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ORIGINAL ARTICLE

The Effect of Priming on Germination and Enzyme Activity of Sesame (*Sesamum indicum* L.) Seeds After Accelerated Aging

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Maximum germination percentage achieves immediately after harvesting and gradually de#creases with storage time. Aging is one of the key factors in plant yield loss especially in vegetables. Seed aging is the main problem of seed storage. Application of accelerated aging treatment is used to assess seed vigor and quality. Seed priming enhances seed germination performance after aging. An experiment was conduct in order to investigate the activity of catalase and ascorbate peroxidase during accelerated aging and repair during priming treatment of sesame (*Sesamum indicum* L.) seeds. In order to improve germination characteristics in aged seeds with seed priming. Our result showed that seed priming treatments significantly ($p \leq 0.01$) affected, germination percentage, germination Index and normal seedling percentage after aging (0, 3 and 6 days). Increasing aging duration resulted higher reduction in germination characteristics. Priming with gibberelic acid (GA) increased germination characteristics of seed aged. The highest germination percentage, germination index, normal seedling percentage and enzyme activity were achieved in control conditions (0 day of aging). Also antioxidant activity of aged seeds increased after seed priming.

Key words: Hormone priming, Seed characteristics, Enzyme activity, Accelerated aging

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Sesame which is usually planted in arid and semi-arid regions is an annual oilseed crop cultivated for centuries, particularly in the developing countries of Asia and Africa, for its high content of both excellent quality edible oil (42-54%) and protein (22- 25%). High quality seed is considered to be one of the most important factors in crop production. One of the components of seed quality is seed vigor (Hampton, 1995). Accelerated aging of seed is a treatment uses to assess storage quality, germination characteristics by simulation natural aging conditions for different crops (Galeshchi *et al*., 2002; Moradi *et al*., 2009). Accelerated ageing of sunflower seeds, which consists of placing seeds at high temperature and relative humidity, is associated with a progressive decrease in seed germinability (Bailly *et al.*, 1996). Priming is a seed improving and invigoration technique applied before planting and can increase rate and percent of germination and emergence especially under stress conditions like salinity, drought and high temperature stresses (Sedghi *et*

al., 2010; Ansari and Sharif-Zadeh, 2012; Ansari *et al*., 2012). At priming, seeds uptake water and progress into the imbibition (second stage in water absorption curve) but, radicle is not sprout, then seeds were re-dried and stored at suitable conditions (low temperature and humidity) until planting time (McDonald, 1999). Sing and Amritphale (1993) used GA3 and benzyladenine for priming soybean seeds and observed vigor increase in artificially and naturally aged seeds. Sedghi *et al*. (2011) indicated that the loss of seed vigor can cause the reduction of germination percentage and priming with phytohormones improved and invigorated the poor vigor seed lots. McDonald and Kwong (2005) reported that the aging leads to decrease DNA synthesis and increased DNA degradation. It is widely believed that degradation of DNA would lead to faulty translation and transcription of enzymes necessary for germination. Most of these studies search for markers of germination such as increases in amylase activity or changes in free radical scavenging enzymes such as superoxide dismutase, catalase, peroxidase and others (Siadat *et al*., 2012; Bailly, 2004). The study aimed was to determine the effect of priming on germination and enzyme activity of sesame *(Sesamum indicum L.)* seeds after accelerated aging.

MATERIALS AND METHODS

The study was conducted in the Faculty member, Agricultural and natural resources research center of Yazd, Iran.

For accelerated aging treatments seeds were then imposed to different accelerated ageing periods of 0, 3 and 6 days at 41°C in sealed ageing boxes which had 100% relative humidity. After that, a germination test was conducted.

After aging, seeds of were pretreated with gibberellin 50 ppm at 15 °C for 24 h. Seeds were exposure in 20 cm glass petri dishes containing 15 ml solution. The imbibed seeds were then washed 4 times with tap water and dried on filter paper at 15±1°C for 24 h (Ansari and Sharif-Zadeh, 2012).

