Effect of Seed Priming treatment with Salicylic Acid on Viability of Okra (*Abelmoschus esculentus* L.) Seeds

Hussein J. Hussein
College of Science for women / University of Babylon

Abstract:

The present study was conducted to knowledge the effect of seed priming techniques on seeds viability characteristics of okra seeds, an experiment was conducted at the seeds obtained directly from the okra field of Babil governorate during the season of (2012). Seeds were soaked for 4 hours at 25 Cº in priming media (10, 25, 50, 75 & 100 mg\L of salicylic acid, hydropriming, distilled water and unprimed seeds as control). Maximum seed germination percentage, germination speed index (GSI) and seedling vigour index (SVI), were observed when the seeds primed by 100 mg\L salicylic acid for 4h at 25 Cº. Relative growth rate and all seeds germination characteristics in this study also increased with increasing salicylic acid concentration from 10 to 100 mg\L compared with control treatment.

Keywords: Seed priming; Salicylic acid; Okra seeds.

تأثير المعاملة الأولية للبذور بحامض السالسليك في حيوية بذور الباميا (*Abelmoschus esculentus* L)

حسين جبر حسين

الخلاصة :

أُجريت الدراسة الحالية من أجل معرفة تأثير تقنيات المعاملة الأولية للبذور بمحلول حامض السالسليك في مواصفات حيوية بذور نبات الباميا، نفذت التجربة على بذور تم الحصول عليها مباشرة من الحقل في محافظة بابل للعام 2012 . تم نقع البذور لمدة 4 ساعات بمحلول حامض السالسليك وبتراكيز (10، 25، 50، 75، و100 ملغم\اللتر) وبالماء المقطركما استخدمت البذور غير المعاملة كمعاملة سيطرة وعلى درجة حرارة 25 م°. أعلى نسبة أنبات و معدل سرعة أنبات ومعامل حيوية للبذور تم الحصول عليها عند معاملة البذور بتركيز 100ملغم\اللتر من حامض السالسليك لمدة 4 ساعات على درحة حرارة 25 م°. أعلى معدل للنمو النسبي وجميع صفات الإنبات في هذة الدراسة زادت بزيادة تركيز حامض السالسليك من 10 الى 100 ملغم\اللتر بالمقارنة مع معاملة السيطرة.

Introduction :

Okra (*Abelmoschus esculentus* L.) belongs to family Malvaceae. It is originated in the Africa, and grown in the Mediterranean region. It is a popular summer crop. It is a good source of vitamins A, B and C, and is also rich in protein, minerals and iodine. When ripe, the black or brown white-eyed seeds are sometimes roasted and used as a

ISSN 2072-3875

substitute for coffee. The stem of the okra plant provides fibre which is used in paper industry (Qayyum, 1990).

Seed priming is an important technique associated with the process of seed germination and is widely used to accelerate the germination of individual seeds with enhanced germination or seedling growth (Taylor & Harman, 1990). Seed priming enhances seed performance by rapid and uniform germination, normal and vigorous seedlings in different crops which have practical agronomic implications, notably under adverse germination conditions (Cantliffe, 2003). It permits seedling development in a wide range of agro-climatic conditions and decreases sensitivity to external factors (Ashraf & Foolad, 2005). Seeds performance of various crops can be improved by inclusion of plant growth regulators and hormones during priming and other pre-sowing treatments (Lee *et al*., 1998). Antioxidant likes salicylic acid (SA) has also proved for alleviating salinity stress in wheat (Afzal *et al*., 2005).

Salicylic acid is an endogenous growth regulator of phenolic nature influencing a range of diverse processes in plants including seed germination (Cutt & Klessig, 1992), ion uptake and transport (Harper & Balke, 1981), membrane permeability (Barkosky & Einhellig, 1993), stomatal closure (Larqué-Saavedra, 1979), photosynthesis and growth rate (Khan *et al*., 2003). In addition, salicylic acid also induces an increase in resistance of seedlings to osmotic stress (Borsani *et al*., 2001), high or low temperature by activation of glutathione reductase and guaiacol peroxidase (Kang & Saltveit, 2002). The aimed of experiment was conducted to explore the role of salicylic acid seed priming in improving emergence, and viability of okra seeds.

