

Influence of Seed Hardening Treatments on Germination and Seedling Behavior of Sugar Beet (*Beta vulgaris* L.) Varieties under Salinity Stress

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LABORATORY experiments were carried out to study the effect of some seed hardening treatments (polyethylene glycol (PEG -6 bar), humic acid 1%, seawater 2000 ppm, seawater 2000 ppm^R, tap water and untreated seeds as a control) on germination and seedling growth of six sugar beet varieties. These varieties namely Soultan, Kawmira, Ras poly, Tenor, FD9901 and FD9902. Germination and seedling growth traits (germination percentage, germination rate, seedling length (cm), seedling fresh weight (mg) and seedling vigor) were determined. Results showed that all germination traits were significantly affected by the studied mitigation treatments, sugar beet varieties and their interaction. The highest values of germination %, as an average of all tested varieties were recorded with polyethylene glycol (P.E.G -6 Bar) followed by that of humic acid 1% and sea water 2000 ppm^R. Enhancement percentages in germination and seedling growth traits were greater with all seed priming treatments compared to the control treatment (untreated seeds). The highest mean values of germination rate, seedling length (cm), seedling fresh weight (mg) and seedling vigor were recorded with humic acid treatment, while the lowest values of the above traits were recorded with the control treatment (untreated seeds). Kawmira and Soultan as the highly salt tolerant varieties recorded the highest values in germination and seedling growth traits. On the contrary the varieties FD9901 and FD9902 recorded the lowest values. The highest enhancement effect in germination percentages and seedling vigor were recorded with the two sensitive varieties FD9901 and FD9902 (at P.E.G (-6 bar), humic acid and S.W. 2000 ppm^R). On the contrary the lowest enhancement effect were recorded with the two highly salt tolerant varieties Kawmira and soultan.

Keywords: Mitigation treatments, Salinity stress, Germination percentage, Seedling length, Seedling fresh weight, Seedling vigor, PE -6 bar, Humic acid, Sea water .

Sugar beet is among the most salt tolerant crops, but is to be less tolerant during germination and seedling emergence (Kaffka & Kurt, 2004). Thus seed priming has been studied as a means to enhance seed/seedling salt tolerance. Murray *et al.* (1993) found that time to 50 % of maximum emergence of sugar beet seedlings

was significantly less for those primed with PEG₈₀₀₀ than for non primed seeds in only 1 of 3 years. Yari *et al.* (2010) studied the effect of different seed priming treatments (PEG₆₀₀₀ 10 and 20%, KCl₂ 4%, KH₂PO₄ 0.5 and 1% and distilled water as a control), priming durations (12, 24 and 36 hr) on germination and early growth of two wheat cultivars (Azar-2 and Sardari 101). Maximum seed germination percentage in cv. Azar-2 was observed when the seeds were primed by PEG 20% for 12 hr. Maximum vigor index (VI) of cv. Azar-2 was obtained from seeds primed with KH₂PO₄ 0.5%, while the lowest germination percentage, germination rate and VI were observed in seeds which primed with KCl 4% solution. Germination rate was improved when seeds were soaked in water and PEG 10%. Ali & Elbordiny (2009) soaked seeds of wheat (*Triticum aestivum* L.) in two concentrations (50 and 100 ppm) of potassium humate for different periods (12, 24 and 36 hr). They showed that more than 90% of seeds were germinated after five days with the application of 100 ppm potassium humate, particularly achieving the highest rate when seeds were soaked for 24 hr. Germination rate, shoot and root lengths, shoot and root dry weights and root/shoot ratio of wheat seedlings were significantly increased with soaking in potassium humate solution at 100 ppm for 24 hr as compared to the control treatment. Patil & Wadje (2010) showed that, maximum seedling vigor (of soybean and black gram) were recorded when seeds were soaked in 1% potassium humate and after 12 hr of soaking period against the control treatment (untreated seeds). Hussain *et al.* (2006) found that sunflower seeds hydro-primed and osmo-primed with NaCl resulted in lower time taken to 50% emergence and lower mean emergence time and higher final emergence and energy of emergence. Bajehbaj (2009) tested the effect of seed priming with KNO₃ on germination traits and seedling growth of four sunflower (*Helianthus annuus* L.) cultivars. Germination percentage of primed seeds was greater than that of un-primed seeds. Radicle length, seedling height and dry weight derived from primed seeds were higher compared with un-primed seeds. Mohammadi (2009) investigated the effect of NaCl priming on seed germination and seedling growth of canola under salinity stress. NaCl priming increased germination percentage; germination rate and seedling dry weight by 25.57, 34.67 and 36.67 %, respectively, as compared with the non-primed seeds.