Standard germination test was carried out at 20°C for 6 days in three replications of 50 seeds. Seeds were germinated between papers (Whatman no. 1) moistened with 5 ml distilled water in petri-dishes. The germinated seeds (2 mm radicle elongation) were counted daily to calculate germination rate. At the end of the germination period, germination percentage, normal seedling percentage and germination index were recorded.

All extraction procedures were carried out at 4 ◦C. The seed samples, weighting about 0.3 gr, were homogenized with 3 ml of tris (PH 7.8), followed by centrifugation of 20000 g for 20 min. The supernatants were used for determination of enzyme activity. The supernatants were used for determination of enzyme activity. Catalase (CAT, EC 1.11.1.6) activity was determined spectrophotometric ally following H_2O_2 consumption at 240 nm (Chiu *et al*., 1995). Ascorbate peroxidase (APX, EC 1.11.1.7) activity was determined according to the procedures of Johnson and Cunningham (1972). The activities of APX and CAT were expressed per mg protein, and one unit represented 1 µmol of substrate undergoing reaction per mg protein per min.

Data of percentage was subjected to data transformation (arcsine) before the statistical analysis in order to unify the variance of the data (Siadat *et al*., 2012; Ansari *et al*., 2012). Data of experiment were subjected to randomized complete design. Statistical analyses on collected data performed with SAS and Microsoft Excel software. Mean comparisons were performed using

an ANOVA protected least significant difference (Duncan) ($P < 0.05$) test.

RESULTS AND DISCUSSION

Analyze of variance showed that aging × treatment interaction was significantly ($P < 0.01$) for all traits (Table 1). In agreement with the results, earlier reports (Bailly, 2004; McDonald, 2004; Seiadat *et al*., 2012) have shown negative affect aging on germination characteristics.

Results showed that the highest germination percentage (98%) (Fig 1), germination index (44) (Fig 2), normal seedling percentage (93%) (Fig 3), and the minimum, mean time to germination (1.03) (Fig 4) were attained from priming treatment in control conditions (Fig 1). with increases of duration of aging this traits reduction, but priming after aging increases this traits.

In agreement with the results, earlier reports (Galeshchi *et al*., 2002; Moradi *et al*., 2009), have shown negative affect aging conditions on germination characteristics. The results of our study suggested that priming cause improvement in the seed characteristics as compared to the unprimed. Also, earlier reports (Bailly, 2004; McDonald, 2004; Seiadat *et al*., 2012) have shown negative effect of aging in relation to seed performance, germination percentage and seedling indices. Akhtar *et al*. (1992) suggested that decreasing in GP was related to chromosomal aberrations that occur under long storage conditions. Decreasing of GP in aged seeds can be due to reduction of α-amylase activity and carbohydrate contents (Bailly, 2004) or denaturation of proteins (Nautiyal *et al*., 1985). According to Abdalla and Roberts, (1968) barley and pea seeds treated with different combinations of accelerated ageing treatment showed that the amount of genetic damage was solely a function of loss of viability.

Our results showed that catalase and ascorbat peroxidase activity decreased in seeds after aging, but priming increases enzyme activity in seeds after aging (Fig. 5).

Most of these studies suggest that decreases occur in the activity of enzymes in aged seeds (Bailly, 2004; McDonald, 2004). Kibinza *et al*. (2011) reported that the CAT is a key enzyme in seed recovery from ageing during priming.

Table 1. Analysis of variance of studied traits sesame seeds under accelerated aging and priming.

S.O.V	df	Germination percentage	Germination index	Mean time to germination	Normal seedling percentage
Aging (A)	2	1876.22^{**}	735.77^{**}	1.76^{**}	3168.66^{**}
Treatment (T)	1	80.22^{**}	14.49^{**}	0.07^{*}	0.22^{ns}
A*T	2	2650.88^{**}	926.32^{**}	2.81^{**}	3372.22^{**}
Error	-	4.44		0.008	22.66
CV%	-	2.76	2.83	4.15	8.06

