EFFECT OF PRE- SOWING SEED AND SEEDLING TREATMENTS ON GROWTH AND YIELD OF EGYPTIAN HYBRID RICE UNDER SALINE SOIL CONDITIONS

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ABSTRACT

Two field experiments were conducted under saline soil during 2006 and 2007 seasons at Research Farm of El Sirw Agriculture Research Station. Damietta province, Egypt. Enhancing seedling vigor and salinity tolerance of hybrid rice as well as its grain yield were the main objectives of this study. The type of experimental soil was clayey with salinity levels of 7.5 and 7.35 dS/m in 2006 and 2007 seasons, respectively.

The seeds of Egyptian SK2034H rice hybrid (Egyptian Hybrid 1) were soaked in 1-water (as a control treatment), 2- $ZnSo_4$(2%) , 3- diammonium phosphate (DAP)(2%), 4- NaCl(1%) , 5- cytokinin (75 ppm), 6- GA_3 (100 ppm), and the seedlings at 14 days after sowing (DAS) were sprayed by 7-N(Urea) and $K2So_4$ (2%), 8- $ZnSo_4$(2%) ,9- diammonium phosphate (DAP)(2%), 10- cytokinin (75 mg/l). The seedling vigor of SK2034H hybrid rice was measured at 30 days after sowing whereas, root and shoot traits as well as leaves and root chemical contents were estimated. Furthermore, growth and grain yield and its components were estimated.

The obtained results showed that pre-sowing seed and foliar spray treatments were found to be significantly effective in enhancing seedling vigor of SK2034H and improved its growth and its favorable nutrient content such as N and P. Therefore, the salinity withstanding of hybrid rice was raised resulted in proper growth and reasonable grain yield under salt stress. The most effective treatments were soaking in GA_3, NaCl and DAP spray at 14 day after sowing in the nursery. These treatments clearly demonstrated their desirable effect on seedling vigor, growth parameters and grain yield of hybrid rice under salt stress.

INTRODUCTION

Salinity problem in Egypt affected wide spectrum area where rice is grown. Rice yield and growth are restricted by salinity. Integrating grain yield of rice under such area has to rise to meet overpopulation. Releasing new salt tolerant rice varieties and developing proper rice management under salt stress was found to be effective way to increase rice grain yield and its salt tolerance under mentioned target area. Improving rice seedling quality and raising rice seedling vigor are ones the proper rice management methods under salt stress using the concept that high seedling vigor and early fast

rice growth and emergences enable rice to be more tolerant to salt stress leading to higher grain yield under the current circumstances **(Zayed *et al.*, 2005). Rajan(1989)Patil (1989), Singh *et al.* (1994), Singh (1996), Lee *et al.* (1999), Bodapati *et al.* (2002), Ros *et al.* (2003), Xu *et al.* (2003), Basra *et al.* (2004), Perumal and Sundari (2004), Chen *et al.*(2005) Farooq *et al.* (2007) and Basslouni (2008)** claimed that seed priming or seed soaking in the terms of pre-sowing chemicals seed treatments such as sodium chloride NaCl , Gibberillic acid (GA3), diammonium phosphate(DAP) and Zinc sulphate (ZnSo4)) could invigorate the rice seedling and improved its quality and increased rice salt tolerance leading to healthy rice growth, standardizing the source –sink relation resulted in significant higher grain yield and yield components. **Deef, Hanan (2007)** stated that pre treatment of wheat and barley with salicylic acid significantly enhanced their salt tolerance and improved their growth and yield that attributed to activation to antioxidant activities. On the other hand, for obtaining entire high yield potentiality of hybrid rice, improving seedling quality and vigor, accelerating early vegetative growth, and idealizing source –sink relation has to be achieved **(Peng *et al.*, 2003 and Zayed *et al.*, 2006).**

The present study was, therefore, carried out with the objectives to develop an appropriate pre-sowing chemical treatment for nursery preparation under saline soil in hybrid rice using its higher vigor and herterosis resulted in improving its salt tolerance leading to higher grain yield under salt affected soil.

MATERIALS AND METHODS

The study was carried out in the two seasons of 2006 and 2007 at the Experimental Farm of El Sirw Agriculture Research Station, Dammietta Governorate, Northern part of Delta, Egypt. The soil was clayey with salinity level of 7.5 and 7.53dS/m in the first and second seasons, respectively.

Forty eight grams of seed of SK2034H hybrid rice variety were used in each treatment. Solutions of some chemical compounds were applied through seed soaking (SS) or foliar spraying (FS) of seedling. The solutions of chemical compounds were applied with the concentration of 2% $ZnSO_4$, 2% Diammonium phosphate (DAP), 1% Na Cl, 75 ppm Cytokinin, 100 ppm Gibberellic acid GA3, 2% NK. The experiment was included ten treatments as follow: seed soaking in solutions of 2% $ZnSO_4$, 2% DAP, 1% Na Cl, 75 ppm Cytokinin, 100 ppm Gibberellic and water alone as control, seed soaking in water along with foliar spraying at 14 days after sowing (DAS) in nursery with 2% NK, 2% $ZnSO_4$, 2% DAP and 75 ppm Cytokinin solutions. The experiment was designated in a randomized complete blocks with

four replications.

