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EFFECT OF SOAKING RICE (*Oryza sativa*, *L*.) SEED IN SOME ANITIOXIDANTS SOLUTIONS ON GERMINATION AND SEEDLING VIGOR UNDER DIFFERENT SALINITY LEVELS

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ABSTRACT

Laboratory experiment was conducted at the laboratory of Seed Technology Research Section, Mansoura during 2009 and 2010 years to study the effect of soaking rice seed cv. Sakha 103 in five antioxidant solutions i.e. ascorbic acid, α-tochopherol, salicylic acid, citric acid and humic acid in addition to (control) distilled water on germination percentage, seed and seedling vigor as well as seedlings chemical traits under four salinity levels i. e. tap water (250ppm.), 2000ppm. 4000ppm and 6000ppm. The results revealed that: Increasing salinity levels not only reduced seed germination but also decreased seed vigor traits which measured by (speed germination index, germination energy, germination rate, mean germination time and time to get 50% germination). Emerged seedlings at the highest salinity levels especially at 6000ppm were most weakness comparing with 250ppm (tap water), seedlings proline content increased up to salinity level 4000ppm and decreased at 6000ppm, meanwhile ascorbate content, peroxidase enzyme and chlorophyll A and B markedly decreased at high salinity levels. Soaking seed in ascorbic or salicylic acid solution improved seed germination, seed vigor and seedlings vigor comparing with soaking in distilled water and promote proline production and increased both of ascorbate content and peroxidase enzyme. Soaking seed in ascorbic or salicylic acid improved seed germination, seed and seedlings vigor under salinity levels comparing with the other antioxidants and distilled water. Also increased proline content within each salinity level under study, except in salinity level (6000 ppm) with all antioxidant solution. In general under salinity conditions, soaking rice seed cv. Sakha 103 in ascorbic acid (100 ppm) or salicylic acid (100 ppm) improved seed germination and seedlings vigor and mitigation the harmful effect of salinity.

INTRODUCTION

Rice (*Oryza sativa*, *L*.) is the major food crop for more than half of the humanity. In Egypt, the cultivated area by rice annually is almost about 22% during the summer season. Seed quality insures good germination, rapid emergence and vigor. These aspects translate to a good stand in the field. Poor seed germination and seedling establishment due to environmental constrains like water stress, soil salinity, high temperature and pathogens limit crop productivity (Blum, 1988). Abiotic stress such as salinity is one of the major environmental stresses which adversely affects germination of seeds (Dubey, 1984). Yeo *et al*., (1990) reported that, rice is sensitive to salinity at the seedling stage and becomes tolerant at the vegetative phase and very susceptible at the reproductive phase in terms of grain yield. Studies carried out by Dubey and Rani (1989) on rice seeds indicated that increased salinity level caused delayed emergence of root and shoot in germinating seeds compared to control meanwhile, Khanam *et al*., (2007) found that growth efficiency and other seedling characteristics of rice decreased as salinity levels increased. Also, Cha-um *et al*., (2009) indicated that growth characters including shoot length, fresh weight and dry weight of salt-stressed rice seedlings were inhibited, depending on NaCl concentrations. Salinity can affect germination of seeds either by creating osmotic potentials which prevent water uptake or by toxic effects of ionic elements (sodium and chloride ions) on germinating seeds (Poljakoff-Mayber *et al*., 1994). Oxidative stress is one consequence of salinity that may be due responsible for much of the damage, oxidative stress, characterized by excess accumulation of reactive oxygen radicles and could result from various environmental stresses such as salinity (Vaidynathan *et al*., 2003).

Salt susceptible species when grown without NaCl have low level of proline and its derivatives compounds but show increased accumulation under influence of salinity (Stewart and Larher, 1980).The function of proline is suggested that proline accumulation is involved in cytosolic osmotic adjustment during stress Kishor *et al*., (1995), preservation of protein structures and enzyme activities Solomon *et al*., (1994) and scavenging of hydroxyl and other free radicals, Prasad and Saradhi (1995).