The current work aims to improve the salt tolerance of the studied sugar beet varieties by using different mitigation treatments.

Materials and Methods

Laboratory experiments were carried out at the Fac. of Agriculture., Ain Shams University at Shoubra El-Kheima, Kalubia Governorate, Egypt. These experiments aimed to investigate the effect of some seed hardening treatments as mitigation techniques to improve the germination percentages and some seedling growth traits of six sugar beet (*Beta vulgaris* L.) varieties namely, Sulttan, Kawmira, Raspoly, Tenor, FD9901 and FD9902. Seeds of these imported varieties were obtained from the Institute of Sugar Crops Research , Agriculture *Egypt. J. Agron.* **37**, No. 1 (2015)

Research Center (ARC), Ministry of Agriculture, El-Giza, Egypt. These six varieties were selected from among twenty two varieties early investigated according to their rating as salt tolerance to represent highly tolerant varieties (Soultan and Kawmira), moderately tolerant varieties (Raspoly and Tenor) and sensitive varieties (FD9901 and FD9902) as earlyier reported by Abd El-hady *et al.* (2014). Seeds of these six selected varieties were soaked in the following solutions as mitigation treatments:

- 1- Tap water for 12 hr and dried aerobically (TW).
- 2- Diluted seawater at the concentration of 2000 ppm for 12 hr and dried aerobically (SW 2000 ppm).
- 3- Diluted seawater at the concentration of 2000 ppm for 12 hr and dried aerobically for 12 hr and soaked again for 12 hr in the same concentration of the diluted seawater and dried aerobically (SW 2000 ppm^R).
- 4- Humic acid at the concentration of 1% for 12 hr and dried aerobically (HA 1%).
- 5- Polyethylene glycol (PEG 6000) at the concentration of -6 bar (10666 ppm) for 12 hr and dried aerobically (P.E.G -6 Bar).
- 6- Untreated seeds used as a control treatment (U T).

Seawater used in this work was obtained from Marsa Matruh beach region. The chemical composition of the used seawater are shown in Table 1.

TABLE 1. The chemical content of the used seawater prior to dillution.

pH	EC dS/m	Cation (me/L)				Anions (me/L)	
		Ca ⁺⁺	Mg ⁺⁺	Na ⁺	K ⁺	HCO ₃ ⁼	Cl ⁻
7.96	54.8	21.25	116.7	434.7	16	2.59	610

The treated seeds were planted in sand culture in standard plastic germination trays (each tray contains 50 seeds) and irrigated with diluted seawater at the concentration of 8000 ppm. The trays were arranged in completely randomized design with four replicates of each treatment. Germination traits germination percentage (after 15 days from sowing), germination rate, seedlings fresh weight, seedlings length and seedling vigor were determined at the end of the experiment (after 30 days from sowing). Seedling vigor was calculated using the following equation according to ISTA (1996):

$$\text{Seedling vigor} = \text{Germination percentage}(\%) \times \text{Seedling length (cm)}$$

Statistical analysis

The obtained data were subjected to the proper statistical analysis of variance by using complete randomized design according to SAS (1995). Duncan's multiple range was used to differentiate between means.

Results and Discussion

Germination percentage

Results in Table 2 showed the significant effects of seed hardening treatments, sugar beet varieties and their interaction on germination percentage.

The highest values of germination % as an average of all tested varieties were recorded with polyethylene glycol (PEG -6 bar) (90%) followed by that of humic acid HA 1% (87%) and sea water SW 2000 ppm^R (87%) while, the lowest value (62%) was recorded with the control treatment (UT). Results also showed that germination percentages were improved by 45%, 40% and 40% with PEG (-6bar), humic acid (1%) and sea water at 2000 ppm^R, respectively as compared to the control. These results revealed that the seed hardening treatments mitigated the salt stress harmful effects. Humic acid and polyethylene glycol are characterized by relatively higher carbon contents, molecular weight of osmotica and higher aromatic ring condensation than the seawater. Humic acid contains higher amounts of basic amino acids, but relatively lower amounts of acidic amino acids. These results agreed with Yari *et al.* (2010) who studied the effect of seed priming treatments (PEG₆₀₀₀ 10 and 20%) and distilled water as a control, priming duration (12, 24 and 36 hr) and three temperatures (20, 23 and 28°C) on germination of two wheat cultivars (Azar-2 and Sardari 101). Maximum seed germination percentage in cv.Azar-2 was observed when the seeds were primed by PEG 20% for 12hr and at 20°C.