Seeds were soaked in 100 ml solution for 24h at 30± 2 °c, incubated between two layers of saturated gunny bags up to chitting (just appearance of radical) at 30± 2 °c, then divided into four equals and sown into four random replications with plot size of one meter square in the soil nursery.

The nursery seedbed preparation was well performed. The land was divided into 40 small plots (1×1m). The nursery was fertilized with calcium super phosphate (15.5% P_2O_5) at the rate of 196 kg/ fed on the dry soil before plough. Nitrogen in the form of urea (46.0% N) was added at the rate of 72 kg/ fed, after the last plough before leveling and immediately before sowing.

The permanent field was well prepared as it indicated in the nursery. Calcium super phosphate (15.5% P_2O_5) was added in the rate of 100 kg/fed on the dry soil before plough. Thirty days old seedlings were transplanted at the rate of 2-3 seedlings/hill with spacing of 20×20 cm, which were sown with 2-3 cm of standing water in the land. Potassium sulphate (48% K_2O) was applied at the rate of 24 kg K_2O/fed into two equal doses as basal application and at maximum tillering stage. The nitrogen at the rate of 69 kg/fed in the form of urea was applied into four splits, 1/4 at tillering stage + 1/4 at maximum tillering stage + 1/4 at panicle initiation +1/4 at the beginning of booting stage. The rest of cultural practices of rice under saline soil were followed according to the recommendation of Rice Research and Training Center.

At seedling stage (30 DAS), plant samples of the area 20×20cm were randomly collected twice from each plot corresponding each treatments. The plant samples were carefully pulled for keeping their full root and shoot system, transferred to the laboratory, gently washed and then the root and shoot were carefully separated to determine; shoot length (cm), root length (cm), shoot dry weight (mg/seedling), root dry weight (mg/seedling), root volume (cm^3/ seedling), number of white roots / seedling, leaf area (cm^2/ seedling), Total chlorophyll content (SPAD value), number of tillers/seedling, number of leaves/ tiller, nitrogen content in shoot and root according to **(Hafez and Mikkelsen 1981)** and phosphorus content in shoot and root by using the procedures of **(Watanabe and Olson 1965).**

At heading stage, five hills were randomly taken and transferred to Lab to determine dry matter production (g/m^2), number of tillers/m^2, flag leaf area (cm^2) and leaf area, and then leaf area index calculated.

At time of harvest, ten hills were randomly taken from

the fourth inner row to estimate the following characters; number of panicles m^{-2}; panicle weight (g), number of filled grains panicle, number of unfilled grains $panicle^{-1}$, 1000-grain weight (g), grain yield (t/ha), straw yield (t/ha) and harvest index (HI).

All data collected were subjected to standard statistical analysis according to **Gomez and Gomez (1984)** using the computer program (IRRISTAT). The treatment means were compared using Duncan's multiple range test **(Duncan, 1955).**

RESULTS AND DISCUSSION

A- Nursery

Application of chemical compounds solutions through seed soaking (SS) or foliar spraying (FS) in nursery resulted in a substantial improve in all seedling vigor and growth traits of Sk2034H hybrid rice variety compared with the control treatment at 30 days after sowing (DAS) under salt stress in both seasons (Tables 1, 2 and 3). The relative ranking of chemical compounds for some seedling vigor and growth traits were inconsistent with time. Seed soaking in 2% Na Cl or 100 ppm GA3 and foliar spraying with 2% DAP solutions, being insignificant, were among those having great shoot length, root length, root volume and number of active roots/seedling, fresh and dry weight of shoot and root/seedling, numbers of tillers/seedling, number of leaves/tiller, leaf area/seedling and total chlorophyll content at 30 DAS in the two seasons. Such effect of the mentioned treatment could be attributed mainly to its role in the stimulation of various physiological processes including cell division and cell elongation of internodes resulting in more tillers formation, leaf numbers and photosynthetic area (leaf area), which resulted in more photosynthetic production and consequently increased dry matter accumulation. Application of 2% ZnSO4 and 75 ppm cytokinin solutions through seed soaking did not differ than its application through foliar spray at 14 DAS in the most mentioned seedling traits in both seasons. Similar findings had been reported by **(Pain and Basu, 1985; Patil, 1989; Acharya *et al.*, 1990; Lin *et al.*, 1993 and Chen *et al.*, 2005)**

Regarding to N % and P % in shoot and root at 30 (DAS), data listed in (Table4) showed that pre-sowing seed and foliar spray treatments significantly increased N% and P% in shoot and root over control treatment in both seasons. The highest values of N% and P% in shoot and root at 30 DAS were given by DAP spray without any significant differences with those produced by GA3 and NaCl treatments in the two years. The lowest values of N % in shoot and root at 30DAS were recorded when seeds of SK2034h hybrid rice

were traditionally soaked in water (control) in both seasons. Similar findings had been reported by **(Singh *et al.*, 1994 and Basra *et al.*, 2005).** The best three treatments of this study of NaCl, GA3 seed soaking and DAP spray which didn't significantly vary in their effects on N% and P% in shoot and root in both seasons (Table 4).

