J. Plant Production, Mansoura Univ., Vol. 7 (9) : 1001- 1005, 2016

Effect of Some Seed Stimulants on Seed Germinability and Seedling Vigour Under Salinity Stress in Wheat

Kishk A. M. S.; Amal A. A. EL-Mahdy and M. R. El-Mowafy
Seed Technology Research Department, Field Crops Research Institute, Giza, Egypt

ABSTRACT

Application of some chemicals such as salicylic acid, chitosan and hydrogen peroxide as pre-sowing treatment could improve its performance under different salinity levels. Laboratories and pot experiments were carried out during 2015 year. Wheat seeds were treated with plant stimulants (0, 50, 100, 150 ppm) and then germinated under different salinity levels namely (0,100,150 and 200 mMol of NaCl). The present study aimed to determine the impact of salt stress on wheat seed viability to screen out the best seed stimulants resistant to the various changes associated with the plants under different salinity levels. The main results showed that treating wheat seed before sowing with chitosan produced the vigours seedling and its length, and dry weight, vigor index, germination percentage, germination energy, as well as proline content as compared with treating the seed with salicylic acid and hydrogen peroxide. Increased salinity levels caused great reduction in seedling length, and its dry weight, vigor index, germination percentage, germination energy, germination rate and pot emergence as compared with control, except for proline content. The results revealed also, that the interaction effect between salinity treatments, seed germination stimulants and concentrations was significant for all studied traits. Furthermore, using chitosan followed by salicylic acid and hydrogen peroxide was the most effective treatment to protect wheat seed cv Gemmiza 9 during germination from adverse salinity effect .
Keywords: Wheat - seed stimulants – salt stress - seedling vigor .

INTRODUCTION

Salinity is one of the most serious abiotic stress factors that caused negative effect on germination, development of plant growth, which reflect finally for limiting crop productivity. Salt stress affects germination percentage, germination rate and seedling growth in different ways depending on plant species (Gul 1999). Seedling vigor is a more promising seed quality character reflecting potential seed germination and field emergence (Qun and Sun, 2007). Therefore, any treatment which could be used to improve seed germination and subsequent seedling establishment under saline conditions would be highly desirable. Pre-sowing seed treatments have been shown to enhance stand establishment in non-saline areas and have potential in saline areas as well. It is thought that the depressive effect of salinity on germination could be related to a decline in endogenous levels of hormones. In order to alleviate effects of salinity stress on germination traits and plant phenology, the application of some chemical and biochemical substances has been tested in different crops, i.e., use of salicylic acid (Khodari, 2004), Chitosan (CH) (El-Hadrami *et al.*, 2010) and more recently, hydrogen peroxide (H_2O_2) (Eva-Guadalupe *et al.*, 2013).

Salicylic acid is an endogenous growth regulator of phenolic nature and acts as potential non-enzymatic antioxidant which participates in the regulation of many physiological processes in plants, such as stomatal closure, photosynthesis, ion uptake, inhibition of ethylene biosynthesis, transpiration and stress tolerance (Arfan *et al.*, 2007). Salicylic acid is a tool to increase plant tolerance against the adverse effect of biotic and abiotic stresses either by seed treatment and/or foliar application. Since, it has a regulatory effect on activating biochemical pathways associated with tolerance mechanisms in plants (Najafian *et al.*, 2009).

Chitosan (CH) is another chemical that has recently been used in plant protection. This biopolymer is a large cationic polysaccharide mainly obtained from waste materials from seafood processing (Guan *et al*., 2009), with antiviral, antibacterial, and antifungal properties (El-Hadrami *et al*., 2010). When CH is applied to plant seeds, their germination index is enhanced, the mean germination time is reduced, shoot height, root length, and seedling vigor are increased (Zeng *et al*., 2012), vegetative growth is increased, time to flowering is reduced and fresh weight is increased (Asghari *et al*., 2009). CH has been applied not only to seeds but also to seedlings.

