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Changes in Viability, Vigor and Relative Growth Rate (RGR), in Okra (*Abelmoschus esculentus* L.) seeds during accelerated Ageing Technique

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Abstract:
Reduction of seedling growth is a consequence of seed deterioration. An experiment was conducted to evaluate the effects of duration of seed aging on Okra (***Abelmoschus esculentus*** L.) seeds germination characteristics. Experiment conducted as completely randomized design with 3 replications. Seeds were subjected to accelerated aging treatment for, 3, 7 and 10 day at 45 ±1 C° and 100% relative humidity. These artificially aged seeds were compared to control (Unaged seeds) for evaluation of seed vigor. Accelerated aging of Okra seeds up to three days had significant effect on germination percentage. Increase ageing period caused highly seed moisture content, electrolyte leakage (in term electrical conductivity EC) and decreased in germination percentage. Germinability was lost completely at 10 days of ageing. The accelerated ageing caused in addition of reducing germination percentage, they caused reduction in seedling length, seed vigor index, germination speed index, and shoot, root fresh & dry weight. Finally, the results revealed that accelerated aging caused depression of Okra seeds viability through the above parameters**.**

Key word : *Abelmoschus esculentus* L.**, Vigor ,** electrical conductivity **.**

Introduction

Okra (*Abelmoschus esculentus* L.) a member of the family Malvaceae and is native of South Africa and Asia. It is an annual fruit vegetable crop grown in tropical and subtropical parts of the world, mainly propagated by seeds.

Seeds contain mainly monounsaturated fatty acids (oleic) and palmitic acid [1] and their high lysine level [2].Seed storage is a serious problem in tropical and subtropical countries like Iraq where high temperature and high relative humidity greatly accelerate seed ageing phenomenon causing consequent deterioration and no viability of seeds. Seed is considered as one of the important basic agricultural inputs for obtaining higher yield. After harvesting several field crops seeds keep in storage conditions for some days, weeks, months or years. Seed storage conditions can determine germination characteristics and vigor potential of seeds [3] storage time and relative humidity of store can affect vigor of seeds [4].

Seed deterioration a natural process is expressed as the loss of quality, viability and vigor during ageing or adverse environmental conditions. It is an irreversible degenerative process that occurs during storage. The rate of deterioration is influenced by the seed moisture content and the temperature of the storage, an increase in either leading to more rapid deterioration [5].Accelerated seed ageing technique is a widely used tool to test the seed quality. The principle of this method is based on the artificial acceleration of the deterioration rate of the seeds, by exposing them to high temperature and high relative humidity, which are considered as the most prominent environmental factors with respect to the intensity and velocity of deterioration [6].This ageing test of seed vigor can give better indications of probable field emergence for vegetable crop seeds than germination and growth tests [7]. High temperature, ambient relative humidity, and seed moisture content are the main factors influencing seed storage capability [8]. Accelerated ageing test is considered standardized and correlates with field emergence under a variety of seed bed conditions [9].Seed storage quality has traditionally been intensified for seed producers. Application of accelerated ageing treatment is used to assess storage quality, germination characteristics by simulating natural ageing conditions [10]. The aims of this work was studying the changes in the total content of storage components of Okra seeds during accelerated ageing technique and its relation to seed viability, in order to reduce the time of storage experiments (which took a long time) to know the extent of changes in content of storage components of seeds.

Materials and Methods:

Plant material:

Experiments were performed on one Iraqi cultivar (*Abelmoschus esculentus* L.) local variety was used for the study. The seed materials were obtained direct from the field of Babil governorate in the season of (2011-2012) Seeds were surface sterilized using 5% sodium hypochlorite solution for 5 minutes and rinsed thoroughly in distilled water. The seeds were dried at 25°C for 24 hours in the laboratory. As described for pea by [11]. Seed material was stored in dark plastic containers at 5C° until use.