Table 1: Shoot and root lengths, root volume and number of white roots of Sk2034H hybrid rice as affected by pre sowing seed and nursery treatments at 30DAS under saline soil in 2006 and 2007 seasons.

Treatment	Shoot length (cm)		Root length (cm)		Root volume (cm^3/seedling)		Number of white roots/seedling	
	2006	2007	2006	2007	2006	2007	2006	2007
Control	22.73d	23.90f	12.07c	14.75c	0.518d	0.725e	12.45d	13.40d
2% $ZnSO_4$ -SS	25.13c	25.75de	13.38b	15.83b	0.760bc	0.950cd	13.17bc	16.62abc
2% In DAP-SS	26.75abc	27.27abc	13.73b	15.75b	0.755bc	0.965bcd	13.70ab	16.55abc
1% NaCl -SS	28.00a	28.02a	14.77a	16.92a	0.903a	1.275a	13.97a	17.70a
75 ppm cyt. -SS	25.78bc	26.22cde	13.66b	16.65ab	0.730bc	0.985bcd	12.67cd	15.45c
100 ppm GA_3 -SS	27.93a	27.87ab	14.88a	16.92a	0.838ab	1.225a	14.02a	17.85a
2% NK -FS	25.40bc	26.40cde	13.13b	15.08b	0.733bc	0.975bcd	13.35ab	16.80abc
2% $ZnSO_4$ -FS	25.18c	25.42e	13.63b	15.98b	0.703c	0.925cd	12.42d	15.75bc
2% DAP -FS	27.20ab	26.80abc	14.93a	17.42a	0.840ab	1.125ab	13.67ab	17.05ab
75ppm cyt. -FS	25.73bc	26.65bcd	13.29b	16.03b	0.835ab	1.000bc	13.58ab	16.75abc
F test	*	*	*	*	**	*	*	*

SS = seed soaking, FS = foliar spray, DAP= Diammonium phosphate, cyt = cytokinin, GA_3= Gibberellic, acid, * and ** indicated P< 0.05and P<0.1 respectively. In each column means designated by the same letter are not significantly different at 5% level, according to DMRT.

Table 2: Fresh and dry weight of shoot and root of SK2034H hybrid rice seedling as affected by pre-sowing seed and nursery treatments at 30 DAS under saline soil in 2006 and 2007 seasons.

Treatment	Fresh weight (mg/seedling)				Dry weight (mg/seedling)			
	Shoot		Root		Shoot		Root	
	2006	2007	2006	2007	2006	2007	2006	2007
Control	0803.2d	681.0d	568.0e	640.0c	139.20c	124.90c	48.95e	50.20e
2% $ZnSO_4$ -SS	1050.0ab	890.0bc	769.0abc	873.0ab	162.00ab	158.10ab	59.67bcd	63.00bc
2% In DAP-SS	1092.0ab	873.0bc	733.5bcd	865.0b	164.00ab	163.40a	61.77abc	61.10bc
1% NaCl -SS	1116.0ab	965.0ab	850.5a	988.0a	165.35ab	162.00a	66.40a	69.40a
75 ppm cyt. -SS	1015.2bc	806.0c	670.0d	860.0b	162.63ab	153.00ab	55.57d	57.10cd
100 ppm GA_3 -SS	1161.2a	969.0ab	805.2ab	986.0a	170.87a	165.00a	63.92ab	65.30ab
2% NK -FS	1087.0ab	823.0c	690.7cd	845.0b	162.55ab	155.00ab	56.27d	63.00bc
2% $ZnSO_4$ -FS	0900.1cd	804.0c	664.0d	800.0b	158.03b	149.10b	56.87cd	53.60de
2% DAP -FS	1194.0a	989.0a	830.0a	981.0a	167.43ab	163.00a	62.99ab	66.10ab
75ppm cyt. –FS	1069.7ab	845.0c	712.7bcd	808.0b	165.80ab	155.20ab	58.00cd	60.30bc
F test	**	**	**	**	**	**	*	*

SS = seed soaking, FS = foliar spray, DAP= Diammonium phosphate, cyt = cytokinin, GA_3= Gibberellic, acid, * and ** indicated P< 0.05and P<0.1 respectively. In each column means designated by the same letter are not significantly different at 5% level, according to DMRT.

Table 3: Number of tillers/seedling, number of leaves/seedling, leaf area/seedling and chlorophyll content of SK2034H hybrid rice as affected by pre-sowing seed and nursery treatments at 30DAS under saline soil in 2006 and 2007 seasons.