Although, hydrogen peroxide (H_2O_2) has been used for years to disinfect seeds prior planting (Miché and Balandreau, 2001), it has recently been found that the exogenous application of vital cellular component to seeds and plants has positive effects over them. H_2O_2 treatment increases seed germination rates, coleoptile emergence percentages, radicle and coleoptile elongation, and fresh weights of the seedlings (Çavusoglu and Kabar, 2010). H_2O_2 is coupled with important functions in metabolism, homeostasis of plants and reactive oxygen species (ROSs) generation too. It has been reported that soaking seeds in H_2O_2 induces a pronounced increase in enzymes activity levels, including catalase (CAT), ascorbate peroxydase (APX), and superoxide dismutase (SOD) (Li *et al*., 2011). These enzymes play an important role on naturally over-expressing stress responses and signal activation at biochemical level.

Salicylic acid, chitosan and hydrogen peroxide pre-sowing treatments have improved seed performance (Datta *et al*., 2009). Concerted attempts have been made to mitigate the harmful effects of salinity by application of plant growth stimulants. Salicylic acid, chitosan and hydrogen peroxide play an important role in the defense response to stresses in plant species.

Therefore the present work aimed to study the effects of SA, CH and H_2O_2 on wheat seed viability under different salinity levels.

MATERIALS AND METHODS

Laboratories and pot experiments were conducted during 2015 year at Seed Technology Research Unit in Mansoura, Dakahalia Governorate, Field Crops Research Institute, Agricultural Research Center, Egypt during 2015 to study some plant stimulants efficiency to reduce of wheat seed deterioration under different salinity levels (0, 100, 150 and 200 mMol of NaCl). Plant stimulants were salicylic acid (0,50,100,150 ppm), hydrogen peroxide H_2O_2 (0, 50, 100, 150 ppm) and chitosan (0, 50, 100, 150 ppm).Wheat seed (Gemmiza 9) were supplied by Central Administration for Seed Production (CASP), Agricultural Research Center, Egypt. Samples seed were soaked in various concentrations of salicylic acid, chitosan, hydrogen peroxide and distilled water for 6 hours. After soaking, the seeds were incubated with forced air circulation for 48 h on filter paper at a temperature of 25 ^{o}C to return to original moisture 12-14% (on dry weight basis). Eight replicates of 50 seeds of each treatment (400 seeds) were placed in Petri dishes (12cm) containing 2 layers of moistened filter paper with 10 ml NaCl solution at (0,100,150, or 200 mMol) and incubated in the growth chamber at 20 ± 2 ^{o}C and determined the following parameters:

Shoot and Root lengths (cm) of ten normal seedlings were measured eight days after sowing. Seedling dry weight (g) were measured after drying ten normal seedlings in hot-air oven at 85 ^{o}C for 12 hours according to (Krishnasamy and Seshu 1990). Seedling Vigor Index (SVI) was calculated according to the following equation of Abdul-Baki (1980), SVI=seedling length × G%. Seedling Vigor Index II= dry weight × G%.

Germination percentage was calculated by counting only normal seedling eight days after planting according to (ISTA Rules 1999). 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, m is No. of seedlings in final count, n is the number of counts.

Mean germination time (MGT) was calculated by using 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 time, D is number of days, counted from the beginning of germination test. Germination energy (GE) was recorded on the 4th day of germination test. It is the percentage of germinated seeds at 4 days to the total number of seeds tested Ruan and Tylkowska (2002). Speed germination index (SGI) was calculated according to the rules of the Association of Official Seed Analysis (AOSA, 1992) by the following formula:

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

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

Pot experiment: Seeds were sown at the depth of 3 cm and replicated three times. Irrigation was applied whenever required. The data regarding seedling emergence, were recorded up to the 8 days of sowing. Proline content (mg/g) was determined according to the procedures outlined by Troll and Lindsey (1955). Data were exposed to the proper statistical analysis of variance (ANOVA) of a randomized complete block design as described by Gomez and Gomez (1984). LSD at 5% level of significance was used to compare between means of different variables.

RESULTS AND DISCUSSION

ANOVA of tested parameters:

Analysis of variance indicated that there is highly significant difference (P≤ 0.01) in mean performance of the most germination traits for main effects (salinity, A; antioxidant B; and its concentration, C and their second (AB, AC, BC) and third interactions (ABC; Tables 1 and 2).