Accelerated aging treatment:

Seeds were aged acceleratedly at (45 ±1C°) and 100% relative humidity up-to 10 days. Seeds were aged in glass desiccators containing distilled water, and spread as a single layer on a metallic net to avoid contact with water. The desiccators were covered and maintained in an incubator at 45±1ºC for 3, 7 and 10 days. Seeds were taken after 3, 7, and10 days of aging treatments. Following the accelerated aging treatment, moisture content was determined and the seeds were air dried at 25°C until their original moisture content (8.0-7.3%) was restored. The seed material was stored at 4°C under the dark until use [11].

Moisture content:

Carried out in an oven at 105±3°C for 72h, using three samples of 4.0 g of seeds, for each lot. Results were expressed as mean percentages for each lot (fresh weight basis) [12].

Germination test:

Germination assays were performed in a germination laboratory. Twenty five seeds for each treatment were placed on moistened two-layered germination paper. The papers were watered whenever required. They were considered germinated when their radical length was approximately 2 mm or more. Germination count, seedlings, length were observed after 7th day of sowing [13].

Electrolyte leakage test:

Twenty five seeds were weighed and placed in 100 ml beaker containing 30 ml of distilled water. Beaker were covered and left undisturbed for overnight. The Elute was collected and the final volume was made to 50 mL with distilled water [14].The conductivity measurements were expressed in (µs\cm\25 seed).

The germination speed index (GSI):

The germination speed index (GSI) was calculated as described in the Association of Official Seed Analysts [15] by following formula:

$$GSI=\frac{\text{No.of germinated seed}}{\text{Days of first count}}+\cdots+\cdots+\frac{\text{No.of germinated seed}}{\text{Days of final count}}$$

Seedling vigor index (SVI):

Seedling vigor index (SVI) was calculated following modified formula of Abdul-Baki and Anderson [16]:

SVI = [seedling length (cm) × germination percentage]/100

Growth analysis: (Relative Growth Rate):

Seedlings of Okra cultivar were transplanted into plastic trays filled with clean sawdust .Water was topped after 3 days of planting, seedlings were harvested from trays. Root and shoot were separated, fresh and dry weights were determined [17].

Statistical test:

Data were subjected to an analysis of variance, a completely randomized design with four replications and 25 seeds per replicate and L.S.D (least significant difference) values were calculated at $P \leq 0.05$.

Results:

Moisture content:

(Fig1) shown there is significant increase in moisture content after ageing for 3 day to 10 day compared to control. Under accelerated ageing moisture content increase from 7.3% at control to 15.26, 19.76 and 30.4% in 3, 7 and 10 day respectively.

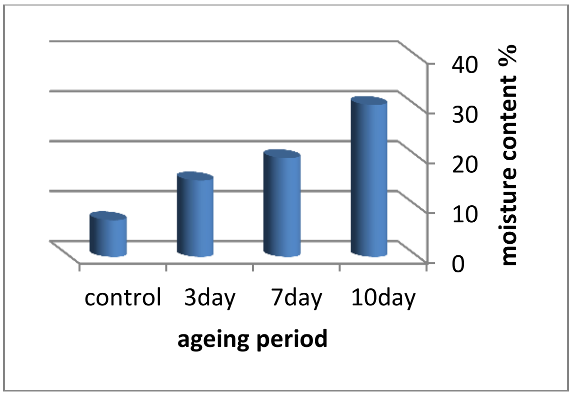

Fig (1) Effect of accelerated aging condition on moisture content (%) for Okra seedL.S.D$_{0.05}$ =5.38

Standard germination test:

The results in (Fig2) shown, during the first three days of accelerated ageing, the seeds become unviable and there was significant reduction in the germination percentage. Further increase in ageing period caused suppressive effect on germination percentage at 10 days. There is no seedling developed at 10 days of ageing. Unaged seeds exhibited average germination of 98.33%.