Treatment	Tillers (No./seedling)		Leaves (No./tiller)		Leaf area (cm^2/seedling)		Chlorophyll content (SPAD Value)	
	2006	2007	2006	2007	2006	2007	2006	2007
Control	3.13f	2.75f	2.89e	2.32e	18.72d	17.82e	26.48d	25.10e
2% $ZnSO_4$ -SS	3.75bc	3.43bcd	3.38bc	3.00cd	25.00bc	23.07bcd	29.60ab	31.92abc
2% In DAP-SS	3.53vde	3.35bcd	3.51bc	3.15bcd	26.08ab	25.35ab	28.60b	29.65cd
1% NaCl -SS	4.13a	3.90a	3.84a	3.77a	26.46a	24.72abc	30.13a	32.40ab
75 ppm cyt. -SS	3.63bcd	3.23cde	3.31cd	3.07bcd	25.41ab	22.44cd	27.85c	30.17bcd
100 ppm GA_3 -SS	3.91ab	3.68ab	3.69ab	3.60ab	26.60a	25.58a	30.18a	32.70a
2% NK -FS	3.70bcd	3.18de	3.38bc	2.74d	23.47bc	22.03d	29.23ab	30.90bcd
2% $ZnSO_4$ -FS	3.23ef	2.93ef	3.25d	2.80d	22.38c	22.19d	27.93c	29.37d
2% DAP -FS	3.93ab	3.75ab	3.66ab	3.59ab	26.17ab	25.36ab	30.23a	32.85a
75ppm cyt. –FS	3.38def	3.03def	3.50bc	2.92cd	25.76ab	24.46abc	29.55ab	30.85d
F test	**	**	**	**	**	**	*	*

SS = seed soaking, FS = foliar spray, DAP= Diammonium phosphate, cyt = cytokinin, GA_3= Gibberellic, acid, * and ** indicated P< 0.05and P<0.1 respectively. In each column means designated by the same letter are not significantly different at 5% level, according to DMRT.

Table 4: N and P content in shoot and root of SK2034H hybrid rice as affected by pre-sowing seed and nursery treatments at 30DAS under saline soil during 2006 and 2007 seasons

Treatment	N % in shoot		N % in root		P% in Shoot		P% in Root	
	2006	2007	2006	2007	2006	2007	2006	2007
Control	2.113c	2.000c	0.550c	0.553c	0.241d	0.299d	0.155e	0.136d
2% $ZnSO_4$ -SS	2.390ab	2.373ab	0.593bc	0.580bc	0.297abc	0.309bcd	0.193c	0.154c
2% In DAP-SS	2.320ab	2.417a	0.620ab	0.678ab	0.307ab	0.327ab	0.210ab	0.177ab
1% NaCl -SS	2.407ab	2.417a	0.657a	0.687ab	0.300abc	0.323ab	0.212ab	0.175ab
75 ppm cyt. -SS	2.330ab	2.393a	0.627ab	0.669ab	0.294bc	0.308cd	0.170d	0.157c
100 ppm GA_3 -SS	2.467a	2.477a	0.667a	0.687ab	0.311ab	0.330a	0.210ab	0.176ab
2% NK -FS	2.470a	2.478a	0.680a	0.700a	0.292bc	0.305cd	0.200bc	0.155c
2% $ZnSO_4$ -FS	2.323ab	2.373ab	0.590bc	0.580bc	0.284c	0.302cd	0.175d	0.151c
2% DAP -FS	2.473a	2.487a	0.690a	0.710a	0.316a	0.335a	0.220a	0.185a
75ppm cyt. –FS	2.343ab	2.333ab	0.600bc	0.580bc	0.283c	0.305cd	0.180d	0.150c
F test	*	*	**	*	**	**	**	**

SS = seed soaking, FS = foliar spray, DAP= Diammonium phosphate, cyt = cytokinin, GA_3= Gibberellic, acid, * and ** indicated P< 0.05and P<0.1 respectively. In each column means designated by the same letter are not significantly different at 5% level, according to DMRT.

Table 5: Dry matter accumulation, number of tiller, flag leaf area and Leaf area index of SK2034H hybrid rice as affected by pre-sowing seed and nursery treatments at heading in 2006 and 2007 seasons.