Material and methods

Plant material

An experiment was performed on one local Iraqi cultivar (*Abelmoschus esculentus* L). The seed materials were obtained directly from the field of Babylon governorate in the season of (2012). Seeds were sterilized using 5% sodium hypochlorite solution for 5 minutes and rinsed thoroughly in distilled water. The seeds were dried at 25 Cº for 24 hours in the laboratory. As described by (Khan *et al.,* 2003). Seed material was stored in dark plastic containers at 5C° until use.

Seed Priming Protocol

For priming, okra seeds were subjected to hydro-priming (distilled water only) and priming with 10, 25, 50, 75 & 100 mg\L of salicylic acid for 4hr at 25Cº. Seed weight to solution volume ratio was 1:5 (w/v) (Farooq *et al.,* 2006). For seed priming; seeds were soaked in the respective solutions or water. Thereafter, seeds were removed, given three surface washings and re-dried with air near to its original weight. Untreated seeds were used as control treatment.

Germination test:

Three replicates, each of 50 seeds, were germinated in petri dishes 9 cm

ISSN 2072-3875

diameter on Whatman NO.1 filter paper. Just enough distilled water (2.5 ml) to moisten the filter paper was provided initially. Moisture level was checked daily and topped-up as necessary. Percentage radical emergence and seed germination speed was recorded at 25 Cº after every 24 hr time interval. Time for initial signs of radical emergence and maximum emergence was recorded after 10 days (Al-Maskri *et al*., 2002).

The germination speed index (GSI)

The GSI it may be defined as "number of germinated seeds per unit day" was calculated as described by Association of Official Seed Analysts (A.O.S.A) (AOSA, 1983) by following formula:

GSI=

$$\frac{\text{Number of germinated seeds}}{\text{Days of first count}} + \cdots + \cdots + \frac{\text{Number of germinated seed}}{\text{Days of final count}}$$

Seedling vigour index (SVI)

Seedling vigour index (SVI) was calculated following modified formula of (Abdul-Baki and Anderson, 1973):

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

Relative Growth Rate (RGR)

Seedlings of okra cultivar were transplanted into plastic trays filled with clean sawdust. Water was topped after 10 days of planting, seedlings were harvested from trays. Root and shoot were separated, fresh and dry weights were determined, and shoot: root lengths were calculated days (Al-Maskri *et al*., 2002).

Statistical test:

All treatments were determined by three replicates. Data were subjected to an analysis of variance, a completely randomized design was used and LSD (least significant difference) was calculated at $P \leq 0.05$.

Results:

Germination test:

Seed priming had a significant positive effect on germination. The results in Fig (1) showed both hydro-priming and different concentration of salicylic acid caused significant increase in seeds germination percentage compared with control treatment. The highest germination percentage was observed in 100 mg\L was 98% and lowest germination percentage was observed in control 40.67%

ISSN 2072-3875

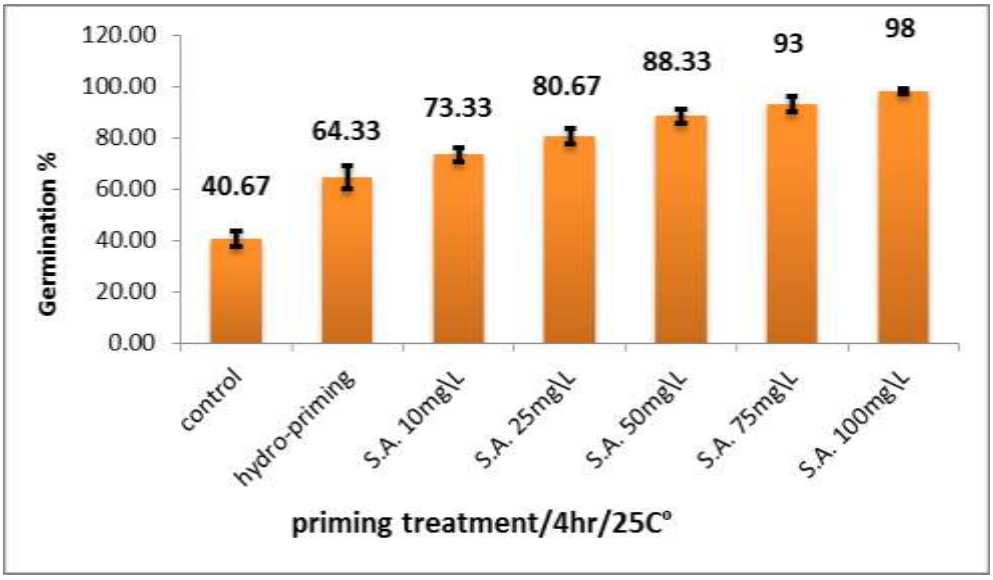

Fig (1) Effect of seeds priming with different concentration of salicylic acid at 25 Cº for 4hr on seed germination% L.S.D= 2.07