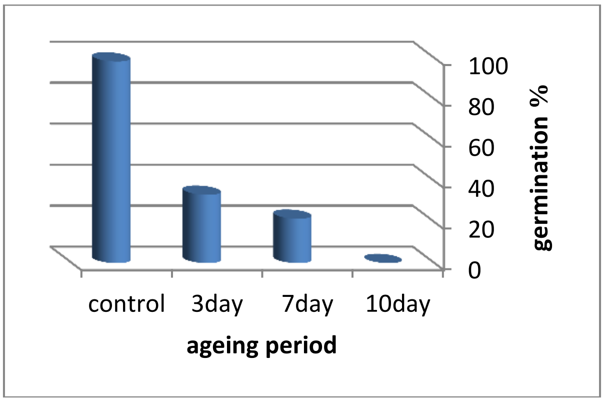

Fig (2) Effect of accelerated aging conditions on germination percentage (%) for Okra seeds.L.S.D$_{0.05}$ =12.45

Germination speed index (GSI):

Germination speed is a direct measure of seed vigor. It may be defined as "number of Germinated seeds per unit day". Accelerated ageing caused decrease the germination speed

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of seed material. The high germination speed was observed in control (17.06) compared to the lowest (0.0) at 10 days of ageing treatment.

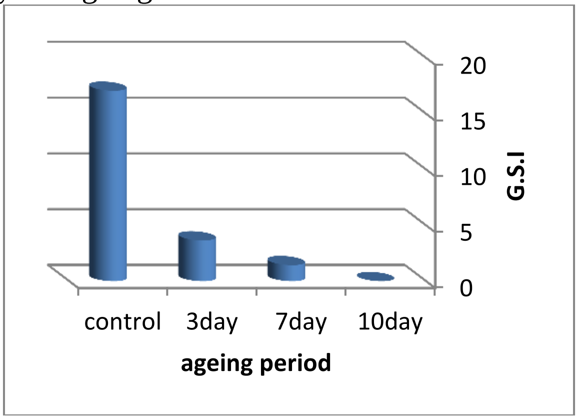

Fig (3) Effect of accelerated aging conditions on germination speed index (GSI) for Okra seeds.L.S.$D_{0.05}$ = 3.78

Electrolyte Leakage:

Solute leakage in terms of permeability perturbation (measured as electrical conductivity). The electrical conductivity of seeds increased with increasing ageing period (Fig4). It was increased from 563.6 µs\cm in control to 1920.3 µs\cm at 10 days of ageing period.

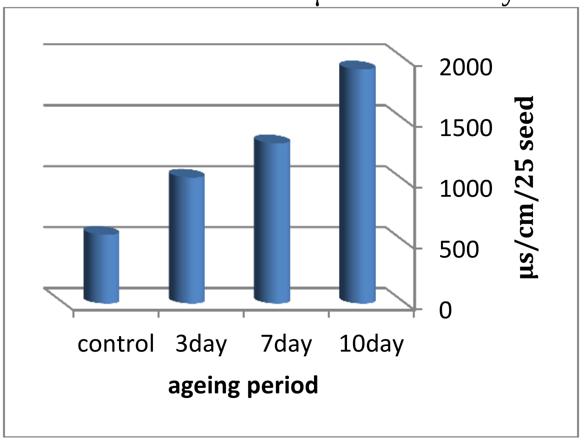

Fig (4) Effect of accelerated aging conditions on membrane permeability in term electrical conductivity (µs\cm\25 seed) for Okra seeds.L.S.$D_{0.05}$ =82.53

Seedling vigor index (SVI):

The results of seedling vigor index are presented in (Fig5). When seeds were not aged accelerating showed high (SVI) more than 26.51%. Compared with 4.88, 2.58, and 0% in 3, 7 and 10 days of accelerated ageing period respectively.

