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EFFECT OF SALINE CONDITIONS AND GROWTH REGULATORS ON GERMINATION AND GROWTH OF FIVE SOYBEAN CULTIVARS PLANT.

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ABSTRACT

Seeds of five Glycine max cultivars (Columbus, Caland, issex, Clark, and Crewford) were subjected to saline irrigation water (0,3000,6000, and 9000 ppm NaCl), and presowing seed soaking in either (50 and 100 ppm GA_3), or (500 and 750 ppm CCC).

Saline irrigation water at the lower level of 3000 ppm increased the germination percent of the tested soybean cultivar seeds except Glycine max cv. Crawford, while the medium and high salinity levels (6000 and 9000 ppm), seed germination of five soybean cultivars was markedly reduced.

All tested aspects of growth including height, fresh and dry weight of the five soybean cvs. seedlings were markedly depressed with the increase of NaCl level in irrigation water.

Under control conditions, presowing seed soaking in both GA or CCC. solutions increased the germination precent of Clark seeds and decreased it for the other varieties. However, under saline conditions, seed sooking treatments improved the germination of Clark and Crawford only, and the treatments relatively reduced the harmeful effects of salinity on seedling growth.

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INTRODUCTION

One of the major problemes which interferes with crop growth and production is salinity conditions: of soil or irrigation water. High salinity levels, usually reduce water absorption which in turn inhibits the most physiological processes, resulting in either reduction or complete failure of seed germination. Several investigators, e.g., Bernstein and Hayward (1958), Strogonov (1962), Tailakov (1967), Petrosovits (1968), Merri and Poljakoff (1970), and, Rai (1977), studied the differential response of seed germination with respect to Kind and salt concentration, as well as the emparing effect of these factors on growth and yield aspects of different crops. Mainwhile, the use of growth regulators including gibberellic acid and cycocel is Known to increase the tolerance of plants to the adverse effect of soil salinity (Nieman and Bernstein 1959). The response of plants to such substances varies according to the nature of the used substance, its concentration, and the growth stages of treated plants (uppel and sing 1976). Also, it was reported that presowing treatments or hardening of plant seeds induced good germination (Cocks and Donald 1973), increased tolerance of plants to salinity as measured by more active coleopeile growth (Hafeez and Hudson 1964), and, development of bigger root system (Chanduri and Weibe 1964).

Nowadays, the current national plan calls for cultivate economical crops in the newely reclaimed lands by using the available water sources, such as the underground and dranaige water. Under such conditions, it is desirable to evaluate the salinity degree of irrigation water which may not adversly reduce seed germination and also try to minimize or counteract the harmeful effect of saline water by several means. Therefore the aim of thie investigation was to study the influece of chloride salinity and presowing seed treatments with GA_3 or ccc., upon seed germination, height, and weight of seedling shoot for five saybean cultivars plant.

MATERIALS AND METHODS

A pot experiment was conducted under green house conditions at N.R.C., Dokki, Cairo, Egypt, to study the effect of different levels of sodium chloride, presowing seed treatment with GA_3 or CCC solutions upon germination percentage, seedling height, fresh and dry weight (aerial parts), for five soybean cultivars (Columbus, Caland, Issex, Clark, and,Crawford). Plastic pots, 15 cm., in diameter supplied with drainage hole were used as seeds bed, and each pot was filled with air dried pure sand, previously treated with Con. hydrochloric acid and washed throughly with water. Twenty treatments were applied for each Spp., and each treatment consist of ten pots. The treatments were four salinity levels of irrigation water (0,3000, 6000, and 9000 ppm. NaCl), and their combination with

presowing seed soaking for 6 hrs., in either GA_3 (50 and 100 PPM.), or CCC (500 and 750 PPM.), solutions. Concerning the salinity treatments, the seeds were presowing soaked also for the same period in tap water. In all cases, the soaked seeds in either tap water or growth regulator solulions were air-dried on filter paper before sowing at a constant depth in the pots (10 seeds/pot). After sowing all treatments (each of 10 pots), were arrangeal in complete randomized block design, and the pots of each treatment recieved the proper saline irrigation water in sufficient volume to allow dripping, and then at 2 days interval throughout the experimntal period. The number of germinated seeds per each pot waa daily recorded until aconstant number of seedlings was obtained and the germination percentage was then calculated. The seedlings were then allowed to grew, and for seedlings fertilization, one g., from each of Ammonium nitrate and Superphosphate were added to each pot. After six weeks from starting the experiment, seedling height, fresh, and, dry weight (at 70 C°), of seedling aerial parts were determined.