Germination speed index

The highest germination speed index (G.S.I) was obtained from seeds treated with 100 mg\L of salicylic acid. Results in Fig (2) showed significantly increased (G.S.I) from 16.95 in control to 47.6 in 100 mg\L of salicylic acid treatment.

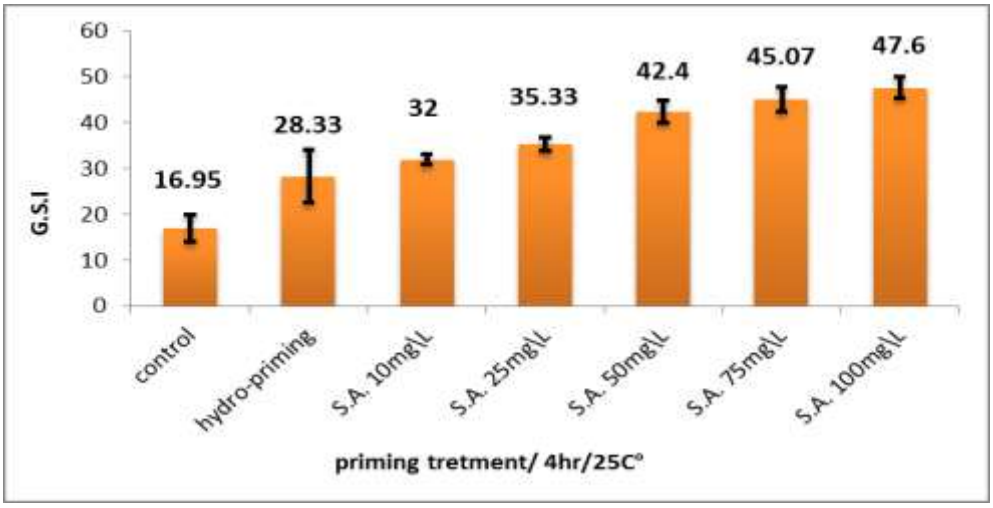

Fig (2) Effect of seeds priming with different concentration of salicylic acid at 25 Cº for 4hr on Germination speed index L.S.D= 1.76

Seedling vigour index (S.V.I)

The maximum seedling vigour index was obtained from seeds soaked in 100 mg\L of salicylic acid treatment at 25 Cº. The results Fig (3) showed the high value of (S.V.I) reached to 28.41 compared with control 2.19

ISSN 2072-3875

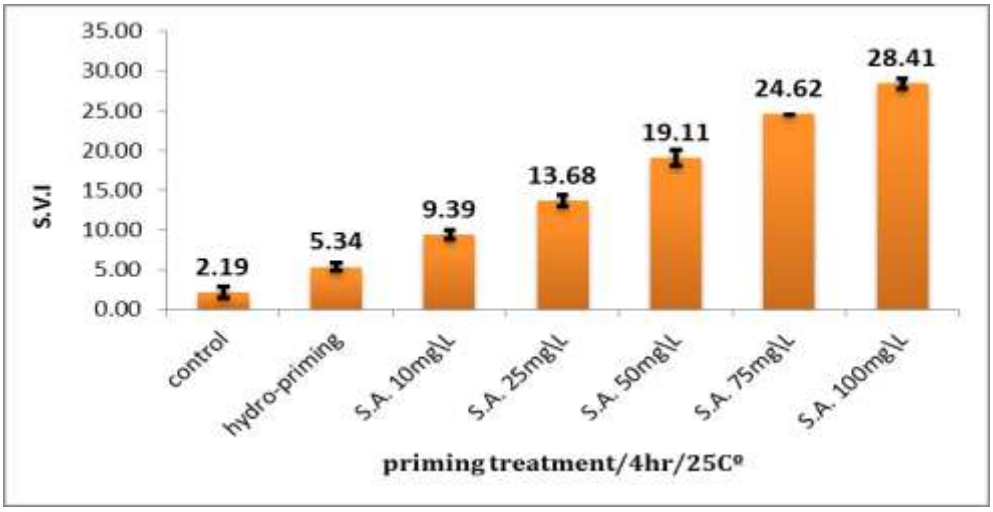

Fig (3) Effect of seeds priming with different concentration of salicylic acid at 25 Cº for 4hr on seedling vigour index (S.V.I) L.S.D= 0.38

