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Effect of Packaging Material, Storage Conditions and Storage Period on Seed Quality Parameters of Sesame (*Sesamum indicum* L.)

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ABSTRACT

The present investigation was carried out to elucidate seedling characters of sesame due to ageing (storage) in different packaging material i.e. seeds in paper bag, aluminium foil pouches, PETE bottle, tetrapack packing, vacuum packing and cloth bags for different periods i.e. 150 and 250 days under dry cold room, refrigerator and ambient conditions. Seedling parameters i.e. germination percentage, seedling length, seedling dry weight and seedling vigor index were calculated and observed that they decreased with the period of ageing. Sesame seeds cultivars are stored in different packaging materials were affected due to storage but the effects were more pronounced in the cloth bag compared to the other packaging materials. Vacuum packing had maintained the seed quality with least deterioration. Storage under refrigerator conditions at low temperatures had superior quality maintained compared to storage under dry cold room and ambient conditions in all the seedling parameters.

Key words: *Sesame, Seedling vigour, Germination, Viability, Deterioration*

INTRODUCTION

India is a paradise for oilseed crops. Sesame (*Sesamum indicum* L.) is an oilseed plant belonging to the family Pedaliaceae. Sesame seed is considered to be the oldest oilseed crop known to humanity. The historic origin of sesame was favored by its ability to grow in areas that do not support the growth of other crops. It is also a robust crop that needs little farming support; sesame has been called a survivor crop. It's mainly cultivated for seeds; which are used as food and as a source of high oil since it contains a good amount of nutrients.

Sesame is usually grown in tropical zones as well as in temperate zones amongst the latitudes 40°N and 40°S. It has been cultivated for centuries, especially in Asia and Africa. In last decade, the world production of sesame seed was 3.97 mt and the major production was from Asia (2.48 mt) and Africa (1.31 mt), constituting about 62.6% and 33.10% of the total world production respectively.

Sesame presents ample adaptability to various conditions of climate and soil, resistance to drought and ease of cultivation;

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characteristics that make it an excellent option for agricultural diversification and of great economic potential in the domestic and international markets[1]. The main product of the sesame plant are its seeds which are rich in mineral components such as calcium, phosphorus, potassium, iron, magnesium, selenium and zinc[2]. Besides being the major source of edible oil with a high content of unsaturated fatty acids, especially oleic and linoleic acids[3], its industrial applications include preparation of sweets, confectionary and bakery products[4].

Seed and its quality among others are vital input in crop production. Crop response to other inputs largely depends on the quality of seed. It is estimated that good quality seeds of improved varieties alone can contribute about 18 to 20 per cent increase in crop yield keeping all the other inputs constant. Seed germination (%) and vigour are important indicators of quality which are substantially reduced during storage. Seed aging is recognized by some parameters like delay in germination and emergence, slow growth and increasing of susceptibility to environmental stresses in various duration of storage. Seed quality (viability and vigour) decreases under long storage conditions due to aging. It is the reason of declining in germination characteristics. Aging is manifested as reduction in germination percentage and those seeds that do germinate produce weak seedlings.

Storage is a basic practice in the control of the physiological quality of the seed and is a method through which the viability of the seeds can be preserved and their vigour kept at a reasonable level during the time between planting and harvesting[5]. Seed deterioration starts immediately after a crop has attained the physiological maturity stage. Thus, in order to prevent the quantitative and qualitative losses due to several biotic and abiotic factors during storage, several methods are being adopted such as seed treatment with suitable chemicals or plant products, as well as seed storage in safe containers. Oyekale[6] reported that seed deterioration during storage was due to the damage in cell membrane and other concoction changes in the seed system, for example, the protein and nucleic acid accumulation. Such degenerative changes result in complete disorganization of membranes and cell organelles and ultimately causing death of the seed and loss of viability. The most widely recognized and predictable ultra-structural changes in all the cell organelles were the loss in integrity of membranes, which constantly leads to increased seed deterioration particularly during storage.

Adriana[7] stated that seeds stored in ambient conditions lose their viability and vigour very fast due to changes in storage conditions of temperature and relative humidity. The storability of seeds is also influenced by the type of packaging material. Regular fluctuation in temperature, moisture content and storage time make the processing and storage of seeds troublesome[8]. Keeping up the viability of seeds by storing them under controlled environmental conditions has been a standout amongst the most essential lines of research in seeds of a great number of species.