TABLE 2 . Effect of seed hardening treatments on germination percentage of studied sugar beet varieties under salinity stress (8000 ppm) after 15 days from sowing.

Varieties	UT	Seed hardening treatments					Means
		TW	SW 2000 ppm	SW 2000 ppm ^R	HA 1%	PEG -6 Bar	
Soultan	90ab	89 ab (-1.1)*	89 ab (-1.1)*	90 ab (0.0)*	92 a (2.2)*	92 a (2.2)*	90 A
Kawmira	90ab	89 ab (-1.1)*	90 ab (0.0)*	91 a (1.1)*	92 a (2.2)*	93 a (3.3)*	91 A
Ras poly	50 g	73 de (46)*	75 de (50)*	83 cd (66)*	83 cd (66)*	85 bc (70)*	75 C
Tenor	62 f	75 de (21)*	77 d (24)*	85 bc (37)*	88abc (42)*	90 ab (45)*	79 B
FD9901	36 i	70 e (94)*	71 e (97)*	83 cd (130)*	83 cd (130)*	89 ab (147)*	72 E
FD9902	44 h	70 e (59)*	69 e (57)*	89 ab (102)*	85 bc (93)*	88abc (100)*	74 D
Means	62 D	78 C (26)*	79 C (27)*	87 B (40)*	87 B (40)*	90 A (45)*	

* Enhancement percentage (%) compared with control treatment (UT)

The results indicated clearly different responses of the tested varieties to the studied mitigation treatments. Kawmira and Soultan varieties recorded the highest values (91% and 90%) of germination percentages, respectively while, the variety FD9902 recorded the lowest value (72%) as an average of all tested hardening treatments. Concerning the interaction effect between varieties and seed hardening treatments on germination percentages, results showed that the response of varieties differed greatly according to the tested seed hardening treatments. Germination percentages of Soultan and Kawmira as highly salt
Egypt. J. Agron. **37**, No. 1 (2015)

tolerant varieties were not significantly affected by the investigated seed hardening treatments. On the contrary the germination percentages of the other varieties, *i.e.*, Raspoly and Tenor (as moderately salt tolerant) and FD9901 and FD9902 (as sensitive) were significantly increased to different extents by the seed hardening treatments. The highest increases as well as the highest improvement in germination % were noticed with the two sensitive varieties particularly with PEG, HA and SW 2000 ppm^R treatments. The highest enhancement % on germination (147%) was noticed with FD9901 variety when the seeds were primed by PEG treatment followed by that of humic acid treatment (130%).

Germination rate

Table 3 demonstrates the effects of seed hardening treatments, sugar beet varieties and their interaction on germination rate of sugar beet varieties. Seeds treated with humic acid 1% and tap water recorded the highest values of germination rate by the same value (0.8) while, the lowest value (0.72) was recorded with the untreated seeds (control). Results also showed that the varieties Kawmira and Tenor recorded the highest values of germination rate by the same value (0.77), while, the variety Raspoly recorded the lowest value (0.75) which was significantly lower than that recorded with Kawmira and Tenor varieties. In respect to the interaction effect between sugar beet varieties and seed hardening treatments, results revealed that the varieties did not behave the same with the tested seed hardening treatments. Raspoly recorded the highest germination rate with humic acid, while varieties Tenor and Soultan recorded the highest germination rate value with tap water treatment. Meanwhile, the lowest values of germination rate were recorded with FD9901 for sea water 2000 ppm and Soultan with the control treatment.

TABLE 3. Germination rate of sugar beet varieties as affected by seed hardening treatments under salinity stress (8000 ppm).