So, it is important to reduce the harmful effects of salinity to enhance the seed germination and seedling vigor, this can achieve through treating rice seed before sowing with some antioxidants such as salicyicate, ascorbate, humic acid , tocopherol (Gossett *et al*.,1994). Farooq *et al*.,(2006 a) demonstrated that rice seed treatments with salicyicate and ascorbate were more effective in vigor enhancement, germination rate and seedling growth, also Farooq *et al.,(*2006 b) reported that soaking seed with Ascorbic acid (10 mg L^{-1}) for 48 h promoted germination and improved germination characters of rice seed. Farooq *et al*., (2007) reported that Salicylic acid seed treatment for 48 h resulted in earlier, synchronized, enhanced germination and improved fresh seedling dry weight than untreated seed. So, the aim of this work was to evaluate rice seed soaking with some antioxidant solutions and their efficiency to mitigate the harmful effects of salinity on rice seed germination, seed and seedling vigor and seedling chemical changes.

MATERIALS AND METHODS

This experiment was conducted in 2009 and 2010 years at the Laboratory of Seed Technology Research Unit, Mansoura, Egypt, to study the effect of soaking rice seed c.v. Sakha 103 in some antioxidants on seed germination, seed and seedling vigor as well as seedlings chemical traits under different salinity levels. The first factor (Salinity levels) had four levels, tap water (control), 2000, 4000 and 6000ppm. The second factor (Antioxidants) had five materials (Ascorbic acid, α-tochopherol, salicylic acid, citric acid and humic acid in addition to (control) distilled water. The experiment was arranged in a completely randomized design with four replicates. Rice seed was obtained from Central Administration of Seed (CAS). Seeds were previously disinfected by immersion in 5% NaOCl (sodium hypochloride solution) for 5 min. to avoid fungal invasion, then washed three times with sterilized distilled water and soaked for 24 h in antioxidants solutions i. e. ascoric acid (100 ppm.), α-tochopherol (100 ppm.), salicylic acid (100 ppm.), citric acid (100 ppm.), humic acid (500 ppm) and control (distilled water). The ratio of seed weight to solution volume was 1 : 5(gm L^{-1}).

Germination tests were carried out in sterilized Perti dishes (150 × 15 mm) covered at the bottom with two sheets of Whatman No.1 filter paper that had been autoclaved. Each dish included 50 seeds and moistened with 10 ml of salinity solutions (Tap water, 2000, 4000 and 6000ppm) and incubated growth chamber at 25 ± 2 ^{o}C and germination was observed daily to study the following characters:

Seed vigor traits:

1- Germination percentage (G%) : It was calculated by counting only normal seedlings 14 days after planting according to (ISTA rules ,1999).

2- Speed germination index (SGI): It was calculated as described in the Association of Official Seed Analysis (AOSA,1983) by following formula:

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

The seeds were considered germinated when the radicale was at least 2 mm. long.

3- Germination energy (GE): It was recorded on the 4 th day after planting. It is the percentage of germinated seeds 4 days after planting relative to the total number of seeds tested (Ruan *et al*., 2002).

4- Germination rate (GR): was defined according to the following formula of Bartllett, (1937).

$$GR = \frac{a + (a + b) + (a + b + c) \ldots\ldots (a + b + c + m)}{n\,(a + b + c + m)}$$

Where a, b, c are No. of seedlings in the first, second and third count, n is the number of counts.

5- Mean germination time (MGT): It was calculated based on the following equation of Ellis and Roberts (1981).

$$MGT = \frac{\Sigma\, Dn}{\Sigma n}$$

Where (n) is the number of seeds, which were germinated on day, D is number of days counted from the beginning of germination.

6- The time to get 50 % germination (T 50 %) was calculated according to the following formula of Coolbear *et al*., (1984).

$$T\,50\,\% = t_i + \frac{(N/2 - n_i)(t_j - t_i)}{n_j - n_i}$$

Where N is the final number of germination and n_i , n_j cumulative number of seeds germinated by adjacent counts at times t_i and t_j when n_i < N/2 < n_j.

Seedling vigor traits:

At the final count, ten normal seedlings from each replicate were randomly taken to measure seedling length.

1- Seedling length (cm): It was measured of ten normal seedlings 14 days after planting.

After then, the seedlings were dried in hot-air oven at 85 ^{0}C for 12 hours to obtain the seedling dry weight (g).