RESULTS AND DISCUSSION

1- Effect of saline Irrigation water and Presowing seed soaking on Germination percent:

The data of germination percent for the seeds of different soybean species as affected by saline irrigation water and presowing seed treatment as well as their inter-

action are presented in table (1). It is obvious from these data that the lowest salinity level of irrigation water increased the germination percent of the tested seeds, with one exception, being the seeds of Cv.Crawford, where its germination percent value decreased than the control. Similar results were obtained by Abichandani and Bhatt (1965) with Pennesetum typhoides and Sorghum vulgere, and, Mandour ebal (1985) with Brassica alba seeds. The medium chloride salinity of irrigation water, (6000 ppm), however showed a slight and insignificant reduction in seed germination of soybean cvs. (Columbus and caland), while seed germination of the other species was markedly decreased . Seed germination of all tested Glycine max cvs. plant was sharply depreseed at the higher salinity level of irrigation water (9000ppm), where the lowest germination percentages were recorded. The obeerved decrease in seed germination of soybean CVS. plant due to high salinity level are in agreement with thoee obtained by Uprety and sarin (1974), Rai (1977), Khadr ebal (1980), and Mandour et al (1985).

Regarding the effect of presowing seed soeking in GA_3 or CCC. solutions, the obtained data (table 1), reveal that under control conditions (Zero salinity), the concentrations used of these substances decreased seed germination of the tested soybean CVS., except seed germintation of CV. Clark, where presowing soaking treatment with the different

concentrations of both substances increased clearly its germination percent. Moreover, the obtained data show that the presowing soaking treatments decreased slightly the germination percent of Crawford in comparison to soybean CVS. (Columbus, Caland, and Issex).

The intereaction effect between saline irrigation water and presowing seed soaking treatments in GA_3 or CCC solutions on seed germination showed various responces table (1). Generally, the presowing soeking treatments in the adopted concentrations of both subetances failed to improve seed germination percentage of CVS. Columbus, Caland, and Issex speeics when seeded under the different levels of saline irrigation water. On the other hand, soaking treatments developed clearly the germination percentage of both CVS. Clark and crawford, when seeded under such conditions of salinity. The above mentioned results indicate that only the germination of CVS. Clark and crawford was positivily affected by preeowing soaking treatments wether they seeded under saline or non saline conditions. In this respect, Soliman (1979), observed promotion effect of CCC solution on seed germination of Egyptian berseem seeded under saline conditions, whereas GA_3 did not overcome this conditions, mainwhile El-Fouly (1972), observed that CCC solution did not improve the germination of wheat seeds under saline conditions.

2- Effect of saline Irrigation water and Presowing seed Soaking on seedling Growth:

The mean values of seedling height (cm.), fresh, and, dry weight of seedling shoot, together with their standard error values are presented in tables 2 and 3.

A. seedling Height

Data presented in table (2) showed a general decreasing effect on seedling height by increasing NaCl conc., a result which may be due to the disturbance in metabolic pathway of plants, resulting from the adverse effect of salinity on enzyme activity (Strogonov 1962).

Comparing the dsta given for GA_3 and CCC growth regulators, it is obvious that, soaking seeds in GA_3 100 ppm, increased the seedling height of soybean CVS. (Colombus, Caland, Issex, Clark and Crawford. The results also indicate that CCC treatments had a general decreasing effect on seedling height of the tested seeds except CV.Clark.

The interaction between salinity treatments and growth substances showed that GA_3 treatment 50,and 100 ppm. increased seedling height of the tested seeds grown under different levels of NaCl compared with their counterparts grown under the same levels of salinity but did not soaked previously in GA_3.

Regarding the effect of CCC upon seeds subjected to saline conditions, the previous table showed that the conc., of 750 ppm CCC depressed seedling height of CVS. (Caland and Crawford) and slightly increased the seedling height of CV. Clark however the 500 ppm., conc. did not exert appreciable effects.

B - Moisture Content:

Saline irrigation generally induced increase in the moisture content of columbus, Caland and Issex seedlings and remarkable decrease in moisture content of clark and Crawford seedling grown under the different levels of NaCl (Table 2).

The concentrations used of GA_3 and CCC reduced the moisture content of CVS. Clark and Crawford under saline and non-saline conditions. The increaaed moisture content of soybean CVS. seedlings grown under saline conditions might be attributed to a decreased rate of transpiration (Strogonov, 1962).

C. Fresh and Dry Weight

Data preeented in Table (3) revealed that both fresh and dry matter production decreased by incressing NaCl concentration. Pre Soaking seeds in CCC regulators at conc. of 500 and 750, increased both fresh and Dry Weight

production of CVS. Caland, Issex and Clark, a result which is in harmony with those obteined by KishK and Shalaby (1983), and Khafagi et. al (1984).