Relative Growth Rate (RGR)

Seed priming treatments with different concentration (10, 25, 50, 75 & 100 mg\L of salicylic acid increased significantly of relative growth rate at 25 Cº. Fig (4), (5) present that shoot and root length had been significantly increased with increasing treatment of salicylic acid concentrations from 10 to 100 mg\L compared to control. Fig (5) showed the effect of salicylic acid seed priming on okra root length at 25 Cº root length increased significantly with increasing salicylic acid concentrations from 10 to 100mg\L at 25 Cº, and reached 11cm in 100 mg\L compared to 3cm in the control treatment.

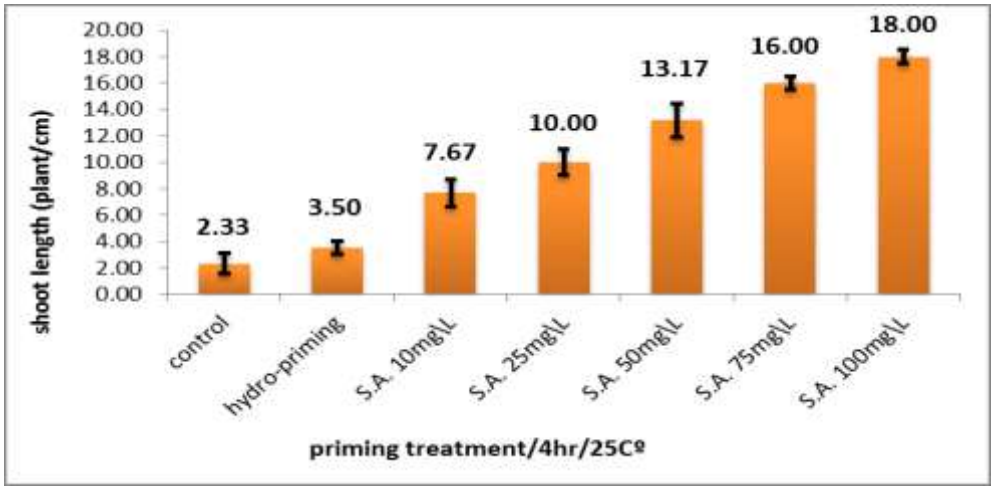

Fig (4) Effect of seeds priming with different concentration of salicylic acid at 25 Cº for 4hr on shoot length L.S.D= 0.49

ISSN 2072-3875

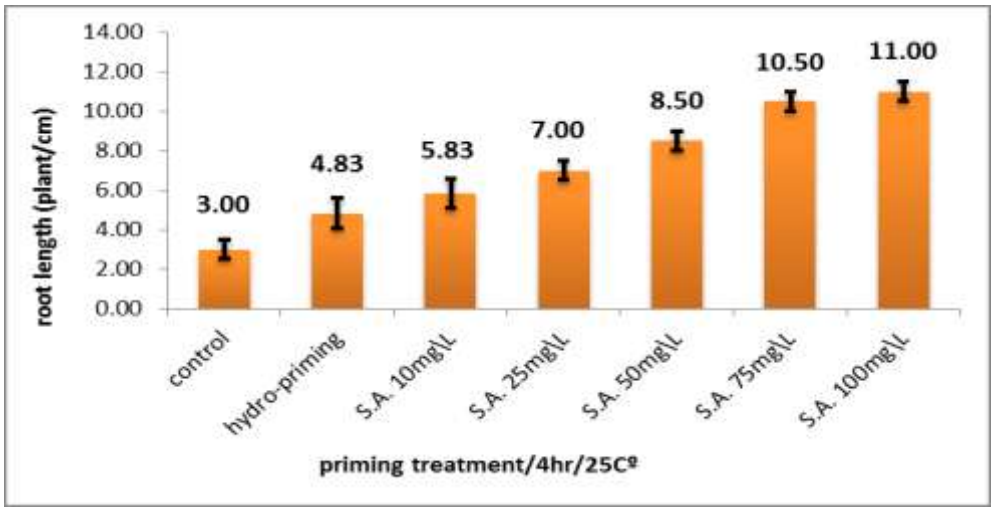

Fig (5) Effect of seeds priming with different concentration of salicylic acid at 25 Cº for 4hr on root length L.S.D= 0.34