2- Seedling dry weight (g): Ten normal seedlings 14 days after planting according to Krishnasamy and Seshu (1990).

3- Seedling Vigor Index (SVI): It was calculated based on the following equation of (ISTA rules, 1999).

Seedling Vigor Index = Seedling length (cm) × Germination percentage.

Chemical traits:

1- Chlorophyll concentrations : were determined at 645 and 663 nm. Concentration of chlorophyll a (Chl a), chlorophyll b (Chl b) were estimated by the equations of Witham *et al*. (1971).

2- Proline content: Free proline content was determined according to Gilmour *et al.*, (2000).

3- Ascorbate contents: The ascorbic acid concentration was determined using the method as described by Kampfenkel *et al.* (1995).

4- Ascorbate peroxidase (APX) activity was determined following the procedure of Nakano and Asada (1981).

All obtained data of characters were subjected to the statistical analysis according to the technique of analysis of variance (ANOVA) of completely randomized design, as described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Results of the salinity levels influence on seed vigor, seedling vigor are presented in Table 1. significant effects for salinity levels on seed or seedlings vigor traits. With respect to the effect of increasing salinity levels on rice seed germination, a gradual decrease in germination percentage with increasing salinity levels, sowing rice seed in high salinity levels alike 2000, 4000 and 6000ppm decreased the germination percentage to 88, 84 and 78% comparing with 93% for the check treatment. These results agreed with (Dubey 1984) who reported that, salinity is one of the major environmental stresses which adversely affects germination of seeds and the decrease in seed germination due to salinity might be refer to the decrease in the rate of water uptake and/ or the toxic effect of accumulated sodium and chloride ions El-Saht (1994). Kord and Khalil (1995) reported that the major effect of salinity on germination may be attributed to a reduce hormone delivery throughout the seedling which inhibit the growth. Also the same effects for increasing salinity levels was observed on the other seed vigor traits such speed germination index, germination energy, germination rate, mean germination time and time to 50% germination, this was agree with germination percentage also salinity can affect germination of seeds by creating osmotic potentials which prevent water uptake (Poljakoff-Mayber *et al*., 1994), this might led to decreasing germination rate and increase the mean germination time and time to get 50% germination

From Table 1, seedlings vigor traits as seedling length, seedling dry weight and seedlings vigor index significantly affected with increasing salinity levels. The tallest length of seedlings (16.7cm), heaviest seedlings dry weight (0.28g) and the highest mean of seedlings vigor index (1496) were produced from the check treatment on contrast, the shortest seedlings length (13cm), slight seedlings dry weight (0.12g) and lowest seedling vigor index (963) were obtained from the salinity level 6000ppm . These results agreed with Dubey and Rani, 1989, Khanam *et al*., 2007 and Cha-um *et al*., 2009 who indicated that, growth characters including shoot height, fresh weight and dry weight of salt-stressed rice seedlings were inhibited, depending on NaCl concentrations.

Table 1: Effect of salinity levels and antioxidants solutions on rice seed germination, seed and seedling vigor characters.

Characters / Treatments	Germination percentage	Seed vigor					Seedling vigor		
		Speed germination index (SGI)	Germination energy (GE)	Germination rate	Mean germination time	Time to 50 % germination	Seedling length (cm)	Seedling dry weigh (g)	Seedling vigor index
A-Salinity levels									
Tap water	93	28.6	83	0.90	4.5	3.6	16.7	0.28	1496
2000 ppm.	88	27.2	60	0.81	4.7	3.9	14.4	0.24	1193
4000 ppm.	84	21.2	53	0.64	5.5	4.4	13.6	0.14	1078
6000 ppm.	78	9.3	35	0.60	6.6	5.5	13.0	0.12	963
L.S.D. 5 %	7.0	2.2	8.0	0.08	0.3	0.3	1.8	0.03	247
B-Antioxidants									
Ascorbic acid	91	23.6	64	0.77	4.9	4.1	16.5	0.23	1446
α-Tochopherol	86	21.4	59	0.73	5.4	4.5	14.1	0.19	1157
Salicylic acid	87	22.3	62	0.75	5.2	4.3	15.2	0.21	1229
Citric acid	85	21.7	59	0.74	5.4	4.4	13.7	0.18	1105
Humic acid	85	21.6	57	0.75	5.4	4.4	14.7	0.20	1186
Control	83	19.0	46	0.70	5.5	4.6	12.4	0.16	970
L.S.D. 5 %	2.0	0.7	2.0	0.02	0.1	0.1	0.3	0.01	34
A×B	*	*	*	N.S.	*	*	*	*	*

