (Gidrol et al., 1998). The activities of superoxide dismutase and peroxidase decreased during sunflower seed ageing and it was especially pronounced when accelerated ageing was applied to the seeds (Balesevic et al., 2005).

All enzyme activity is positively correlated with germination of seed as ageing progressed germination also decreased and enzyme activity also decreased which showed significant deterioration in both accelerated as well as in natural aged seed lot. All seeds undergo ageing process during long-term storage which leads to deterioration in seed quality, especially in the humid tropical regions. However, the rate of seed deterioration can vary among various plant species (Merritt et al., 2003). Aged seeds show decreased vigour and produce weak seedlings that are unable to survive once reintroduced into a habitat (Aiazzi et al., 1996).

Conclusion

The sunflower hybrid (RSFH-130) seeds were under gone for accelerated ageing to know the relative storability of the sunflower seeds and that to an adverse environment conditions, germination of the seeds has been reduced over the number of hours has been increased for the treatments. After 4 months of storage the T1 (a.a at 90 to 95% RH and 41°C for 48 h) has been maintained the minimum seed certification standards. As the storage increases the accelerated aged seeds are decreased in the minimum seed certification standards and the treatments found statistically superior and if the same environmental factor we can store the seeds for about 4 months. These findings corresponded well to those reported elsewhere that unfavourable storage conditions (high air temperature and high humidity of air) accelerate seed deterioration, causing seed quality losses and therein lower germ inability percentage of stored seed (Burris, 1980; Tewari and Gupta, 1981; Al-Yahya,1995; Depaula et al., 1996; Beratlief and Iliescu, 2005).

Conflict of Interest

The authors have not declared any conflict of interest.

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