MATERIAL AND METHODS

A storage experiment was carried out for period of 250 days in Laboratory of Department of Seed Science and Technology, Junagadh Agricultural University Junagadh. Sesame seeds were taken from Krishi Vigyan Kendra, Jamnagar and packed in different packaging material and stored in different storage conditions *viz.*, C_1: dry cold room (18±2ºC and 55% RH), C_2: refrigerator (5±2ºC and 38-43% RH) and C_3: ambient temperature conditions. 200 grams of seeds were packed in each packaging material i.e. P_1: paper bag, P_2: aluminium foil packets, P_3: tetrapack packing, P_4: PETE bottle, P_5: vacuum packing and P_6: cloth bag and stored under each storage condition in three replicates in completely randomized design (factorial). The observation on germination was conducted as per the procedures given by International Seed Testing Association (ISTA) using moist germination paper in petriplate method. Seedling vigour index was calculated using

formula given by Abdul Baki[9]. Seed quality parameters like seedling length, seedling dry weight, germination and seed moisture was recorded at initial and at 150 and at 250 days after storage.

Experimental data was analysed as suggested by Cochran and Cox, 1957[10] at 5% level of significance.

RESULTS AND DISCUSSION

Gradual decrease in the seed quality parameters were observed, germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigour index decreased with the increase in storage period.

Effect of storage periods

The results showed a significant effect of storage periods on the means of germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigor index [Table-1]. The results showed germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigor index were in the decreasing trend as storage periods increased. Results revealed that before storage treatments significantly exceeded the other storage periods germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigor index followed by after 150 days. While, after 250 days from storage recorded lowest germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigor index. In this regard, Manomani, *et al*.[11], reported that the decline in seedling length, seedling dry weight and seedling vigor index with increase of storage periods might be due to their genetic differences age induced deterioration, inherent differences in seed structure and composition. In addition, Mohammadi, *et al*.[12], reported that seed deterioration results in decreased percentage of normal seedlings. Seedling growth and the fraction of seed reserve mobilization indicated a significant reduced with the advance of deterioration. Decrease of seed quality is connected with bio-chemical changes in seeds of oil crops. These seeds had a quick deterioration due to auto oxidation of lipids and the increase of the content of free fatty acids during storage period. The longer seeds storage period increases intensity of seeds aging[6]. These results are in good agreement with those reported by Kandil *et al*.[13], Meena *et al*.[14], Kavitha *et al*.[15].

Effect of packaging materials

The results showed that a significant effect of package materials on the means of germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigour index [Table-1]. The results showed that germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigour index significantly affected by package materials. Highest germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigour index was noticed in seeds packed under vacuum packing since it is moisture impervious and lowest seed deterioration was recorded in followed by seeds stored in aluminium foil pouches. Lowest seedling parameters were observed in seeds stored in cloth bag as they are moisture pervious and prone to atmospheric conditions. The results were similar with results obtained by Monira *et al*.[16], Meena *et al*.[14] and Lambat *et al*.[17].

Effect of storage conditions

The results showed that a significant effect of storage conditions on the average of germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigour index [Table-1]. The results clearly indicated that storage under refrigerator conditions at surpassed dry cold room and ambient temperature conditions in germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigour index. The seeds stored under refrigerator condition maintained better seed quality compared to the other two storage conditions. Under the low temperature storage conditions even the seed metabolic activities maintained at a lower rate and minimizing the deterioration. The results were in accordance with Singh *et al*.[18] and Meena *et al*.[14].

Table 1: Mean values of germination percentage, speed of germination, seedling length (cm), seedling dry weight (mg), seedling vigour index

Characters					
Treatments	**Germination**	**Speed of germination**	**Seedling length (cm)**	**Seedling dry weight (mg)**	**Seedling vigour index**
STORAGE PERIODS (S)					
Before storage	99	36.95	7.32	2.68	265.32
150 days	90.51	31.25	6.97	2.21	201.60
250 days	83.46	27.30	5.90	1.79	150.60
CD @ 5%	0.50	0.10	0.01	0.01	1.10
PACKAGING MATERIALS (P)					
P_1	84.67	27.37	6.23	1.88	159.64
P_2	91.11	31.53	6.65	2.16	197.31
P_3	88.11	29.65	6.55	2.04	180.38
P_4	85.89	28.72	6.41	1.94	167.70
P_5	92.83	32.37	6.73	2.28	212.61
P_6	79.33	26.03	6.05	1.74	139.00
CD @ 5%	0.86	0.18	0.02	0.01	1.90
STORAGE CONDITIONS (S)					
C_1	86.89	29.24	6.44	2.00	175.47
C_2	89.14	30.67	6.51	2.08	187.03
C_3	84.94	27.92	6.36	1.93	165.82
CD @ 5%	0.61	0.13	0.01	0.01	1.34
F test interactions					
SXC	□	□ □	□ □	□	NS
SXP	□ □	□ □	□ □	□ □	□ □
PXC	□	□	□ □	□ □	□
SXPXC	□ □	□ □	□ □	□ □	□ □

CONCLUSION

Seed quality deterioration is inevitable process. Since seed is a vital input in agriculture which determines not just the production but also the productivity, it is crucial to maintain the seed quality as well as seed vigor during the storage. It has been found from present investigation that under vacuum packing seeds can be stored for longer period with least deterioration. Refrigerated condition is more suitable for storage compared to the others.

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