With respect to the effect of the salinity levels on seedlings chemical traits, data in Table 2, cleared that increasing salinity levels significantly affected proline content, cholorophll A and B, ascorbate contents. Proline content in seedlings varied according to the salinity level while the lowest content (3.88 µ mol/gF.Wt) was obtained from rice seedlings which planted in tap water (250ppm), after that seedlings proline content increased to (5.37 µ mol / g F.Wt) at salinity level 2000ppm and reached its highest content (8.33

μ mol / g F.Wt) in salinity level 4000ppm after that proline content decreased to (6.55 μ mol / g F.Wt) at the highest salinity level (6000ppm) . These results agreed with Cha-um *et al*., (2009). Also, Stewart and Larher (1980) reported that, salt susceptible species when grown without Nacl have low level of proline and its derivatives compounds but show increased accumulation under influence of salinity. The considerable decrease in the content of proline at 6000ppm might be due to the inhibition of the seedling growth by salt stress (Momayezi, *et al*., 2009) found that a slight increase in the content of proline at 2.5 dS m^{-1} as compared to the control, rice seedlings tend to accumulate proline at 5 dS m-1 then decrease in the content of proline at 10 dS m^{-1}. Increasing salinity levels decreased both of chlorophyll A and B, the highest means were obtained from the emerged seedling in tap water on contrast, the lowest means were obtained from emerged seedlings in salinity level 6000ppm.

Table 2 : Effect of salinity levels and antioxidants solution on rice seedling chemical traits.

Characters / Treatments	Proline ontent (μ mol / g F.Wt)	Chl .A (mg/g F Wt)	Chl .B (mg/g F Wt)	Ascorbic content (μ mol / g F.Wt)	Ascorbic acid peroxidase (m mo/ min/ g DW)
A-Salinity levels					
Tap water	3.88	1.92	1.25	138.8	9.57
2000 ppm.	5.37	1.81	1.21	135.0	8.85
4000 ppm.	8.33	1.76	1.12	125.6	8.52
6000 ppm.	6.55	1.71	1.11	101.0	7.70
L.S.D. 5 %	0.25	0.11	0.10	4.1	0.32
B-Antioxidants					
Ascorbic acid	6.54	1.88	1.20	129.0	8.90
α-Tochopherol	6.25	1.84	1.16	126.2	8.70
Salicylic acid	6.45	1.86	1.26	128.5	8.77
Citric acid	5.70	1.76	1.15	125.3	8.60
Humic acid	5.88	1.75	1.14	126.0	8.55
Control	5.39	1.72	1.13	115.8	8.42
L.S.D. 5 %.	0.34	0.08	0.07	1.9	0.17
A×B	*	N.S.	N.S.	N.S.	N.S.

Regarding the effect of salinity levels on Ascorbate contents and peroxidase enzyme, significant decrease was noticed with increasing the salinity levels from 250ppm (tap water) to 2000, 4000 and 6000ppm, Ascorbate contents and peroxidase were decreased from 138.8μmol/g F.Wt and 9.57 mmo/min/ g DW to 101μmol/g F.Wt and 7.70 mmo/min/gDW with increasing salinity levels from 250 to 6000ppm, respectively. These results similar to Morad and Ismail (2007) while they reported the decreasing ascorbate contents in sensitive rice variety with increasing the salinity levels.