Treatment	Dry matter (g/m^2)		Number of tillers/m^2		Flag leaf area (cm^2)		Leaf area index (LAI)	
	2006	2007	2006	2007	2006	2007	2006	2007
Control	607d	652f	350.0d	355.0e	19.45c	20.18d	3.33c	4.86e
2% $ZnSO_4$ -SS	813bc	878abcd	407.8ab	445.0abc	22.28a	22.47ab	5.15ab	6.06ab
2% in DAP-SS	882ab	851bcd	394.7bc	417.5cd	19.72c	20.51cd	4.57b	5.25cde
1% NaCl -SS	893ab	925ab	423.5a	455.0ab	22.43a	22.89a	5.65a	6.14ab
75 ppm cyt. -SS	695cd	745ef	379.8c	390.0d	19.82c	21.91ab	4.67b	5.13de
100 ppm GA_3 -SS	973a	979a	426.5a	468.8a	22.62a	23.00a	5.72a	6.59a
2% NK -FS	803bc	822cde	407.5ab	417.3cd	19.87c	20.85cd	4.62b	5.39cde
2% $ZnSO_4$ -FS	724c	804de	393.8bc	405.5d	20.62bc	21.45bc	4.75b	5.63bcd
2% DAP -FS	900ab	928ab	418.0ab	456.3ab	22.44a	22.97a	5.70a	6.15ab
75ppm cyt. –FS	852ab	876abcd	391.5bc	425.0bcd	20.35c	21.96ab	4.65b	5.66bcd
F test	**	**	**	**	*	*	**	**

SS = seed soaking, FS = foliar spray, DAP= Diammonium phosphate, cyt = cytokinin, GA_3= Gibberellic, acid, * and ** indicated P< 0.05and P<0.1 respectively. In each column means designated by the same letter are not significantly different at 5% level, according to DMRT.

B- Growth;

Data in table 5 indicated that the pre-sowing seed and foliar spray treatments had favorable effects on growth parameters at heading stage. All pre-sowing seed and foliar spray treatments significantly increased dry matter production, number of tillers, flag leaf area and leaf area index against control treatment in both seasons. Salinity significantly restricted the rice growth at heading as detected in the results obtained with control treatments but, pre-sowing seed treatments particularly GA3, NaCl and DAP spray could alleviate this harmful effect and improved rice growth; number of tillers, flag leaf area, leaf area index and dry matter production at heading stage. The highest values of the previous mentioned growth traits were recorded when seed were soaked in GA3 followed by seed soaking in NaCl and then DAP spray .Meanwhile, the control treatment gave the lowest values of them (Table5). The rest of pre sowing treatments intermediated the control treatment and the best three treatments of DAP spray, NaCl and GA3 soaking. Similar findings had been reported by **(Awan and Alizai, 1989; Prakash and Prathapasenan, 1990 and Singh, 1996).**

C-yield and yield attributes:

Regarding the yield and yield components, the pre-sowing treatments significantly increased the all yield components and grain yield of SK2034H over control treatment under saline soil (Tables 6and7). The treatment of GA_3 gave the highest values of panicle numbers/m^2 and heaviest 1000-grain weight followed by NaCl and DAP spray treatments, while the lowest values of them were produced by the control treatment. The treatment of DAP spray treatment gave the highest values of filled grains, heaviest weight and the lowest values of number of unfilled grains /panicle, while the lowest values of filled grains/ panicle and highest values of number of unfilled grains were recorded by control treatment. The most affected yield component under salt stress is fertility.

The highest grain yield and straw yield were obtained by DAP spray without in significant differences with GA_3 and NaCl treatments. The lowest values of them were produced by control treatment. The results are in agood agreement with those reported by **(Awan and Alizai, 1989; Prakash and Prathapasenan, 1990 and Singh, 1994).**

Table 6: Number of panicles, panicle weight, filled grains, and unfilled grains of Sk2043H hybrid rice as affected by pre-sowing seed an nursery treatments in 2006 and 2007 seasons.

Treatment	Number of panicles/m^2		Panicle weight (g)		Number of filled grains / panicle		Number of unfilled grains / panicle	
	2006	2007	2006	2007	2006	2007	2006	2007
Control	300.0e	315.6e	2.97e	3.052c	132.25c	134.95e	18.75a	18.62a
2% $ZnSO_4$ -SS	355.0abc	392.3abc	3.46abc	3.59ab	141.87ab	148.98ab	16.82b	15.63de
2% in DAP-SS	345.0cd	355.0d	3.16de	3.43b	136.07bc	134.98e	17.02b	16.90bc
1% NaCl -SS	371.8ab	400.0ab	3.55a	3.60ab	144.00a	147.35abc	17.06b	16.60bcd
75 ppm cyt. -SS	325.5d	352.5de	3.27bcd	3.47ab	136.12bc	143.33bcd	16.63b	16.37bcde
100 ppm GA_3 -SS	376.0a	422.0a	3.57a	3.79a	145.00a	148.30ab	16.65b	15.60de
2% NK -FS	355.3abc	358.3cd	3.20cde	3.44b	131.42c	141.73cd	16.54b	15.95de
2% $ZnSO_4$ -FS	348.4bcd	360.7cd	3.27bcd	3.49ab	134.00c	139.80de	17.12b	18.15b
2% DAP -FS	375.3a	421.0a	3.58a	3.80a	148.05a	151.23a	15.60c	15.35e
75ppm cyt. –FS	347.3bcd	368.8bcd	3.20cde	3.54ab	133.87c	141.98cd	16.53b	16.20bcde
F test	**	**	*	*	**	**	*	*

SS = seed soaking, FS = foliar spray, DAP= Diammonium phosphate, cyt = cytokinin, GA_3= Gibberellic, acid, * and ** indicated P< 0.05and P<0.1 respectively. In each column means designated by the same letter are not significantly different at 5% level, according to DMRT.