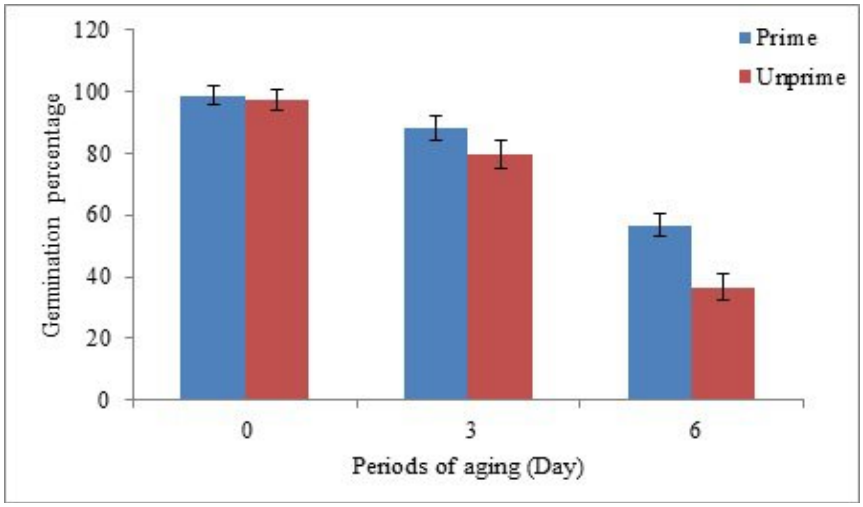

Figure 1. The effect of Aging × Treatment interaction on germination percentage.

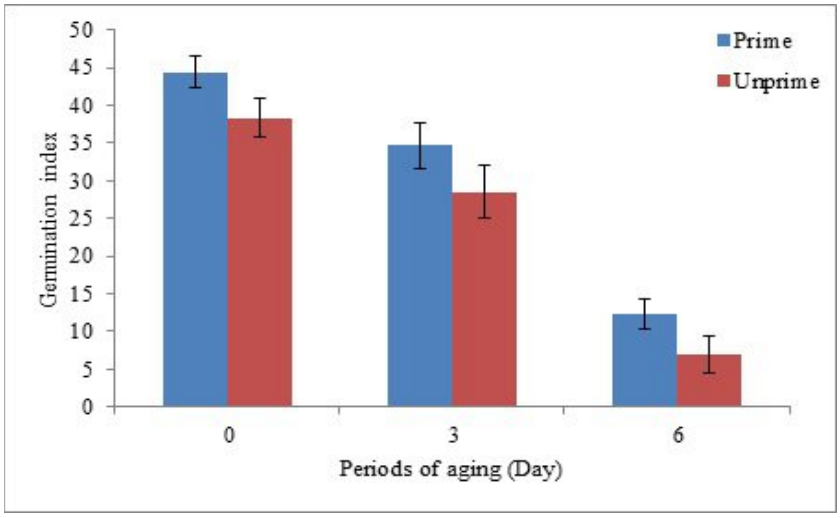

Figure 2. The effect of Aging × Treatment interaction on germination index.

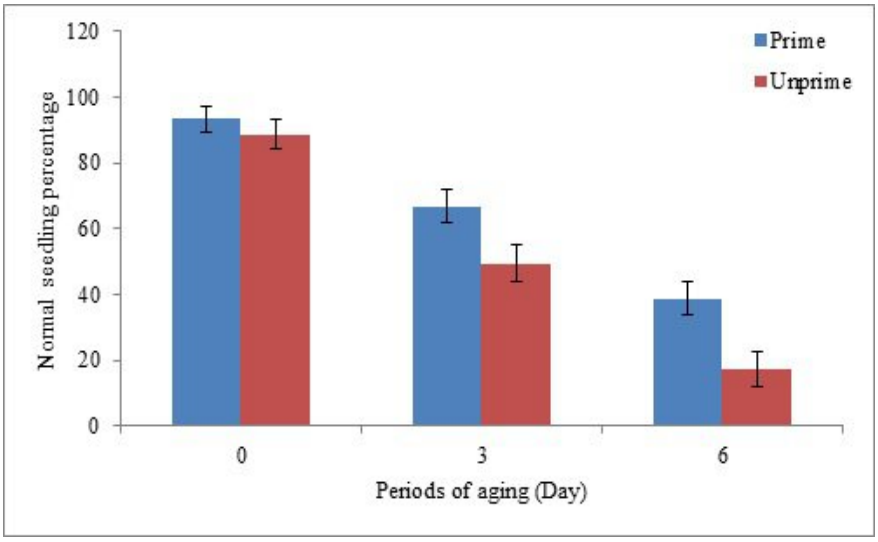

Figure 3. The effect of Aging × Treatment interaction on normal seedling percentage.