Table 1. Analysis of variance (expressed as mean square) for germination tested parameters under different treatments.

Source of variation	DF	SL (cm)	SDW (g)	G(%)	GR	MGT (day)
Salinity (A)	3	246.8 **	0.003**	198.91**	0.0.003**	0.141**
Antioxidant (B)	2	14.62**	0.005**	300.25**	0.0005**	0.160**
AB	6	108.62**	0.005**	33.91^{ns}	0.0005**	0.142**
Concentration (C)	3	3.67^{ns}	0.033**	127.58**	0.0003**	0.0071**
AC	9	15.00**	0.009**	43.36^{ns}	0.0002**	0.058**
BC	6	15.54**	0.049**	80.08**	0.0003**	0.053**
ABC	18	15.76**	0.012**	46.19**	0.0001**	0.056**
Error	96	2.060	0.015	24.91	0.0004	0.006
Total	143					
CV (%)		10.25	17.05	5.34	0.91	1.07

Table 2: Analysis of variance (expressed as mean square) for germination tested parameters under different treatments.

Source of variation	DF	GE	SG	VG1	VG2	FE %	Proline content
Salinity (A)	3	58.93**	12.26**	2663169**	7.896**	6009.6**	1924**
Antioxidant (B)	2	0.109^{ns}	2.133**	297460**	10.98**	116.06**	67.60**
AB	6	57.73**	1.26**	916205**	6.494**	83.72**	62.12**
Concentration (C)	3	46.93**	3.24**	28637^{ns}	47.88**	57.0**	1770.17**
AC	9	50.03**	1.59**	164622**	17.41**	184.77**	223.04**
BC	6	97.35**	1.30**	92143**	45.39**	115.06**	15.32**
ABC	18	22.95**	0.857**	217393**	10.06**	132.50**	14.01**
Error	96	7.698	0.222	30109	1.659	10.87	1.312
Total	143						
CV (%)		3.87	4.45	13.18	18.99	5.34	4.69

Salinity level effects:

It is evident from Tables (3 and 4) that salt stress significantly affected all the traits investigated in this study. Salt stress significantly decreased seedling length, seedling dry weight, vigor index, germination percentage, germination energy, as well as proline

content. Increasing NaCl concentration led to decrease in previous traits. The highest values for germination percentage and other traits was observed in seedlings without salt stress treatment. The lowest germination percentage was observed with 200mMol NaCl as compared to optimum conditions (distill water). These results are in accordance with those reported by (Datta *et al.*, 2009). They found that the reduction in germination percentage of wheat seeds when planted under different levels of NaCl may be due to loss of viability at higher salinity level, delaying germination of seeds at salinities Also, due to salinity induced high oxidative stress. Salinity markedly reduces the growth (fresh and dry weight) of shoots and roots at the higher NaCl concentration as reported by (Amor *et al.*, 2005).

Table 3. Average of seedling length, seedling dry weight, vigor index I and vigor index II of Gemiza 9 wheat cultivar as influenced by salinity levels, seed stimulants and concentrations treatment.

Character	Treatment	Seedling length (cm)	SDW (g)	Vigor index I	Vigor index II
Salinity (mM)	Control	16.8	0.08	1645	6.6
	100mM	14.9	0.08	1346	7.3
	150mM	13.6	0.07	1291	6.9
	200mM	10.5	0.07	981	6.2
LSD5%		0.6	0.01	81	0.6
Stimulation treatment	Salicylic	13.5	0.07	1284	6.5
	H_2O_2	13.8	0.07	1258	6.5
	Chetozan	14.6	0.08	1406	7.3
LSD5%		0.6	0.00	70	0.5
Concentration (ppm)	0	13.6	0.07	1304	6.5
	50	14.3	0.10	1344	8.4
	100	14.1	0.06	1333	6.0
	150	13.8	0.07	1282	6.0
LSD5%		0.6	0.01	81	0.6