Table 7: 1000-grain weight, straw yield, grain yield and harvest index of Sk2043H hybrid rice as affected by pre-sowing seed and nursery treatments under saline soil in 2006 and 2007 seasons

Treatment	1000 - grain weight (g)		Grain yield t/ha		Straw yield t/ha		Harvest Index	
	2006	2007	2006	2007	2006	2007	2006	2007
Control	20.20f	23.01c	4.80d	5.55d	7.52b	8.43d	0.389	0.395
2% $ZnSO_4$ -SS	21.75abcd	23.57ab	6.08bc	6.46bc	7.73b	9.36c	0.440	0.410
2% in DAP-SS	21.35de	23.44b	5.63c	6.22c	8.33a	9.41c	0.404	0.398
1% NaCl -SS	22.38ab	23.58ab	6.56ab	6.81ab	8.48a	9.68abc	0.435	0.413
75 ppm cyt. -SS	21.83abcd	23.51b	5.66c	6.46bc	7.75b	9.56bc	0.423	0.403
100 ppm GA_3 -SS	22.50a	23.72a	6.90a	7.26a	8.50a	10.01ab	0.448	0.423
2% NK -FS	21.55cd	23.43b	6.19bc	6.41bc	8.53a	9.56bc	0.421	0.400
2% $ZnSO_4$ -FS	20.67ef	23.47b	5.74c	6.44bc	7.80b	9.34c	0.424	0.410
2% DAP -FS	22.38ab	23.59ab	6.94a	7.30a	8.60a	10.12a	0.446	0.419
75ppm cyt. –FS	21.65bcd	23.47b	6.04bc	6.39bc	8.62a	9.77abc	0.412	0.395
F test	*	*	**	**	*	*	NS	NS

SS = seed soaking, FS = foliar spray, DAP= Diammonium phosphate, cyt = cytokinin, GA_3= Gibberellic, acid, * and ** indicated P< 0.05and P<0.1 respectively. In each column means designated by the same letter are not significantly different at 5% level, according to DMRT.

The current investigation clarified that employing varying pre-sowing seed treatments could significantly invigorate the rice seed of SK2034H more than those obtained by traditional treatment (control) under salt stress. The superiority of NaCl treatment in inducing high seedling vigor under salt stress than others might be mainly due to its hardening effect, accelerating germination, increasing metabolic activities, raising some growth regulators and hormones such as IAA, NAA, ATPase and inducing gene of salt tolerance **(Bose and Mishra,1992; Lee *et al.*, 1999 and Barsa *et al*,2004 and 2005)**. All previous improved growth of rice seedlings and their salt tolerance as result of using seed soaked in NaCl resulted in early vegetative rice growth, faster recovery after transplanting, more adoption to salt stress, healthy growth, increased dry matter production, leaf are index (LAI), flag leaf area, more assimilates translocation to grains leading to considerable yield components, less sterility(high sterility percentage) of rice under salt stress and subsequently higher grain yield as well as harvest index than those obtained by traditional soaking **(Ros *et al.*, 2003 and Bassiouni 2008).**

Regarding the mode of action of GA3, the obtained favorable effect of GA3 in improving seedling vigor traits and rice growth as well as yield and yield components of hybrid rice under such conditions might be mainly due to its activation to ά-amylase for breakdown of starch stored in the seeds that will be used by the growing embryo during germination, enhancing IAA exertion, promoting cell elongation and division particularly mesocotyle length and internodes of rice seedlings, reducing Na and Cl uptake, increased K, P and N uptake

and chlorophyll content of rice seedling resulted from seeds soaked in GA3 leading to high seedling vigor, reasonable rice growth at early and late stages, improving source-sink relation resulted in high yield components and grain yield under salt stress as compared to traditional treatment **(Prakash and Prathapasenan,1990; Singh, 1996; Lee *et al.*, 1999; Chen *et al.*, 2005 and Bassiouni, 2008).**

Regarding the mode of action of diammonium phosphate (DAP) Spray which including N that increased root growth, leaf chlorophyll content, photosynthesis, leaf ATPase, metabolism, translocation and accumulation of photosynthate **(Lin *et al.*, 1993)** and P that be importance in promoting root growth and enhanced the chlorophyll content in leaves, soluble sugar and starch content in grains, protein and total nitrogen content in leaves and grains **(Tang and Yu, 2002).**

It could be concluded that the desirable effect of GA3 through seed soaking and DAP spray, it also promoted seedling vigor and quality, enhanced salt tolerance by inhibited sodium uptake, exhibited both Ca^{+2} and K^{+} uptake, promoted cell division and elongation, pushed hybrid rice to grow fast under stress as possible and improved photosynthesis and enzyme activities, translocation processes as well as standardized yield components resulted in considerable grain yield. Sodium chloride seed soaking was found to be effective in salt stress mitigation and amelioration resulted in proper seedling vigor, optimum growth and yield components producing contentment grain yield. The rest of treatments might be have similar method in improving grain yield of hybrid rice under salt stress

REFERENCES

Acharya, U.T.; L. Prakash and G. Prathapasenan (1990). Effect of gibberellic acid on seedling growth and carbohydrate metabolism during germination of rice (Oryza sativa, L. var.GR-3) under saline condition. J. of Agron. and Crop Sci.,165 (1):6-13.