Varieties	UT	Seed hardening treatments					Means
		TW	SW 2000 ppm	SW 2000 ppmR	HA 1%	PEG -6 Bar	
Soultan	0.68 c	0.82 a (21)*	0.73 bc (7.3)*	0.78 b (15)*	0.81 ab (19)*	0.77 b (13)*	0.76 ab
Kawmira	0.76 b	0.80 ab (5.3)*	0.79 b (3.9)*	0.75 bc (-1.3)*	0.78 b (2.6)*	0.76 b (00)*	0.77 a
Raspoly	0.70 bc	0.78 b (11)*	0.75 bc (7.1)*	0.73 bc (4.3)*	0.83 a (18)*	0.74 bc (5.7)*	0.75 b
Tenor	0.76 b	0.82 a (7.9)*	0.72 bc (-5.3)*	0.77 b (1.3)*	0.81 ab (6.6)*	0.76 b (00)*	0.77 a
FD9901	0.73 bc	0.81 ab (11)*	0.69 c (-5.5)*	0.76 b (4.1)*	0.77 b (5.5)*	0.78 b (6.8)*	0.76 ab
FD9902	0.72 bc	0.76 b (5.5)*	0.70 bc (-2.8)*	0.80 ab (11)*	0.80 ab (11)*	0.77 b (6.9)*	0.76 ab
Means	0.72 c	0.80 a (11)*	0.73 bc (1.4)*	0.76 b (5.5)*	0.80 a (11)*	0.76 b (5.5)*	

* Enhancement percentage (%) compared with control treatment (UT) .

Similar findings were early reported by Mohammadi (2009) on canola seeds and Bajehbaj (2009) on sunflower. They showed that germination rates of primed seeds were greater than that of non-primed seeds. Moreover, Hussain *et al* (2006) found that sunflower seeds primed with NaCl resulted in lower time taken to 50% emergence and main emergence time and higher final emergence. Ali & Elbordiny (2009) found that germination rate of wheat seeds were significantly increased with soaking in potassium humate solution at 100 ppm for 24 hr as compared to the control (soaking in distilled water).

Seedling length

Table 4 shows that seedling length of the studied sugar beet varieties were significantly affected to different extents by seed hardening treatments, sugar beet varieties and their interaction. Seeds treated with humic acid 1% recorded the highest values in seedling length. However, the lowest values were obtained with seawater 2000 ppm and the control treatment (untreated seeds). Results also showed that the seedling length of Sultana and Kawmira varieties were significantly superior when compared with other varieties. Concerning the interaction effect between seed hardening treatments and sugar beet varieties, results revealed that the highest and the lowest values in seedling length (10.4 and 4.9 cm) were recorded with Kawmira treated with humic acid 1% and with Raspoly treated with the control treatment, respectively. These results revealed clearly that the tested varieties did not response similarly to the seed hardening treatments. It is worth to mention here that the greatest enhancement in seedling length (96%) was recorded with Kawmira variety treated with humic acid (1%). These results are in general agreement with those of Ali & Elbordiny (2009) who found that shoot and root lengths of wheat seedlings were significantly increased with soaking seeds in potassium humate solution particularly with 50 and 100 ppm concentrations for 24 hr compared to the same period of soaking in distilled water. Bajehbaj (2009) reported that shoot and root lengths of sunflower seedling were increased significantly with osmopriming treatment compared to un-primed seeds under salinity stress conditions.

Seedling fresh weight (mg)

Effect of seed hardening treatments, sugar beet varieties and their interaction on seedling fresh weight are shown in Table 5. Data showed that seeds soaked in tap water and humic acid 1% recorded the highest mean values of seedling fresh weights by 67 and 65.9 mg, respectively. On the other hand, the control treatment (untreated) gave the lowest mean value (39.2 mg). The results also showed that the variety Sultana was significantly superior in seedling fresh weight as compared to the other varieties while, the variety FD9902 recorded the lowest mean value. In respect of the interaction effect between seed hardening treatments and sugar beet varieties the highest values were recorded by humic acid 1% treatment with the varieties Raspoly, Sultana and Tenor, while the lowest value was recorded by the control treatment (untreated) with the variety FD9901. Ali & Elbordiny (2009) confirmed that soaking wheat seeds in potassium humate solution at 100 ppm for 24 hr significantly increased shoot and root dry weights and root/shoot ratio of wheat seedlings as compared to the control (soaking in distilled water). Mohammadi (2009) reported that canola seeds primed with NaCl increased seedling dry weight by 36.67% as compared with the non-primed seeds.

Egypt. J. Agron. **37**, No. 1 (2015)

TABLE 4. Seedling length (cm) of sugar beet varieties as affected by seed hardening treatments under salinity stress (8000 ppm) (after 30 days from sowing).