Seed germination stimulants:

Highly significant differences were detected among seed germination stimulants regarding to seedling length, seedling dry weight, vigor index, germination percentage, germination energy, as well as proline content. While, Salicylic acid surpassed in germination rate, mean germination time, speed of germination and pot emergence Tables (3 and 4). Treating wheat seed with chitosan gave the highest values in the mentioned treats, followed by salicylic acid and hydrogen peroxide. The superiority of chitosan over control may be attributed to improve seed performance at different salinity concentrations and when CH is applied to plant seeds, their germination index is enhanced, the mean germination time is reduced, shoot height, root length, and seedling vigor are increased Similar data were obtained by (Zeng *et al*., 2012) and Bahrani and Pourriza (2012).

Concentration effects:

Highly significant differences were detected among seed germination stimulants regarding to shoot length, germination percentage, germination rate, mean germination time, germination energy, seedling vigor index, pot emergence, as well as proline content (Tables 3 and 4). Treating wheat seed with salicylic acid gave the highest values in seedling length, speed of germination, pot emergence and proline content. However, hydrogen peroxide gave the lowest values in germination percentage, seedling dry weight, germination rate, speed of germination and seedling vigor index-I. The superiority of salicylic acid over control may be attributed to improve seed performance at different salinity concentrations. Similar data were obtained by Bahrani and Pourriza (2012).

Table 4:Average of germination percentage, germination rate, mean germination time, germination energy, speed of germination, pot emergence and proline content of Gemiza 9 wheat cultivar as influenced by salinity levels, plant stimulants and concentrations treatment.

Character	Treatment	G (%)	GR	MGT (day)	GE	SG	PE (%)	Proline (mg/100 gm DW)
Salinity (mM)	Control	96	0.66	7.0	72	10.3	77	17.7
	100mM	90	0.67	6.8	73	11.4	66	19.4
	150mM	94	0.67	7.0	72	10.4	54	26.9
	200mM	92	0.67	7.0	69	10.0	48	33.5
LSD5%		2	0.00	0.04	1.3	0.2	1.5	0.5
Stimulation treatment	Salicylic	93	0.67	6.9	72	10.8	63	23.4
	H_2O_2	91	0.67	7.0	72	10.4	60	24.0
	Chetozan	96	0.66	7.0	72	10.4	61	25.7
LSD5%		2	0.00	0.03	1.1	0.2	1.3	0.46
Concentration (ppm)	0	95	0.67	6.9	72	10.6	62	13.9
	50	94	0.67	6.9	72	10.9	63	27.9
	100	93	0.67	7.0	71	10.5	61	26.9
	150	91	0.66	7.0	69	10.2	60	28.8
LSD5%		2	0.00	0.04	1.3	0.2	1.5	0.5

Interaction effects:

Data in Table (5) showed that the interaction between salinity, seed stimulants and concentrations had highly significant effect on seedling length, seedling dry weight, vigor index, germination percentage, germination energy, as well as proline content. The highest seedling length was produced at zero NaCl with chitosan under zero level followed by 100 ppm chitosan under zero of NaCl. On the other hand, the lowest values of seedling length produced from 200 mMol of NaCl with salicylic acid 150 ppm. High salinity levels gave the lowest reduction in germination percentage, but chitosan and salicylic acid gave the highest value over control. These results indicated that Chitosan and salicylic acid play an essential role in enhancing seed germination and increasing seedling length especially when soaking the seed as compared with other treatments. Salicylic acid is common stimulant plant produced phenolic compound, endogenous growth regulator of physiological process in plants. Exogenous application of salicylic acid may influence stomata closure ion uptake and transport inhibition of ethylene biosynthesis, transpiration and stress tolerance. These

data are in accordance with those reported by Khan and Smith (2003) and Ibrahim and Kishk (2014).

Table (6) showed that the interaction between salinity, seed stimulants and concentration levels was highly significant as to germination percentage, germination rate, mean germination time, germination energy, speed of germination, pot emergence and proline content. Chitosan (0 to 100 ppm) with zero NaCl gave the highest mean values (100%) followed by salicylic acid and hydrogen peroxide, respectively.