The obtained data indicate clearly that, at least one of the used concentrations of GA_3 or CCC stimulated fresh and dry weight production of the five soybeam CVS. subjected to seline conditions.

The interaction between salinity conditions and pre-sowing soaking treatments showed in most cases a general reduction in both fresh and dry weight of seedlings. Nevertheless, soaking treatments seems to be usefull, where these treatments enables the seedlings to survive under the highest level of saline water (9000 ppm). Generally, it could be concluded that clark and Crawford seeds seemed to be more salt tolerance, while soybean cultivars Columbus, Caland and Issex eeeds are relatively salt sensitive. However the imbalonce in nutritive cations in tissues of salt affected plants mey also be responsible for the depression of growth.

REFERENCES

Abichandani, C.T., and Bhatt, P.N. (1965). Salt tolerance at germinetion of bajra (Pennesetum typhoides and Sorghum vulgare) Ann. Arid Znne, 4: 36-42.

Bernstein, L. and H.E. Hayward (1958). Physiology of salt tolerance. Ann. Rev. Plant Physiol. 9: 25-46.

Chanduri, I.I., and Weibe, M.H. (1964). The induction of salt resistance by calcium chloride pretreatment of wheat grains. Nature vissenschaftan, 51: 563-564.

Cocks, P.S. , and Donald, C.M. (1973). The germination and eatablishment of two annual grasses (Hordium leporimum Link and Lolium rigidum Gaud.) Aust. J. Agric. Res. 24: 1-10.

El-Fouly, M.M. (1972). Enzyme activity in wheat seedlings grown under different NaCl salinity levels and their interaction with growth regulators. Biochem. physiol. Pflanz (BPP) 163 (5): 492-498.

Hafeez., A.T.A., and Hudson, J.P. , (1964). Effect of hardening raddish seeds. Nature, 216-288.

Khadr, A.A., Nowalgg, N., and Hussein, N.M. (1980). Differential tolerance of wheat, barley, broad beans, and pea seedling to varioua levels of salinity, Bull. N.R.C. Egypt, 5, 283-289.

Khafagi, O.A., Shalaby, A.A., and E.T. Kishk (1984). Effect of (2-chloroethyl Trimethyl Ammonium Chloride "CCC" on the salt talerance of wheat, barley and broadbean. Desert Inst. Bull. A.R.E. 34: No. 1, 323-336.

Kishk, E.T. and Shalaby, A.A. (1983). Effect of CCC and 2, 4-D on salt tolerance of Vigna sinensis L. in calcareous soil 1st Conf. of Agric., 1983, Egypt, Soc. of Crop. Sci.

Mandour, M.S., Sohier El-Sherbeny and Fatma Reda (1985). Seed germination of two Brassica spp. as affected by different saline solutions. Zagazig of Journal of Agricultural Research. Zagazig Univ. Egypt.

Meiri, A., and A. Poljakoff-Mayber (1970). Effect of Various salinity regimes on growth, leaf expansion and transpiration rate of bean plants. Soil Sci., 104: 26-32.

Nieman, R.H. and L. Bernstein (1959). Interactive effects of gibberellic acid and salinity on the growth of beans. Amer. Jour. Bot. 46 (9): 667-670.

Petrasovits, I. (1968). The salt tolerance of plants in the germination phase and under irrigation. Agrokem. Talajt., 17, No. 1, 61-67.

Rai, M. (1977). Salinity tolerance in indian mustard and safflower. Indian J. of Agric. Sci., 47: 70-73.

Soliman, M. D. (1979). Effect of GA_3 and CCC on growth and structure of bersseem clover grown under different salinity levels. M.Sc. Fac. of Agric., Cairo Univ.

Strogonov, B.P. (1962). Physiological basis of salt tolerance of plants. Academy Science of U.S.S.R., Inst. of plant Physiology. English translation by Isreal program of Scientific Translation (1964).

Tsilakov, V. (1967). Germination of Sorghum and Maize seeds in salt solutions. IZV. Akad. Nauk. Turkmen SSR No. 1, 34-39.

Uppel, S. and V.P. Singh. (1976). Note on germination in Saybean Jour. of Res. 6 (1): 85-86.

Uprety, D.C. and M.N. Sarin (1974). Physiological studies on salt tolerance in Pisum sativum L.I. Germination and seedling growth. Acta Agronomica Academiae Scientiarum Hung Aricae, 23, 3-4: 269-274.

Table (1): Effect of saline condition and seed treatment on germination percent of soybean CVS. Columbus, Caland, Issex, Clark and Crawford.