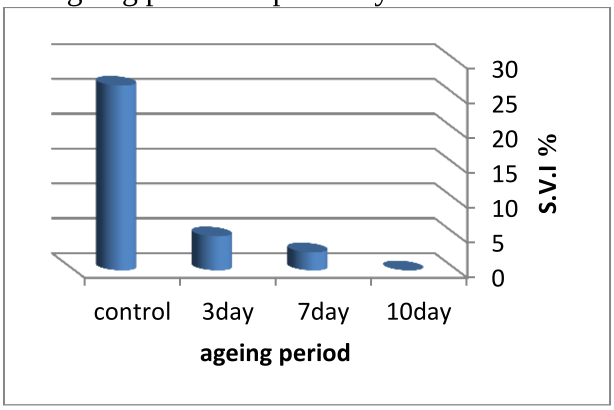

Fig (5) Effect of accelerated aging conditions on seedling vigor index for Okra seeds. L.S.$D_{0.05}$ = 3.56

Seedling length:

Accelerated ageing significantly inhibited seedling growth (Fig 6). Increase Ageing period up to 3,7 days and control produced statistically different seedling length. No seedlings were produced by seeds of 10 days of accelerated aging.

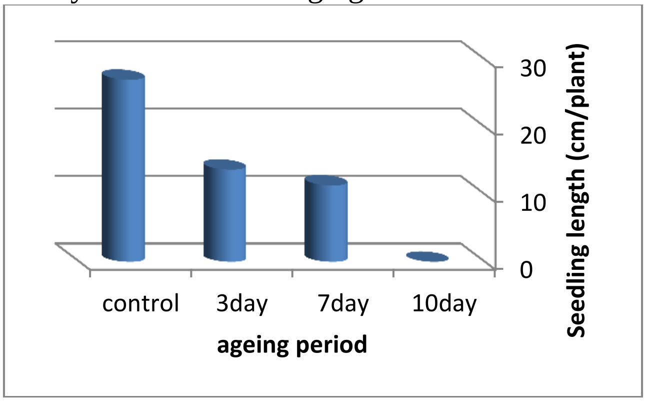

Fig (6) Effect of accelerated aging conditions on Okra seedling length (cm\plant) 7 days old.L.S.$D_{0.05}$ = 5.38

Growth analysis (Relative Growth Rate):

Accelerated aging condition showed a decline effects on fresh and dry weight of shoot compared with (un aged) seeds (Fig 7, 8).

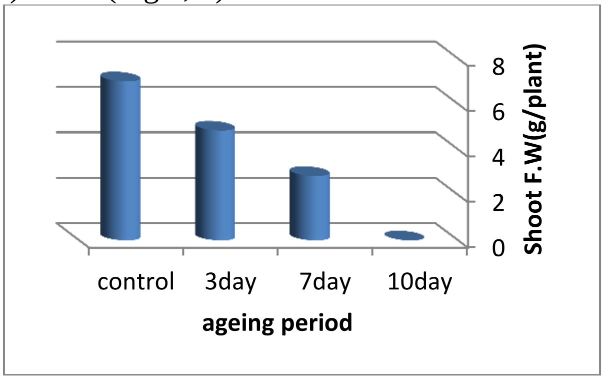

Fig (7) Effect of accelerated aging conditions on fresh weight of shoot (g\plant) of 7 days old Okra seedling . L.S.$D_{0.05}$ = 1.01

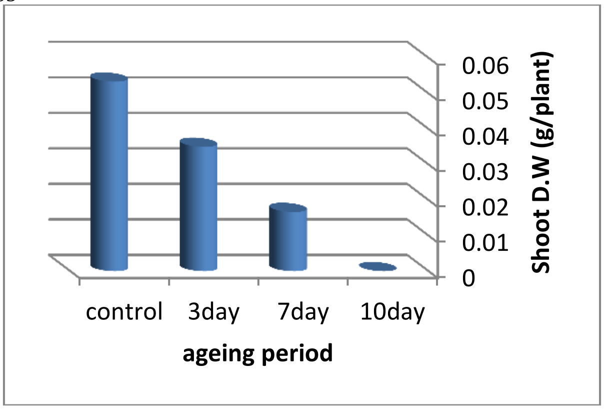

Fig (8) Effect of accelerated aging conditions on dry weight of shoot (g\plant) of 7 days old Okra seedling.L.S.$D_{0.05}$ = 0.009

Accelerated ageing condition also exhibited a significant effect on fresh and dry weight of seedling root compared to control (Fig 9, 10).The lowest value were in 10 days of ageing period (0.0) (g/ root plant), compared to highest value in control (un aged) (0.633) (g/root plant).