The effect of soaking rice seed in antioxidant solutions on seed germination, seed and seedling vigor traits as well as seedling chemical traits was significant as presented in Tables 1 and 2. Soaking seed before sowing in ascorbic acid solution produce the highest means of germination percentage 91% followed by soaked seed in salicylic acid 87%, α-Tochopherol 86%, citric and humic acid 85% finally, the lowest means 83%

was obtained from the check treatment. The effect of antioxidants on seed vigor was similar to its effects on germination percentage, while soaked seed in ascorbic acid, salicylic acid and humic acid had the highest speed germination index, germination energy, germination rate, the lowest mean germination time and time to get 50% germination compared with the soaked seed in distilled water. On the other hand, and as a results of enhancing seed vigor with soaking in ascorbic, salicylic acid, α-Tochopherol, humic and citric acid comparing with distilled water seedling vigor traits i.e seedling length, seedling dry weight and seedling vigor index of seed reached its highest levels with significant differences at confidence level 5% comparing with the check treatment (distilled water). These results were similar with Farooq et *al*.,(2006 b), Farooq *et al*., (2007), while they reported that soaking seed with Ascorbic or salicylic acid enhanced the seed germination. The earlier germination might be attributed to increased metabolic activities in treated seeds (Basra *et al*., 2005). Improved seedling dry weight might be due to increased cell division within the apical meristem seedling roots. Moreover, salicylate treatment maintains the IAA and Cytokinin levels, which enhances the cell division (Sakhabutdinova *et al*., 2003) and induces an increase in the resistance of seedlings to osmotic stress (Borsani *et al*., 2001). Soaking seed in antioxidant solutions had significant effects on seedlings chemical components as presented in Table 2. Soaking seed in ascorbic acid solution produced the highest proline contents 6.54 µ mol / g F.Wt comparing to 5.39 µ mol / g F.Wt for soaking in distilled water. Soaked seed in ascorbic acid solution produced the highest means of chlorophyll A 1.88 mg/g FWt meanwhile, salicylic acid produce the highest chlorophyll B 1.26 mg/g F Wt .On contrast, soaked seed in distilled water had the lowest chlorophyll A (1.72 mg/g F Wt) and B (1.13 mg/g F Wt). The seeds pretreated with 10.2 mol/L SA solution exhibited higher chlorophyll content and significantly increased the pigment content under salt stress (El-Tayeb 2005). Ascorbate contents and peroxidase enzyme significantly increased from 115.8 µmol/g F.Wt and 8.42 mmo/min/ g DW for soaked seed in distilled water to 129 µmol/g F.Wt and 8.90 mmo/min/ g DW in soaked seed in ascorbic acid solution. Bhattacharjee and Gupta, (1985) reported that, Pre-treatment of seeds with antioxidant compounds such as ascorbic acid can increase free radical scavenging enzymes such as superoxide dismutase (SOD), catalase (CAT) and peroxidase in seeds.

Data in Tables 3 and 4, cleared that the interaction between salinity levels and antioxidants solution had significant effects on germination percentage, mean germination time , time to 50% germination and speed germination index. Sowing soaked seed in ascorbic acid solution at salinity level 250ppm (tap water), produced the highest germination percentage (96%) whereas, the lowest mean of germination percentage (75%) was obtained from soaked seed in distilled water and planting in 6000ppm. Also this interaction had the same effects on seed vigor traits while, the indicators of seed vigor as increasing speed germination index, short germination time and less time to get 50% germination were obtained from soaking rice seed in ascorbic acid and planting at salinity level 250ppm (tap water).

Table (3): Effect of interaction between salinity levels and antioxidants solution on rice seed germination percentage and mean germination time.

Salinity levels / Antioxidants	Germination percentage				Mean germination time (days)			
	Tap water	**2000 ppm**	**4000 ppm.**	**6000 ppm.**	**Tap water**	**2000 ppm.**	**4000 ppm.**	**6000 ppm.**
Ascorbic acid.	96	93	89	85	4.1	4.3	5.0	6.3
α-Tochopherol	94	92	84	75	4.4	4.7	5.7	6.6
Salicylic acid	94	87	83	82	4.4	4.7	5.3	6.4
Citric acid	93	85	85	77	4.7	4.8	5.4	6.6
Humic acid	92	88	83	76	4.6	4.6	5.6	6.7
Control	91	83	81	75	4.8	4.9	5.7	6.7
L.S.D. 5 %	3.0				0.2			

On the contrast, indicators of reduction seed vigor as decreasing speed germination index, increasing mean germination time or time to get 50% germination were notice from sowing soaked seed in distilled water and plating in salinity level 6000ppm.