Table 5. The interaction between salinity levels, seed stimulants and concentration treatments on seedling length, seedling dry weight, and vigor index I, II.

Character Treatment Salinity (mM)	Stimulation material	Conc. (ppm)	Seedling Length (cm)	Seedling dry wt. (g)	Vigor index-I	Vigor index-II
Control	Salicylic acid	0	9.7	0.077	1208	7.3
		50	17.3	0.073	1670	4.0
		100	14.7	0.077	1426	7.3
		150	8.9	0.043	832	4.0
	H_2O_2	0	12.7	0.077	1208	7.3
		50	17.3	0.077	1663	7.3
		100	19.4	0.087	1706	7.3
		150	19.7	0.070	1975	6.8
	Chitosan	0	21.2	0.070	2120	7.1
		50	20.2	0.163	2025	6.4
		100	20.5	0.077	2055	7.7
		150	19.8	0.077	1861	7.1
100	Salicylic acid	0	11.4	0.050	898	5.4
		50	14.9	0.070	1172	6.5
		100	17.5	0.103	1690	9.9
		150	19.0	0.090	1855	8.8
	H_2O_2	0	16.9	0.050	1451	5.3
		50	17.0	0.070	1637	7.0
		100	16.0	0.060	1413.	5.4
		150	12.2	0.077	1024	6.3
	Chitosan	0	13.0	0.060	1102	5.9
		50	13.8	0.180	1303	16.6
		100	13.4	0.047	1311	5.2
		150	13.8	0.057	1298	5.1
150	Salicylic acid	0	16.3	0.077	1599	7.4
		50	17.9	0.093	1610	8.2
		100	17.7	0.050	1704	4.8
		150	15.5	0.077	1504	7.5
	H_2O_2	0	14.6	0.077	1437	7.4
		50	11.6	0.070	1043	6.4
		100	11.1	0.067	1043	6.2
		150	11.7	0.077	988	6.3
	Chitosan	0	14.9	0.050	1402	4.4
		50	10.4	0.157	1027	15.3
		100	8.4	0.037	828	3.4
		150	13.4	0.057	1314	5.3
200	Salicylic acid	0	9.8	0.073	964	7.0
		50	8.6	0.063	798	5.9
		100	9.6	0.047	874	4.3
		150	7.8	0.050	753	4.9
	H_2O_2	0	11.1	0.073	1092	7.0
		50	9.6	0.077	876	6.7
		100	9.5	0.063	822	5.5
		150	10.1	0.070	752	5.7
	Chitosan	0	11.9	0.070	1167	6.3
		50	13.4	0.113	1312	11.1
		100	11.8	0.057	1133	5.3
		150	13.5	0.050	1236	4.6
$LSD_{5\%}$			2.3	0.020	281	2

This positive effect may due to the fact that seed treatments had better efficiency for water absorption from growing media that is why metabolic activities in seed during germination process commence much earlier than radicle and plumule appearance. These data are in accordance with those reported by Kishk and El-Mowafy (2015).

Table 6: The interaction between salinity, seed germination stimulants and concentration treatments on germination percentage, germination rate, mean germination time, germination energy, speed of germination, pot emergence and proline content.