Varieties	UT	Seed hardening treatments					Means
		TW	SW 2000 ppm	SW 2000 ppm ^R	HA 1%	PEG -6 Bar	
Soultan	6.7 d	8.8 ab (31) [*]	7.4 c (10) [*]	7.8 bc (16) [*]	9.8 ab (46) [*]	8.9 ab (33) [*]	8.2 A
Kawmira	5.3 ef	9.8 ab (85) [*]	6.6 d (25) [*]	7.2 cd (36) [*]	10.4 a (96) [*]	8.0 bc (51) [*]	7.9 AB
Ras poly	4.9 f	8.0 bc (٦٣) [*]	5.6 e (46) [*]	6.5 d (١٤) [*]	8.2 bc (٦٧) [*]	7.1 cd (٤٥) [*]	6.7 B
Tenor	5.2 ef	8.4 b (٦٣) [*]	5.9 de (١٣) [*]	6.1 de (٢٣) [*]	8.1 bc (٥٦) [*]	6.7 d (٢٩) [*]	6.7 B
FD9901	5.8 de	7.7 c (٣٣) [*]	5.8 de (٠٠) [*]	6.6 d (١٤) [*]	7.2 cd (٢٤) [*]	7.7 c (٣٣) [*]	6.8 B
FD9902	5.5 ef	7.8 bc (٤٢) [*]	5.3 ef (-3.6) [*]	6.0 de (9.1) [*]	8.1 bc (47) [*]	8.3 bc (51) [*]	6.8 B
Means	6.6 B	8.4 A (27) [*]	6.1 B (-6.1) [*]	6.7 B (1.5) [*]	8.5 A (29) [*]	7.8 AB (18) [*]	

* Enhancement percentage (%) compared with control treatment (UT) .

TABLE 5. Seedling fresh weight (mg) of sugar beet varieties as affected by seed hardening treatments under salinity stress (8000 ppm) after 30 days from sowing.

Varieties	UT	Seed hardening treatments					Means
		T.W	S.W 2000 ppm	S.W 2000 ppm ^R	H.A 1%	P.E.G -6 Bar	
Soultan	50.9 fg	69.0 b (35) [*]	52.2 ef (2.5) [*]	51.7 f (1.6) [*]	71.2 ab (40) [*]	61.5 cd (21) [*]	59.4 a
Kawmira	48.8 g	71.0 ab (45) [*]	47.5 gh (-1.4) [*]	51.2 fg (4.9) [*]	63.0 c (29) [*]	58.8 d (20) [*]	56.7 b
Raspoly	33.3 k	68.0 b (102) [*]	41.2 ij (24) [*]	41.8 i (25) [*]	73.0 a (119) [*]	47.7 g (43) [*]	50.8 c
Tenor	39.4 j	70.5 b (79) [*]	41.7 i (5.8) [*]	43.3 h (9.9) [*]	71.1 ab (80) [*]	60.1 d (52) [*]	54.4 b
FD9901	29.0 h	61.4 cd (111) [*]	41.4 ij (43) [*]	43.0 h (48) [*]	63.0 c (117) [*]	61.4 cd (111) [*]	49.9 cd
FD9902	34.0 k	62.1 cd (83) [*]	41.1 ij (21) [*]	45.5 h (34) [*]	54.0 e (59) [*]	51.6 fg (52) [*]	48.1 d
Means	39.2 d	67.0 a (71) [*]	44.2 c (13) [*]	46.2 c (18) [*]	65.9 a (68) [*]	56.9 b (45) [*]	

* Enhancement percentage (%) compared with control treatment (UT) .

Seedling vigor

Results in Table 6 shows the significant effects of seed hardening treatments, sugar beet varieties and their interaction on seedling vigor. The highest mean values of seedling vigor as an average of all tested varieties were recorded with humic acid 1% (754) followed by that of PEG (-6 bar) (698) and tap water (659) while, the lowest mean value (310) was recorded with the control (untreated seeds) treatment. These results indicated clearly that the seed hardening treatments mitigated to different extents the detrimental effect of salt stress on seedling vigor. Results also revealed that seedling vigor as an average over all varieties were enhanced by 143%, 125% and 112% with humic acid (1%), PEG (-6bar) and tap water, respectively as compared to the control (untreated treatments). Results also showed that the variety Soultan recorded the highest mean value (744) in seedling vigor as an average of all seed hardening treatments followed by the variety Kawmira (714). On the other hand, the variety FD9901 recorded the lowest mean value (499).

TABLE 6. Seedling vigor of sugar beet varieties as affected by seed hardening treatments under salinity stress (8000 ppm) after 30 days from sowing.