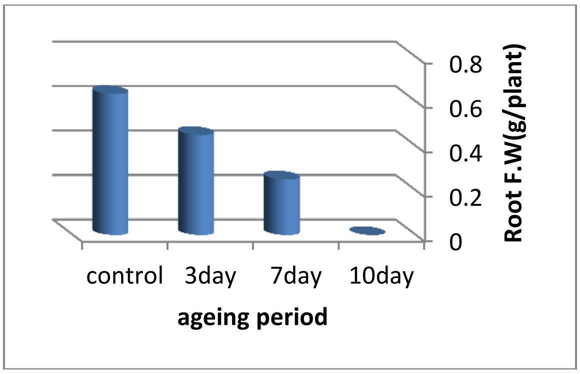

Fig (9) Effect of accelerated aging conditions on fresh weight of root (g\plant) of 7 days old Okra seedling.L.S.$D_{0.05}$ = 0.076

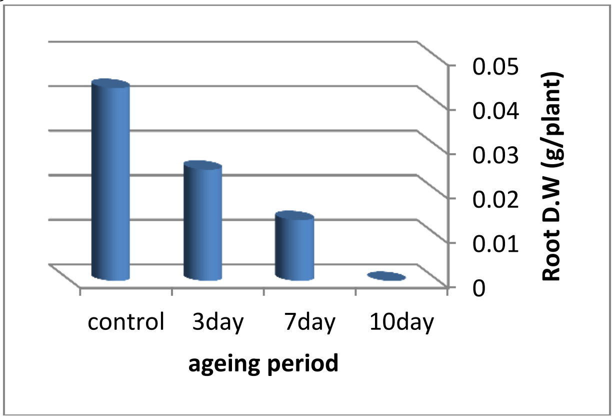

Fig (10) Effect of accelerated aging conditions on dry weight of root (g\plant) of 7 days old Okra seedling.L.S.$D_{0.05}$ = 0.0078

Discussion:

Accelerated aging treatment caused a decline in both vigor and germinability of Okra seeds. The results in (Fig1) similarly with [18] were reported increase in moisture content of sunflower seeds after accelerated ageing. This increase could be explained by imbibed water due to the disintegration of cell membranes during accelerating ageing [19].The decrease in, germination speed, and seed germination by accelerated aging may be a result of progressive loss of seed viability and vigor, which was evident in the results of this study [20]. These observations that showed a decline in seed vigour were in accordance with earlier works on *Artiplex cordobensis*[21] and soybean [22].

Earliest symptoms of seed ageing are enhanced leakage of solutes [23]and [3] and such sharp increase in the solute leakage has also been seen in the present study due to ageing ,(Fig4) showed that electrolytic leakage increase from (563.66µs\cm) at control to (1920.33µs\cm) at 10 days of ageing treatment. This confirms that solute leakage is a good indicator of the physiological status such as viability and vigour of the seeds [3].Accelerated aging also decreased seedling length, shoot, Root dry and fresh weights, and seedling vigor index. (Fig 6, 8, 10, 7, 9, 5 respectively). Similar results were reported in sunflower [18].The decrease in germination or viability related well with increased electrolyte leakage, thereby reflecting on the loss in membrane integrity. Seed viability loss is often attributed to the loss of integrity of the membrane[24].In the presence of oxygen, ageing of seed can lead to peroxidative change in polyunsaturatedfatty acid (PUFA) [25],[26]. This free radical inducing non- enzymatic peroxidation may lead to membrane damages and is likely to cause seed deterioration [28].

Reduced seed germination following seed aging treatments might have been resulted from the increased solute leakage following imbibitions which is usually accompanied with inevitable exit of some necessary materials for germination and normal seedling growth.

Present results are in agreement with those of [29]. Failure of aged seeds to germinate might be due to lipid peroxidation, mitochondrial dysfunction and less ATP production [3]; [13].Many studies have shown that peroxidative changes in fatty acid composition of membrane lipids lead to massive dysfunction of cellular membranes associated with increased viscosity and permeability of bilayers [30]; [31].Changes in membrane lipids therefore could account for the increase in solute leakage [31].Lipid peroxidation results in the loss of intact membranes in the mitochondrial cristae thereby reducing ATP production during germination process [3].