Awan, I. and H.k. Alizai (1989). Effect of plant growth regulators on ripening grain development and rice quality. International Rice Research Newsletter, 14 (3) :30-31.

Basra, S.M.A.; M. Farooq; K. Hafeez and N. Ahamed (2004).Osmohardening a new technique for rice seed invigoration. International Rice Research. Notes, 29 (2):80-81.

Basra, S.M.A.; M. Farooq; K. Hafeez and R. Tabassum (2005). Physiological and biochemical aspects of seed vigor enhancement treatments in fine rice (*Oryza sativa*, L.). Seed Sci. Technol., 33 (3):623-628.

Bassiouni, S.M. (2008). Effect of pre- sowing and nursery treatments of seedling vigor , growth and yield of hybrid rice under saline soil. M.Sc. Thesis, Agron. Dept., Fac. Of Agric., Kafr El-Sheikh univ., Egypt.

Bodapati, N.; R. Williams and S. Fukai (2002). Increasing cold tolerance in rice by osmoprotecants and gibberellic acid .Farmers- Newsletter, 159:20-22.

Bose, B. and T. Mishra (1992). Response of wheat seed to pre-sowing treatments with Mg(NO3)2. Annals of Agriculture Research ,13: 132-136.

Chen, D.; T.A. Gunawardena; B.P. Naidu; S. Fukai and J. basnayake (2005). Seed treatment with gibberellic acid and glycinebetaine improves seedling emergence and seedling vigor of rice under low temperature. Seed Sci. and Techn., 33(2):471-479.

Deef, E. Hanan (2007). Influence of salicylic acid on stress tolerance during seed germination of Triticum aestivum and Hordium vulgare. Advances in Biological Research, 1(1-2):40-48.

Duncan, B.D., (1955). Multiple Range and Multiple F-test. Biometrics, 11: 42.

Gomez, K.A. and A.A Gomez (1984). Statistical procedures for agricultural research. 2nd Ed. John Wiley and Sons, New York, USA.

Farooq, M.; S. M. A. Basra; H. M. Rehman; Hussain; Y. Amanat (2oo7). Pre-sowing salicylicate seed treatments improve the germination and early seedling growth in fine rice. Pakistan-Journal of agricultural Sciences. 44 (1): 16-23.

Hafez, A.R. and D.S. Mikkelsen. (1981). Colorimetric determination of nitrogen for evaluating the nutritional status of rice. Soil Sci. and Plant Analysis, 12 (1): 61-69 (1981).

Lee, S.; K.J. Hyeum and H.S. Beom (1999). Effect of priming and growth regulator treatment of seed on emergence and seedling growth of rice. Korean. J. of crop Sci., 44 (2):134-137.

Lin, QM.; Kc. Zhang; JG. Pan and YQ. ke (1993). The effect of zinc foliar nutrient solution on rice yield and its mechanism. Journal of Fijian Agricultural College, 22(2):199-202. (C. F. CD Rom Computer System).

Pain., S.K., and M.K. Basu (1985).Growth and metabolism of rice seedling : the effect of gibberellic acid. India J. of Agric. Res., 19 (2):59-68.

Patil, K.D. (1989). A note on the effect of presoaking in sodium salt solution on germination of rice in coastal saline soil. Agric. Res., 17 (1):71-72.

Peng S.; R.C. Laza; A. L. Sanico; R. M. Visperas and T.T. Son (2003). Physiological bases of heterosis and crop management strategies for hybrid rice in the tropics .Hybrid rice for food security ,poverty alleviation , and environment protection .Proceedings of the 4th International Symposium on hybrid rice, Hanoi , Vietnam ,14-17 May 2002 .Loss Banos .,Philippines ,IRRI

Perumal, A.P.S. and A.Sundari (2004). Response of rice fallow black gram C-V ADT5 to the application of DAP and phosbacteria. Legume Research, 27(1):73-74.

Prakash, L. and G. Prathapasenan (1990). NaCl and gibberellic acid induced changes in the content of auxin and the activities of cellulose and pectinlyase during leaf growth in rice (*Oryza sativa*, L.).Annals of Botany, 65(3):251-257.

Rajan, A.R. (1989). Relative efficiency of different methods of phosphate fertilization to rice (*Oryza sativa,* L.). Journal of Nuclear Agriculture and Biology, 18 (1):44-47.