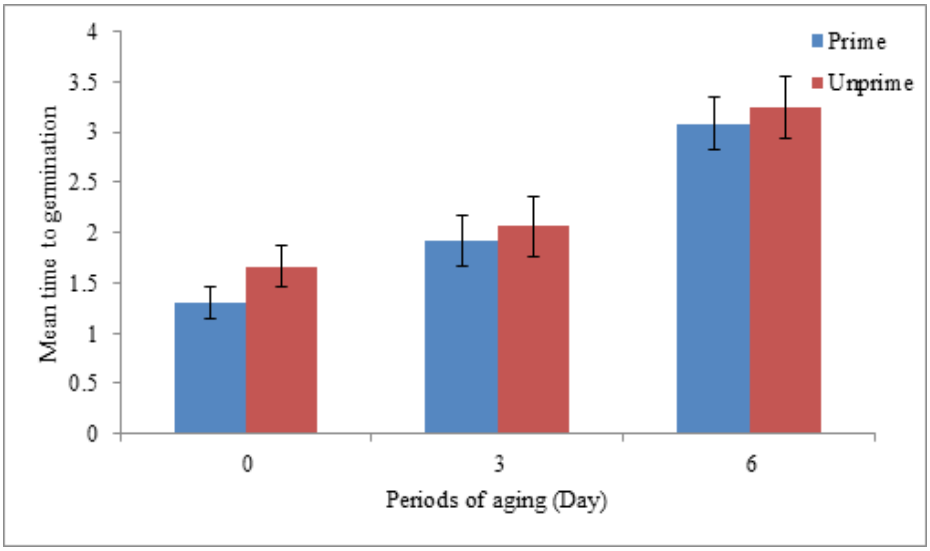

Figure 4. The effect of Aging × Treatment interaction on mean time to germination.

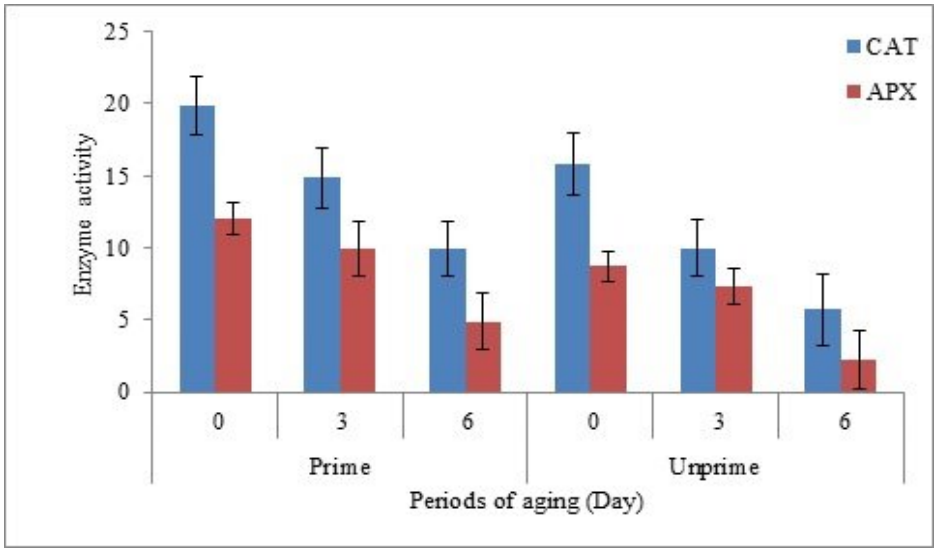

Figure 5. The effect of Aging × Treatment interaction on enzyme activity (CAT: catalase and APX: ascorbate peroxidase).

CONCLUSIONS

Our results clearly indicate that decline in germination characteristics and enzyme activity in response to aging in sesame seeds. The highest germination characteristics and enzyme activity were attained under control conditions in seed primed (0 day of aging).

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