Reference:

1- Martin, F.W. &Rhodes, A.M. 1983. Seed characteristics of okra and related *Abelmoschus* species qualities plantarum. *Pl. Foods Human Nutr.* **33**:41-49.
2- Al-Wondawi, H. 1983. Chemical composition of seeds of two okra cultivars. *J. Agr. Food Chem.*, **31**: 1355-1358.
3- Mc Donald, M.B. 1999. Seed deterioration: Physiology, repair and assessment. Jou. Seed .Sci. Technol. 27:177-273.
4- Marshal, A.H. & Levis, D.N. 2004. Influence of seed storage conditions on seedling emergence, seedling growth and dry matter production of temperate forage grasses. Jou. Seed. Sci. Technol 32:493-501.
5- Ellis, R.H.; T.D. Hong & E.H Roberts. 1992. Ann. Bot.**69**: 53-58.
6- Marcos filho, J. Teste de envelhecimentoacelerado. In: KRZYZANOWSKI, F.C.; VIEIRA, R.D.; FRANÇA NETO, J.B. (Ed.) **Vigorde sementes**: conceitos e testes. Londrina: ABRATES, .1999. cap.3, p.1-24.
7- Pandey, P.K., R.D. Goyal, V. Parakash, R.P. Katiyar& C.B. Singh, .1990. Association between laboratory vigor tests and field emergence in cucurbits. *Seed Res.*, 18: 40–3.
8- Abdul-Baki, A.A. 1980. Biochemical aspects of seed vigor. *Hort.Sci.*,15:765–71.
9- Egli, D.B. and D.M. Tekrony, 1996. Seedbed conditions and prediction of field emergence of soybean seed. *J. Prod. Agri.*, 9: 365–70.
10- Siadat, S.A; Moosavi, A& Zadeh, M. S. 2012. Effects of seed priming on Antioxidant Activity and Germination Characteristics of Maize seeds under Different Ageing Treatment. Reserch. J. Of seed science. 5(2):51-62.
11- Khan, M.M; M.J. Iqbal; M. Abbas &M. Usman. **2003**. Effect of accelerated aging on viability, vigor and chromosomal damage in pea (*Pisum sativum* L.) seeds. Pakistan J. Agri. Sci., **40:** 50–4.
12- Woltz, J. M &Tekrony, D.M. **2001**. Accelerated aging test for corn seed. Seed Technology**.v.23:**p. p.21-34.
13- Basra,S.M.A;Ahmad,N.;Khan,M.M.;Iqbal,N.&Cheema,M.A.2003.Assessment of cotton seed deterioration during accelerated aging. Seed. Sci. Technol. 31: 531-540.
14- Simon, E.W & R.M. Rajaharun .1972. Leakage during seed imbibition. J. Exp. Bot. **23:** 1076-1085.
15- Association of Official Seed Analysts (AOSA).**1983**. Seed vigor testing handbook. Contribution 32, Handbook on Seed Testing, AOSA, Lincoln, NE, USA.
16- Abdul Baki, A.A. & Anderson, J.D. **1973**. Vigor determinations in soybean seed multiple criteria. Crop Sci. **13:** 630-633.
17- Al-Maskri, A; M.M. Khan; O. Al-Manthery & K. Al-Habsi .2002. Effect of accelerated aging on lipid peroxidation, leakage and seedling vigor (RGR) in cucumber (*Cucumis sativus* L.) seeds. Pakistan J. Agri. Sci., 39: 330–337.
18- Hussein, J. H; Abdulla. I.S; Oda .M.Y. 2011. Effect of Accelerated Aging Conditions on Viability of Sunflower (*Helianthus annus* L.) Seeds. Euphrates .Jou. Of Agri. Sci.3 (3): 1-9.