Character Treatment Salinity (mM)	Stimulation material	Conc. (ppm)	G (%)	GR	MGT	GE	SG	PE (%)	Proline (mg)
Control	Salicylic acid	0	96	0.65	7.0	70	10.1	84	13.5
		50	96	0.67	7.0	72	10.5	72	16.5
		100	96	0.67	7.0	73	10.6	82	17.0
		150	92	0.67	7.0	72	10.4	76	21.0
	H_2O_2	0	96	0.65	7.0	70	10.2	84	14.0
		50	96	0.67	7.0	71	10.3	76	20.0
		100	88	0.65	7.1	63	9.2	76	18.0
		150	100	0.66	7.0	72	10.4	76	19.5
	Chitosan	0	100	0.67	7.0	75	10.9	84	14.0
		50	100	0.67	7.0	75	10.9	100	19.1
		100	100	0.67	7.0	75	10.9	60	18.3
		150	94	0.67	7.0	70	10.2	60	21.5
100	Salicylic acid	0	89	0.67	6.5	69	11.5	68	14.0
		50	88	0.67	6.0	66	13.5	72	22.3
		100	91	0.67	7.0	71	11.5	71	22.8
		150	90	0.67	7.0	75	11.5	68	22.0
	H_2O_2	0	92	0.67	7.0	74	10.7	68	14.0
		50	96	0.67	7.0	75	11.5	64	20.0
		100	88	0.67	7.0	74	11.4	60	19.5
		150	84	0.67	7.0	74	10.6	56	20.0
	Chitosan	0	91	0.66	7.0	76	11.5	68	14.0
		50	94	0.67	7.0	76	12.0	70	28.0
		100	93	0.67	7.0	73	10.6	67	16.9
		150	94	0.65	7.1	70	10.4	66	19.4
150	Salicylic acid	0	98	0.67	7.0	73	10.6	52	14.0
		50	90	0.67	7.0	70	10.2	58	25.2
		100	96	0.67	7.0	73	10.6	66	25.0
		150	96	0.67	7.0	75	10.9	58	27.2
	H_2O_2	0	98	0.67	7.0	73	10.6	52	14.0
		50	90	0.67	7.0	72	10.4	56	30.1
		100	94	0.67	7.0	72	10.4	52	29.2
		150	84	0.67	7.0	72	10.4	52	32.3
	Chitosan	0	94	0.67	7.0	69	10.0	52	14.0
		50	98	0.66	7.0	72	10.4	50	36.1
		100	98	0.67	7.0	73	10.6	52	36.5
		150	98	0.67	7.0	70	10.1	56	40.2
200	Salicylic acid	0	98	0.67	7.0	72	10.4	44	14.0
		50	92	0.66	7.0	70	10.1	46	38.1
		100	90	0.67	7.0	69	10.0	48	41.2
		150	96	0.67	7.0	72	10.4	50	42.0
	H_2O_2	0	98	0.67	7.0	72	10.4	44	14.0
		50	90	0.67	7.0	73	10.6	48	39.5
		100	86	0.67	7.0	70	10.2	50	39.0
		150	76	0.67	7.0	64	9.3	52	41.0
	Chitosan	0	98	0.67	7.0	73	10.6	44	14.0
		50	98	0.67	7.0	73	10.6	48	40.0
		100	96	0.67	7.0	71	10.2	52	40.0
		150	90	0.63	7.1	52	7.4	54	40.0
$LSD_{5\%}$			8.1	0.01	0.13	4.5	0.8	5.3	1.9

REFERENCES

AOSA (Association of Official Seed Analysis) (1992). Rules for testing seeds. Journal of Seed Technology, 6:1-125.

Abdul-Baki, A. N. J; A. Prentice Hall and J. D. Anderson (1980). Vigor determination in soybean seed by multiple criteria. Crop Science, 13: 630-633.

Amor N. B; K. B. Hamed; A. Debez,; C. Grignon and Crabbedly (2005). Physiological and antioxidant responses of perennial halophyte *Crithmum maritimum* to salinity. Plant Science 4: 889-899.

Arfan M., Athar, H. R., M Ashraf (2007). Does exogenous application of salicylic acid through the rooting medium modulate growth and photosynthetic capacity in differently adapted spring wheat cultivars under salt stress? – J. Plant Physiol. 6: 685-694, 2007.

Asghari-Zakaria R, B Maleki-Zanjani, E. Sedghi. (2009). Effect of in vitro chitosan application on growth and minituber yield of *Solanum tuberosum* L. Plant, Soil Environ.; 55(6):252–256.

Bahrani A and J. Pourreza (2012). Gibrillic acid and salicylic acid effects on seed germination and seedlings growth of wheat under salt stress conditions. World Applied Science Journal 18 (5): 633-641.

Bartllett M. S (1937). Some samples of statistical method of research in agriculture and applied biology. Jour Roy. Soc. 4:2.