Seed priming caused significantly increased in seedling growth, Fig (6). Increase seed priming to 100 mg\L of salicylic acid concentrations produced highest seedling length which reached to 29cm compared to 5.33cm in the control treatment.

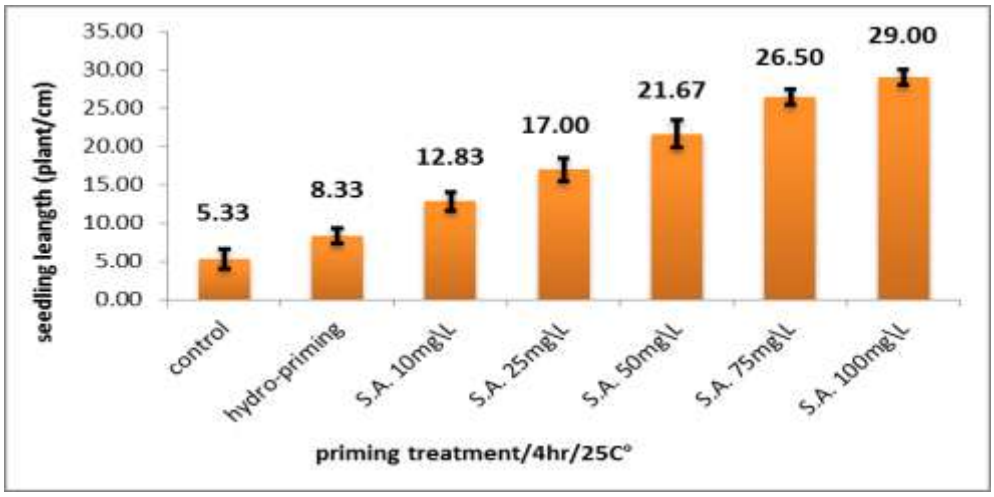

Fig (6) Effect of seeds priming with different concentration of salicylic acid at 25 Cº for 4hr on seedling length L.S.D= 0.75

Results in Fig (7), (8), indicates that priming treatment of the okra seeds with different concentrations of salicylic acid at 25 Cº for 4hr caused significant increase in fresh weight 0.2867, 0.4612, 0.5950, 0.7677, 0.9413 & 0.9988gm respectively, dry weight 0.0113, 0.0262, 0.0362, 0.0448, 0.0546 &0.0603gm respectively, of seedling compared to the control treatment.

ISSN 2072-3875

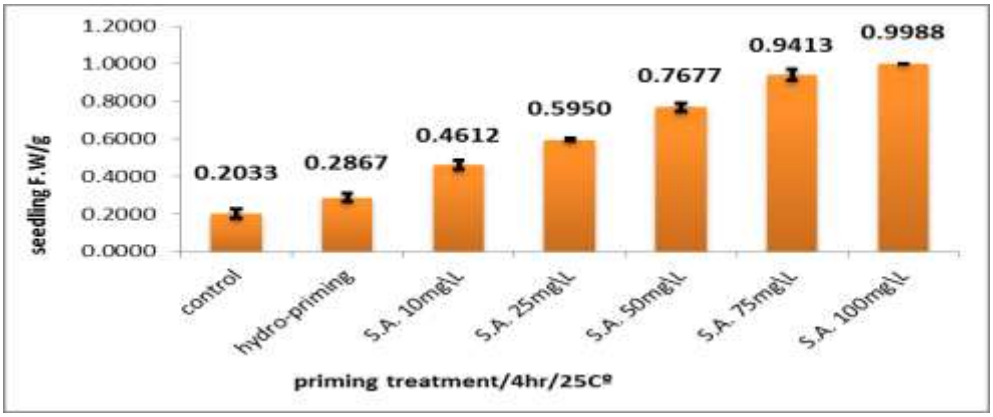

Fig (7) Effect of seeds priming with different concentration of salicylic acid at 25 Cº for 4hr on fresh weight L.S.D= 0.0175