Table (4): Effect of interaction between salinity levels and antioxidants solution on time to 50 % germinated seed and speed germination index.

Salinity levels / Antioxidants	Time to 50 % germinated seed (days)				Speed germination index (SGI)			
	Tap water	**2000 ppm**	**4000 ppm.**	**6000 ppm.**	**Tap water**	**2000 ppm.**	**4000 ppm.**	**6000 ppm.**
Ascorbic acid	3.5	3.7	4.0	5.3	30.5	29.8	24.1	10.0
α-Tochopherol	3.5	4.1	4.6	5.6	29.2	27.4	19.3	9.6
Salicylic acid	3.5	3.8	4.4	5.5	29.6	29.3	23.0	9.5
Citric acid	3.8	3.7	4.4	5.6	27.6	26.8	22.8	9.6
Humic acid	3.6	3.9	4.5	5.6	28.2	28.1	20.3	9.6
Control	3.9	4.2	4.6	5.6	26.6	23.8	17.8	9.6
L.S.D. 5 %	0.2				1.5			

Also data in Tables 5 and 6 cleared that, germination energy and seedling vigor traits significantly affected by this interaction. Germination energy, seedling length, seedlings dry weight and seedlings vigor index for germinated seedlings in salinity level 250 ppm(tap water) and soaking in ascorbic acid pre-sowing were the highest on contrast, sowing seed after soaking in distilled water in salinity level 6000ppm produced the lowest readings of germination energy and seedlings vigor traits.

Data in Table 7, show the interaction between salinity levels and antioxidants had significant effect on proline content, the lowest mean of proline content was produced from sowing soaked rice seed in distilled water at salinity level 250ppm (tap water), on the contrast, proline contents increased gradually at salinity level 2000ppm and reached its highest content at 4000ppm after that, proline contents reduced at the salinity level 6000ppm .From these results soaking rice seed in ascorbic or salicylic acid improved seed germination, seed and seedlings vigor under salinity levels comparing with other antioxidants and distilled water. Also increased proline content within each salinity level under study, except of salinity level (6000ppm) with other antioxidant solution. Thus, under salinity conditions soaking rice seed c.v. Sakha 103 in ascorbic (100 ppm) or salicylic acid (100 ppm) improved seed germination and seedling vigor and mitigation the harmful effect of salinity.

Table (5): Effect of interaction between salinity levels and antioxidants solution on germination energy and seedling length.

Salinity levels / Antioxidants	Germination energy (GE)				Seedling length (cm)			
	Tap water	2000 ppm	4000 ppm.	6000 ppm.	Tap water	2000 ppm.	4000 ppm.	6000 ppm.
Ascorbic acid	86	70	60	40	19.2	16.5	15.6	14.6
α-Tochopherol	82	63	57	34	16.2	14.1	13.0	12.5
Salicylic acid	84	66	60	38	17.2	15.3	14.3	13.9
Citric acid	84	59	58	36	15.3	13.4	13.3	12.9
Humic acid	80	61	50	36	17.1	15.2	13.6	13.0
Control	80	40	35	28	15.0	12.0	11.5	11.0
L.S.D. 5 %	3.0				0.69			

Table (6): Effect of interaction between salinity levels and antioxidants solution on seedling dry weight and vigor index.

Salinity levels / Antioxidants	Seedling dry weight (g).				Seedling vigor index.			
	Tap water	2000 ppm.	4000 ppm.	6000 ppm.	Tap water	2000 ppm.	4000 ppm.	6000 ppm.
Ascorbic acid	0.34	0.27	0.17	0.15	1846	1456	1312	1171
α-Tochopherol	0.28	0.24	0.13	0.12	1461	1230	1030	907
Salicylic acid	0.29	0.25	0.16	0.14	1533	1196	1117	1072
Citric acid	0.25	0.22	0.13	0.11	1347	1076	1066	930
Humic acid	0.29	0.25	0.14	0.11	1491	1263	1064	925
Control	0.24	0.19	0.10	0.09	1295	937	876	772
L.S.D. 5 %	0.02				68			

Table 7: Effect of interaction between salinity levels and antioxidants solution on proline content (μ mol /g F.Wt) of rice seedling.