Çavusoglu K and K. Kabar. (2010). Effects of hydrogen peroxide on the germination and early seedling growth of barley under NaCl and high temperature stresses. Eur Asian J Biosci. 2010;4:70–79. doi: 10.5053/ejobios.2010.4.0.9.

Datta J.K.; S. Nag ; A. Banerjee and N. K. Mondal (2009). Impact of salt stress on five varieties of Wheat (*Triticum aestivum* L.) cultivars under laboratory condition J. Appl. Sci. Environ. Manage. SeptemberVol. 13(3) 93 – 97.

El-Hadrami A., L.R. Adam, I. El Hadrami, F. Daayf (2010). Chitosan in plant protection. Marine Drugs 8(4):968-987.

Ellis R. H. and E. H. Roberts (1981). The quantification of ageing and survival in orthodox seeds. Seed Sci.Tech., 9, 379- 409.

Eva-Guadalupe L.P., M.C Susana-Patricia., M.M Ernesto., L.S Alma-Virginia., I T.P rineo. (2013). Maize seed coatings and seedling sprayings with chitosan and hydrogen peroxide: their influence on some phenological and biochemical behaviors. Journal of Zhejiang University-SCIENCE B (Biomedicine & Biotechnology. 2013 14(2):87-96.

Gomez K. A. and A. A. Gomez (1984). Statistical procedures for agricultural research. 2nd Ed. John Whley & Sons.

Gul B. and D.J.Weber (1999). Effect of salinity, light, and temperature on germination in Allenrolfea occidentalis . Can. J. Bot77:240- 246.

Guan YJ, Hu J, XJ Wang, CX. Shao (2009). Seed priming with chitosan improves maize germination and seedling growth in relation to physiological changes under low temperature stress. J Zhejiang Univ-Sci B (Biomed & Biotechnol) 2009;10(6):427–433. doi: 10.1631/jzus.B0820373.

Ibrahim E.A.M and A. M. S. Kishk (2014). Enhancing viability of onion seed using some treatments. J. Plant Prot. and Path., Mansoura Univ., 5 (4): 179 – 192.

ISTA Rules (1999). International rules for seed testing. Proc. Int. Seed Test. Ass., 31 (1) : 1-152.

Khan W., B and D. L. Smith (2003).Photosynthetic response corn and soybean to foliar application of salicylates. J. Plant Physiol., 160: 485-492.

Khodari S.E.A., (2004). Effect of salicylic acid on the growth, photosynthesis and carbohydrate metabolism in salt stressed maize plants. *Int. J. Agric. Biol*., 6(1):5-8.

Kishk A.M.S and M. R. El-Mowafy (2015) . Rice seed priming to overcome salt stress conditions. J. Plant Production, Mansoura Univ., 6 (5): 658 – 694.

Krishnasamy V. and D.V.Seshu (1990). Phosphine fumigation influence on rice seed germination and vigor. Crop Sci., 30:28-85.

Li JT. Qiu, XW. Zhang, L.S. Wang (2011). Exogenous hydrogen peroxide can enhance tolerance of wheat seedlings to salt stress. Acta Physiol Plant. 2011;33(3):835–842. doi: 10.1007/s11738-010-0608-5.

Miché L, J. Balandreau (2001). Effects of rice seed surface sterilization with hypochlorite on inoculated *Burkholderia vietnamiensis*. Appl Environ Microbiol. 67(7):3046–3052. doi: 10.1128/AEM.67.7.3046-3052.2001.

Najafian L, A Ghodsvali, M.H.H. Khodaparast, L.L. Diosady (2009). Aqueous extraction of virgin olive oil using industrial enzymes. *Food Research International.* V.42, pp.171-175.

Qun S.; J. Wang and B. Sun (2007). Advances on seed vigor physiological and genetic mechanisms. Agricultural Sciences in China, 6 (9): 1060-1066.

Ruan S. Q. Xue and K. Tylkowska (2002).The influence of priming on germination of rice (*Oryza sativa*, L.) seeds and seedlings emergence and performance in the flooded soil. Seed Sci and Tech., 30: 61-67.