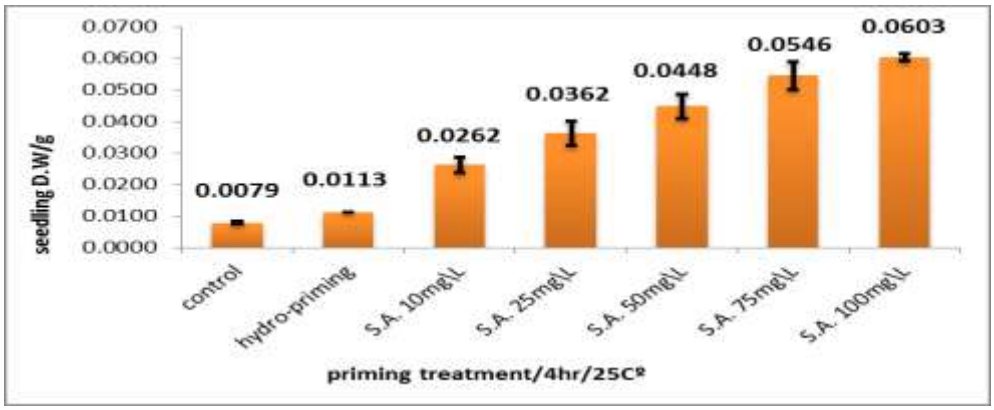

Fig (8) Effect of seeds priming with different concentration of salicylic acid at 25 Cº for 4hr on dry weight L.S.D= 0.0011

Discussion:

Seed priming increases enzyme of antioxidants such as glutathione and ascorbate in seed, these enzymes decrease the activities of lipid peroxidation in stage of germination (sharafizad *et al*., 2013). Seed priming is an efficient method for increasing seed vigour and synchronization of germination, as well as the growth of seedlings of many crops under stressful conditions (Carvalho *et al*., 2011). The results of the present study revealed that hormonal seed priming with salicylic acid enhanced animation of okra seeds. Pre-treatment with salicylic acid at different concentration (10, 25, 50, 75 & 100) mg\L increased germination percentage and Germination speed index compared with control Fig (1, 2). Similarly, an improved germination rate and percentage by ascorbate and sodium salicylic acid treatments in wheat (Al-Hakimi & Hamada, 2001). Improved the earlier emergence, final emergence, emergence index and reduced E_{50} in cucumber seeds (Rehman *et al*., 2011). Enhance in germination percentage after treatment might be the consequence of breakdown of dormancy in fresh seeds. Alternatively, the earlier and synchronized germination might be attributed to enhanced metabolic activities in treated seeds (Shakirova *et al*., 2003).

ISSN 2072-3875

Salicylic acid priming also increased seedling vigour Index (Fig 3). Increased shoot length, root length, seedling length, fresh and dry weight of Okra seeds Fig (4, 5, 6, 7 & 8). Similarly, these results were in agreement with the results which mention by Rehman *et al*., (2011) on cucumber seeds. The possible reason of this increment might be due to increased cell division within the apical meristem of seedling shoots and roots, which caused an increase in plant growth. Salicylic acid treatments maintain the IAA and cytokinin levels in the plant tissues, which enhanced the cell division (Sakhabutdinova *et al*., 2003). Hence, seed priming with different concentrations can be successfully used to improve the germination and seedling growth in okra seeds.

In conclusion, salicylic acid may be more effective for enhanced germination and seeds viability of okra.

REFERENCES

Abdul Baki, A.A. and Anderson, J.D. 1973. Vigor determinations in soybean seed multiple criteria. *Crop Sci.* 13: 630-633.

Afzal, I., S.M.A. Basra, N. Ahmad and M. Farooq . 2005. Optimization of hormonal priming techniques for alleviation of salinity stress in wheat (*Triticum aestivum* L.). *Caderno de Pesquisa Série Biologia*, 17: 95-109.

Al-Hakimi, A.M.A. and A.M. Hamada . 2001. Counteraction of salinity stress on wheat plants by grain soaking in ascorbic acid, thiamin or sodium salicylate. *Biol. Plant*., 44: 253-261.