Ros, C.; R.W. Bell and P.F. White (2003). Seedling vigor and the early growth of transplanted rice *(Oryza sativa,L.).* Australian Plant and Soil, 252: 325 -337.

Singh, B.P.; M. Das; R.N. Prasad and M. Ram (1994). Phosphorus nutrition to rice *(Oryza sativa,* L.*)* in Fe toxic acid haplaquent. Annals of Agricultural Research, 15 (1):81-84.

Singh, S. (1996). Physiological effect of growth promoter (GA3) and retardant (CCC) in diverse genotype. Plant Physiology and Biochemistry. Delhi, 23(2):153-158. (C. F. CD Rom Computer System).

Tang, X.R. and T.Q. Yu (2002). Effects and mechanisms of P and K nutrients on yield and protein content of fodder rice. Agricultural Sciences in China, 1(4):432-437.

Watanabe, F. S and S. A. Olson (1965). Colorimetric determination of phosphorus in water extract. Soil Sci. 93: 183-188.

Xu, X.; H. Jun; L. Shuhua; X. Zhaozhen and D. Xiping (2003). Effect of calcium and gibberellin mixture on drought resistance of soaked rice seed during germination and young seedlings. Acta Botanica Boreali Occidentalia Sinica, 23 (1): 44-48. (C. F. CD Rom Computer System).

Zayed, B.A.; A. Abou-khalifa and H.F. El-Mowafi (2005). Seedling vigor of hybrid rice as related to seed rate in nursery under saline soil. Egypt. J. of Agric. Res., 83 (5B): 423-435.

Zayed, A.B.; A.M. EL-khtyar; A.B.El-Abd and M.A. Badawi (2006). Response of some hybrid rice varieties to various nitrogen levels under saline soil conditions. J. Agric. Sci., Mansoura univ., 31 (12): 7497- 7509.

الملخص العربى

تأثير معاملات التقاوى قبل الزراعة والبادرات بالمشتل على نمو ومحصول الأرز الهجين المصرى تحت ظروف الأراضى الملحية

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***مركز البحوث والتدريب فى الأرز- معهد بحوث المحاصيل الحقلية بسخا– مركز البحوث الزراعية- الجيزة- مصر**

****قسم المحاصيل - كلية الزراعة – جامعة كفرالشيخ**

أقيمت تجربتان حقليتان تحت ظروف الأراضى الملحية وذلك خلال موسمى ٢٠٠٦ ، ٢٠٠٧ م بمزرعة محطة بحوث السرو الزراعية، بمحافظة دمياط. وكان الهدف من هذه الدراسة هو زيادة تحمل الملوحة وتحسين نمو البادرات وزيادة محصو حبوب الأرز الهجين المصرى سخا ٢٠٣٤.

وكانت أرض التجربه طينية ومستوى الملوحه بها ٧,٥ ديسيسمنز/م ، ٧,٣٥ ديسيسمنز/م فى كلا موسمى الزراعه على التوالى.

وتضمنت الدراسه عشر معاملات هى نقع التقاوى فى ١- الماء (المقارنه) ٢- كبريتات الزنك (٢%) ٣- فوسفات الأمونيوم الثنائيه (٢%) ٤- كلوريد الصوديوم (١%) ٥- السيتوكينين (٧٥ جزء فى المليون) ٦- حامض الجبريللين (١٠٠ جزء فى المليون) ورش البادرات بعد ١٤ يوم من الزراعة بكل من ٧- النيتروجن(يوريا) وكبريتات البوتاسيوم (٢%) ٨- كبريتات الزنك (٢%) ٩- فوسفات الأمونيوم الثنائيه (٢%) ١٠- السيتوكينين (٧٥ جزء فى المليون). وقد تم تقدير صفات الجذور والمجموع الخضرى فى الأرز الهجين المصرى سخا ٢٠٣٤ وكذلك التركيب الكيماوى لها بعد ٣٠ يوم من الزراعة بالأضافة الى تقدير صفات النمو والمحصول ومكوناته.
أوضحت النتائج أن معاملات نقع التقاوى قبل الزراعة والرش بعد ١٤ يوم من الزراعة كانت ذات تأثير معنوى فى زيادة قوة بادرات الأرز الهجين المصرى وحسنت من نموه وأدت الى زيادة محتوى النيتروجين والفوسفور فى النبات وكذلك أدت الى زيادة تحمله للملوحة مما أدى الى زيادة محصول الحبوب بصورة معنويه.

ومن نتائج هذه الدراسة يمكن الحصول على بادرات قويه تتحمل الملوحه مما يؤدى الى الحصول على أعلى محصول حبوب من الأرز الهجين باستخدام معاملات نقع التقاوى فى حمض الجبريللين بتركيز ١٠٠ جزء فى المليون، وكلوريد الصوديوم بتركيز ١% أو رش البادرات بعد ١٤ يوم من الزراعه بمحلول فوسفات الأمونيوم الثنايه بتركيز ٢%.