Troll W, J and Lindsey (1955). A photometric method for the determination of proline. Journal of Biological Chemistry 215: 655-660.

Zeng D, X. Luo, R. Tu (2012). Application of bioactive coatings based on chitosan for soybean seed protection. Int J Carbohydr Chem. 2012(1):1–5. doi: 10.1155/2012/104565.

تأثير بعض محفزات الإنبات على إنبات بذور القمح وقوة البادرات تحت ظروف الملوحة

عبدالمجيد محمد سعد كشك - أمل على أحمد المهدي - محمد رضا عبدالسميع الموافي

قسم بحوث تكنولوجيا البذور- معهد بحوث المحاصيل الحقلية- مركز البحوث الزراعية – مصر.

استخدام تقنيات حديثة لزيادة الإنتاج من خلال معاملة تقاوي القمح ببعض محفزات الإنبات أدى إلى تحسين إنبات البذور وقوة البادرات تحت مستويات مختلفة من الملوحة وهى (صفر،١٠٠،١٥٠ و٢٠٠ مليمول كلوريد الصوديوم). لذلك أقيمت تجربه بوحدة بحوث تكنولوجيا البذور بالمنصورة خلال عام ٢٠١٥ لدراسة تأثير بعض محفزات الإنبات على نمو بادرات القمح فى المراحل الأولى تحت ظروف الملوحة. وكانت عوامل التجربة محفزات الإنبات وهى حامض السالسليك بتركيزات (صفر،٥٠،١٠٠،١٥٠ جزء فى المليون)، الشيتوزان بتركيزات (صفر،٥٠،١٠٠،١٥٠جزء فى المليون)، فوق اكسيد الهيدروجين بتركيزات (صفر،٥٠،١٠٠،١٥٠جزء فى المليون) والمعاملة بالماء. وكانت مستويات الملوحة بتركزات (صفر،١٠٠،١٥٠ و٢٠٠ مليمول من كلوريد الصوديوم). أشارت النتائج أن المعاملة بمحلول الشيتوزان ٥٠ جزء فى المليون كان لها تأثير إيجابي على تحفيز ونمو البادرات فى معظم الصفات المدروسة. بينما لم يُحدث فوق أكسيد الهيدروجين نفس التأثيرالإيجابي. كما أظهرت النتائج وجود إختلافات معنوية بين مستويات الملوحة المختلفة فى كل الصفات المدروسة حيث أعطت المعاملة بالتركيزات المنخفضة الملوحة أعلى القيم بالمقارنة بالتركيزات المرتفعة. وأظهرت النتائج أيضا أن تأثير التفاعل بين المواد المحفزة لنمو البادرات ومعاملات الملوحة كان معنويا حيث أعطى محلول السالسليك وفوق أكسيد الهيدروجين أعلى نسبة إنبات تحت كل مستويات الملوحة المستخدمة بعد الشيتوزان. أظهرت النتائج أيضا أن تأثير التفاعل بين معاملات الملوحة والمحفزات والتركيزات المختلفة من المحفزات كان معنويا حيث أعطى الصنف جميزة ٩ أعلى القيم لطول البادرة عند المعاملة بالشيتوزان بتركيز(صفر، ٥٠ جزء فى المليون) وصفر NaCl. وكانت أعلى نسبة إنبات ووزن جاف للبادرة عند المعاملة بالشيتوزان ٥٠ جزء فى المليون وكلوريد صوديوم ١٠٠ مليمول ثم فوق أكسيد الهيدروجين وحمض السالسليك. بينما أقل زمن للإنبات كان عند المعاملة بالسالسليك اسد بتركيز ٥٠ جزء فى المليون وصفر من كلوريد الصوديوم.

لذا تقترح الدراسة إستخدام محلول الشيتوزان بتركيز(٥٠ – 100) جزء فى المليون مع صنف القمح جميزة ٩ عند الزراعة فى الأراضي التى بها نسبة ملوحة تصل إلى ١٠٠- ٢٠٠ مليمول كلوريد صوديوم للوصول إلى أفضل النتائج.