Al-Maskri, A., Khan, M.M., Al-Manthery, O. and Al-Habsi, K . 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.

Ashraf, M. and M.R. Foolad . 2005. Pre-sowing seed treatment-A shotgun approach to improve germination, growth and crop yield under saline and non-saline conditions. *Adv. Agron*. 88: 223-271.

Association of Official Seed Analysts (AOSA). 1983. Seed Vigour Testing handbook. Contribution 32, Handbook on Seed Testing, AOSA, Lincoln, NE, USA.

Barkosky, R.R. and F.A. Einhellig . 1993. Effects of salicylic acid on plant water relationship. J. Chem. Ecol. 19: 237–247

Borsani, O., V. Valpuesta and M.A. Botella .2001. Evidence for a role of salicylic acid in the oxidative damage generated by NaCl and osmotic stress in Arabidopsis seedlings. *Plant Physiol*. 26: 1024–1030.

Cantliffe, D.J. 2003. Seed Enhanc-ements. *Acta Hort*. 607: 53-59.

Carvalho, R.F., Piotto, F.A., Schmid, D., Peters, L.P., Monteiro, C.C. and Azevedo, R.A. 2011. Seed priming with hormones does not alleviate induced oxidative stress in maize

ISSN 2072-3875

seedlings subjected to salt stress. *Sci Agri*. 68: 598-602.

Cutt, J.R. and D.F. Klessig . 1992. Salicylic acid in plants. A changing perspective. J. *Pharm. Technol*. 16: 25–34.

Farooq, M.; Basra, S. M. A. & Hafeez, K. (2006). Seed invigoration by osmo hardening in coarse and fine rice, Seed Science and Technology.34: 181-187.

Harper, J.P. and N.E. Balke .1981. Characterization of the inhibition of K^+ absorption in oat roots by salicylic acid. *Plant Physiol*., 68: 1349–1353.

Kang, H.M. and M.E. Saltveit .2001. Activity of enzymatic antioxidant defense systems in chilled and heat shocked cucumber seedling radicles. *Physiol. Plant* 113: 548–556.

Khan, M.M, Iqbal, M.J., Abbas, M. and Usman, M . 2003. Effect of accelerated aging on viability, vigour and chromosomal damage in pea (*Pisum sativum* L.) seeds. *Pakistan J. Agri. Sci*. 40: 50–4.

Khan, W., B. Prithiviraj and D. Smith .2003.. Photosynthetic responses of corn and soybean to foliar application of salicylates. *J. Plant Physiol*. 6: 1–8.

Larqué-Saavedra, A. 1979. Stomatal closure in response to acetylsalicylic acid treatment. Z. *Pflanzenphysiol*. 93: 371–375.

Lee, S.S., J.H. Kim, S.B. Hong, S.H. Yuu and E.H. Park .1998. Priming effect of rice seeds on seedling establishment under adverse soil conditions. *K. J. Crop Sci*. 43: 194-198.

Qayyum, S. 1990. A varietal trial on okra (*Hibiscus esculentus* L.) cultivars. *Pak. Agric*. 7(4): 55-78.

Rehman, H., M. Farooq , S.M.A. Basra and I. Afzal. 2011. Hormonal priming with salicylic acid improves the emergence and early seedling growth in cucumber. *J. Agric. Soc. Sci*. 7: 109–113.

Sakhabutdinova, A.R., D.R. Fatkhutdinova , M.V. Bezrukova and F.M. Shakirova. 2003. Salicylic acid prevents damaging action of stress factors on wheat plants. *Bulgerian J. Plant Physiol*. Special Issue: 314–319.

Shakirova, F.M., A.R. Sakhabutdinova, M.V. Bezrukova, R.A. Fatkhutdinova and D.R. Fatkhutdinova . 2003. Changes in the hormonal status of wheat seedlings induced by salicylic acid and salinity. *Plant Sci*. 164: 317–322.

Sharafizad, M., Naderi, A., siadat, S. A., Sakinejad, T. and Lak, Sh. 2013. Effect of Salicylic Acid Pretreatment on Germination of Wheat under Drought Stress. *Journal of Agricultural Science* 5(3): 179-199.

Taylor, A.G. and G.E. Harman 1990. Concepts and technologies of selected seed treatments. *Ann. Rev. Phytopathol*. 28: 321-329.

ISSN 2072-3875