Varieties	UT	Seed hardening treatments					Means
		TW	SW 2000 ppm	SW 2000 ppm ^R	HA 1%	PEG -6 Bar	
Soultan	603 gh	781 c (29) [*]	659 f (9.3) [*]	702 def (16) [*]	902 ab (49) [*]	819 c (36) [*]	744 A
Kawmira	478 j	873 b (82) [*]	594 gh (24) [*]	656f f (37) [*]	939 a (96) [*]	744 d (55) [*]	714 B
Raspoly	246 m	584 h (137) [*]	420 k (71) [*]	540 i (119) [*]	681 ef (177) [*]	604 gh (145) [*]	513 DE
Tenor	323 L	631 f (95) [*]	455 jk (41) [*]	519 ij (61) [*]	713 de (121) [*]	603 gh (86) [*]	541 C
FD9901	209 m	539 i (158) [*]	412 k (97) [*]	548 hi (162) [*]	598 gh (186) [*]	686 ef (228) [*]	499 E
FD9902	242 m	546 i (125) [*]	366 L (51) [*]	534 i (120) [*]	689 ef (185) [*]	731d (202) [*]	518 D
Means	310 E	659 B (112) [*]	485 D (56) [*]	583 C (88) [*]	754 A (143) [*]	698 B (125) [*]	

*Enhancement percentage (%) compared with the control treatment (UT)

The interaction between sugar beet varieties and seed hardening treatments on seedling vigor, showed that the response of varieties differed significantly according to seed hardening treatments. Seedling vigor of the varieties FD9901 and FD9902 recorded the highest values of seedling vigor with the PEG (-6 bar) treatment while, other varieties, *i.e.* Soultan, Kawmira, Raspoly and Tenor recorded the highest values with humic acid treatment. These results are in agreement with those of Fu *et al.* (1988) who studied the osmo-conditioning of peanut seeds with 20-25% PEG for 48 hr which offered an effective means for raising germination percentage and vigor index in various deteriorated peanut seeds. Patil & Wadje (2010) showed that, maximum seedling vigor of soybean

and black gram were recorded in 1.0% potassium humate and after 12 hr soaking period in soybean and black gram against the control treatment.

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معاملات تقسية البذور و تأثيرها علي الانبات و سلوك البادرة لأصناف بنجر السكر (*Beta vulgaris L.*) تحت ظروف الاجهاد الملحي

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قسم المحاصيل – كلية الزراعة – جامعة عين شمس و *معهد بحوث المحاصيل
السكرية – مركز البحوث الزراعية – القاهرة – مصر.

أقيمت تجربة إنبات لدراسة تأثير بعض معاملات تقسية البذور عن طريق النقع في بعض المحاليل (بولى اثيلين جليكول (-٦ بار) – هيومك اسيد (١%) – مياه بحر (٢٠٠٠ جزء في المليون) – مياه بحر (٢٠٠٠ جزء في المليون) – بدون نقع) على الانبات و نمو البادرة لعدد ٦ اصناف من بنجر السكر (*Beta vulgaris L.*) و هي Ras poly - Kawmira - Soultan - FD9901-Tenor - FD9902 تم أخذ قراءات النسبة المئوية للإنبات (%) ، سرعة الإنبات ، الوزن الغض للبادرة (ملجم) ، طول البادرة ، قوة البادرة بعد ٣٠ يوم من الزراعة . أظهرت النتائج وجود تأثير معنوى لمعاملات تقسية البذور و الأصناف و كذلك التفاعل بينهم على جميع القراءات السابقة. سجلت المعاملة بالبولى اثيلين جليكول اعلى قيمه فى نسبة الانبات تلتها المعاملة بالهيومك اسيد ثم مياه البحر (نقع متكرر) على الترتيب. سجلت معاملة الهيومك اسيد اعلى القيم فى كلا من سرعة الانبات – طول البادرة – الوزن الغض للبادرة – قوة البادرة بينما معاملة المقارنه (بدون نقع) سجلت اقل القيم لهذه القراءات. اظهرا الصنفان Soultan – Kawmira تفوقا واضحا و سجلا اعلى القيم معنوية فى كلا من النسبة المئوية للإنبات (%) ، سرعة الإنبات ، الوزن الغض للبادرة (ملجم) ، طول البادرة ، قوة البادرة مقارنة ببقى الاصناف فى حين سجل الصنفين FD9902 و FD9901 اقل القيم معنوية.