19- Kapoor, N; Arya, A; Siddiqui, Mohd. Asif; kumar, H. & Amir, A. 2011.Physiological & Biochemical Changes During Seed Deterioration in Aged Seeds of Rice (*Oryza sativa* L.). American. J. of plant physiology 6(1): 28-35.
20- Jain, N.; Koopar, R. & Saxena, S. 2006. Effect accelerated ageing on seed of radish (*Raphanus sativu* L.). Asian. Jou. of plant Sci. 5(3):461-464.
21- Aiazzi M.T.; Arguell, J.A; Perezo, A. & Guzman, C.A. 1996. Deterioration in *Artiplex cordobensis* (Gandogeret Suckert) seed: Natural and accelerated ageing. Seed .Sci. Technol. 25:147-155.
22- Filho, J.M.; November, A.D.C. &Champma, H.M.C.P. 2001**.** Accelerated ageing and controlled deterioration seed vigour tests for soybean. Sci. Agric. 58:421-426.
23- Vashisth, A&Nagarajan, S. 2009. Germination Characteristics of Seeds of Maize (*Zea mays* L.) Exposed to Magnetic Fields under Accelerated Ageing Condition. Journal of Agricultural Physics. *Vol. 9, pp. 50-58.*
24- Bernal, I.L. & Leopold, A.C. 1998. The dynamics of seed mortality. *Journal of Experimental Botany*, **49**(326): 1455-1461.
25- Stewart, R.R.C. & Bewley, J.D. 1980. Lipid peroxidation associated with accelerated ageing of soybean axes. *Plant Physiology*, 65: 245-248.
26- Wilson, D.O. & McDonald, M.B. 1986. The lipid peroxidation model of seed ageing. *Seed Science and Technology*, 14: 269-300.
27- Jung, J.M. & Chiu, C.C. 1995. Lipid peroxidation and peroxide scavenging enzymes in naturally aged soybean seed. *Plant Science*, **110**: 45-52.
28- Ruzrokh, M.; Golozani, K.G. & Javanshir, A. 2003. Relationship between seed vigor with growth and yield in pea (*Cicer arietinum* L). nahal o bazr. 18: 156-169.
29- Priestley, D.A. 1986. Seed ageing. Cornell University Press, Ithava, New York.
30- Copland, L.O. & McDonald, M.B. 1995. Principles of seed science and technology. Chapman and Hall, New York, USA.
31- Sung, J.M., 1996. Lipid peroxidation and peroxide scavenging in soybean seeds during ageing. Physiologia Plantarum, 97: 85-89.

التغيرات الحيوية ومعدل النمو النسبي لبذور نبات الباميا خلال استخدام تقنية الهرم المعجل

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كلية العلوم /جامعة القادسية

الخلاصة:
اختزال نمو البادرات يكون نتيجة حدوث ضرر في البذور. نفذت هذه التجربة لتقييم تأثير فترات مختلفة من الهرم المعجل لبذور نبات الباميا في بعض صفات الإنبات. نفذت التجربة باستخدام التصميم العشوائي الكامل وبثلاث مكررات. حيث عرضت البذور لظروف الهرم المعجل لمدة 3 , 7 , 10 يوم وعلى درجة حرارة 45 م±1 ورطوبة نسبية 100%. ثم قورنت البذور المعمرة مع معاملة السيطرة لتقييم حيويتها. بذور نباتات الباميا المعمرة لأكثر من ثلاثة أيام انخفضت فيها نسبة الإنبات معنوياً. أن زيادة فترة التعمير للبذور أدت إلى حدوث زيادة معنوية في المحتوى الرطوبي للبذور, كما زادت نسبة نضوح الايونات من البذور بدلالة التوصيلية الكهربائية . أن الهرم المعجل سبب بالإضافة إلى اختزال نسبة الإنبات أيضا اختزال في طول البادرة, معامل حيوية البذور, معامل سرعة الإنبات, الوزن الطري و الجاف للمجموع الجذري والخضري. في النهاية أوضحت النتائج أن الهرم المعجل سبب انخفاض في حيوية بذور نبات الباميا من خلال المؤشرات أعلاه.

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