Salinity levels / Antioxidants	Tap water	2000 ppm.	4000 ppm.	6000 ppm.
Ascorbic acid	3.82	5.73	9.17	7.43
α-Tochopherol	4.65	5.42	8.11	6.81
Salicylic acid	4.38	5.48	8.83	7.12
Citric acid	3.61	5.32	7.93	5.93
Humic acid	3.45	5.30	8.05	6.72
Control	3.39	4.96	7.90	5.31
L.S.D. 5 %	0.67			

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تـأثير نقـع تقـاوي الأرز فـي بعـض محاليـل مضـادات الأكسـدة علـى الإنبـات وقـوة البادرات تحت مستويات الملوحة المختلفة

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أجريت تجربة معملية بمعمل وحدة بحوث تكنولوجيا البذور بالمنصورة خلال عامي ٢٠٠٩ و ٢٠١٠ م في تصميم التام العشوائية في أربع مكررات لدراسة تأثير نقع بذور الأرز صنف ١٠٣ في بعض محاليل مضادات الأكسدة وهي الأسكوربيك ، الألفاتوكوفيرول ، السالسيليك ، السيتريك ، الهيوميك و المقارنة (ماء مقطر) على إنبات بذور وقوه بادرات الأرز وذلك تحت مستويات الملوحة وهي معاملة المقارنة (ماء الصنبور) ، ٢٠٠٠ جزء/ المليون ، ٤٠٠٠ جزء / المليون و ٦٠٠٠ جزء / المليون) ويمكن تلخيص أهم النتائج فيما يلي :-

أدت زيادة مستويات الملوحة إلى انخفاض النسبة المئوية للإنبات وصفات قوه البذور والتي تم قياسها بواسطة (معدل الإنبات , متوسط زمن الإنبات , الزمن اللازم لإنبات ٥٠% من البذور، دليل سرعه الإنبات وطاقه الإنبات) وقوة البادرات والتي تم قياسها بواسطة (طول البادرة ، الوزن الجاف للبادرة ودليل قوة البادرات) مقارنة بالكنترول. كما أدت زيادة مستويات الملوحة أيضا حتى مستوي ٤٠٠٠ جزء/المليون إلي زيادة محتوي البادرات من البرولين ثم تناقص المحتوي بعد ذلك عند مستوى ٦٠٠٠ جزء / المليون. أيضا إنخفض محتوي الأسكوربات و إنزيم البيروكسيديز وكلوروفيل ا، ب بزيادة مستويات الملوحة.

أدى نقع بذور الأرز في محلول الأسكوربيك (١٠٠ جزء/ مليون) أو السالسيليك (١٠٠ جزء/ مليون) إلى تحسين الإنبات وقوه البذور والبادرات (طول البادرة ، الوزن الجاف للبادرة ، دليل قوه البادرات) وزيادة محتوى البادرات من كلا من (كلوروفيل أ ، كلوروفيل ب ، الأسكوربات و إنزيم البيروكسيديز).

كان التفاعل معنويا بين مستويات الملوحة ومحاليل مضادات الأكسدة علي معظم الصفات المدروسة. حيث أدى نقع البذور في محلول الأسكوربيك أو السالسيليك إلى تحسين صفات جوده التقاوي تحت مستويات الملوحة المختلفة مقارنة بالنقع في مضادات الأكسدة الأخرى والماء المقطر وقد لوحظ زيادة إنتاج البرولين تدريجيا عند تفاعل مضادات الأكسدة مع مستويات الملوحة حتى ٤٠٠٠ جزء/ المليون ثم إنخفض بعد ذلك عند مستوى ٦٠٠٠ جزء في المليون.

لذلك توصي هذه الدراسة بنقع تقاوي ألأرز صنف سخا ١٠٣ قبل الزراعة في محلول الأسكوربيك (١٠٠ جزء/ مليون) أو السالسيليك (١٠٠ جزء/ مليون) لمدة ٢٤ ساعة لما له من تأثير فعال في تحسين حيوية التقاوي وقوة البادرات و تخفيف الأثر الضار لزيادة مستوى الملوحة .

قام بتحكيم البحث

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