NaCl ppm	Growth Subs.ppm.	Columbus		Caland		Issex		Clark		Crawford	
		germ. %	germ. % as % of the cont.	germ. %	germ. % as % of the cont.	germ. %	germ. % as % of the cont.	germ %	germ. % as % of the cont.	germ. %	germ. % as % of the cont.
0	Control	77.0	100.0	78.3	100.0	93.3	100.0	68.8	100.0	91.0	100.0
	$GA_3$50	53.0	68.8	54.3	69.3	69.3	74.8	80.8	117.4	86.0	94.5
	$GA_3$100	66.6	86.4	67.0	85.5	82.0	87.8	84.3	122.5	88.0	96.7
	CCC 500	54.5	70.7	55.5	70.8	61.0	65.3	94.7	137.6	85.0	93.4
	CCC 750	70.0	90.9	73.0	93.2	77.0	82.5	94.0	136.6	91.0	100.0
3000	Control	90.0	100.0	79.6	100.0	98.3	100.0	81.6	100.0	81.2	100.0
	GA_3 50	57.0	63.3	58.5	73.5	65.0	66.1	83.0	101.7	83.7	103.0
	GA_3 100	62.0	68.8	63.4	79.6	70.0	71.2	86.0	105.3	86.0	105.9
	CCC 500	64.0	71.1	65.0	81.6	72.0	73.2	83.2	101.9	82.0	100.9
	CCC 750	61.0	67.7	62.0	77.8	69.0	70.1	85.0	104.1	87.0	107.1
6000	Control	74.0	100.0	76.0	100.0	82.0	100.0	58.0	100.0	61.2	100.0
	GA_3 50	51.0	68.9	53.0	69.7	59.0	71.9	66.0	113.7	68.0	101.1
	GA_3 100	48.0	64.8	50.0	65.7	56.0	68.2	73.0	125.0	71.0	116.4
	CCC 500	52.0	70.2	53.4	70.2	58.0	70.7	72.0	124.1	67.0	109.5
	CCC 750	48.0	64.8	49.5	65.1	54.0	65.8	76.0	131.0	73.5	120.0
9000	Control	61.0	100.0	62.0	100.0	69.0	100.0	43.0	100.0	42.0	100.0
	GA_3 50	35.0	57.3	36.5	58.8	43.0	62.3	48.0	111.6	44.0	104.8
	GA_3 100	40.0	65.5	42.0	67.7	48.0	69.5	53.0	123.2	50.3	120.0
	CCC 500	41.0	67.2	43.4	70.0	49.0	71.0	54.0	125.5	48.0	114.3
	CCC 750	39.0	63.9	40.0	64.5	47.0	68.1	56.0	130.2	52.5	125.0

Table (2)*: Effect of the interaction between salinity and growth substances on shoot height (cm) and moisture content (%) of five Glycine max cultivars.

Treatments	Columbus		Caland		Issex		Clark		Crawford	
Growth subs. ppm	Shoot height cm	Moisture content %	Shoot height cm	Moisture content %	Shoot height cm	Moisture content %	Shoot height cm	Moisture content %	Shoot height cm	Moistur content %
Control	10.5±1.9	79.2	14.0±3.4	81.4	15.0±2.3	82.7	14.9±2.5	86.2	15.2±3.7	82.5
GA_3 50	8.9±1.7	81.9	17.0±3.1	83.3	13.0±2.9	78.5	19.2±3.0	84.6	14.3±2.2	75.7
GA_3 100	12.4±1.5	82.8	21.0±2.2	84.7	17.0±2.2	83.5	19.3±1.4	83.2	17.4±3.6	75.6
CCC 500	8.9±0.7	77.5	11.0±2.2	81.9	14.0±1.6	80.8	18 ±1.7	80.7	14.5±3.1	74.3
CCC 750	11.9±1.1	77.4	10.0±1.9	80.7	16.0±1.1	82.0	18.5±2.0	81.8	14.0±2.1	82.4
Control	9.2±1.4	83.3	9.6±1.4	85.5	13.7±2.0	85.6	14.2±1.3	84.4	14.8±1.8	80.6
GA_3 50	9.6±0.8	84.2	11.9±1.2	82.3	14.1±3.0	83.0	17.2±3.2	80.3	14.0±2.0	72.7
GA_3 100	13.3±1.5	82.0	16.4±1.4	83.6	17.7±5.2	83.7	16.6±2.6	83.2	16.0±0.3	70.5
CCC 500	9.0±1.7	81.3	7.6±1.2	81.5	13.4±1.2	82.6	15.2±2.8	81.8	13.0±1.9	72.5
CCC 750	11.3±20	80.4	8.6±1.6	81.7	15.7±4.1	83.8	16.6±3.0	82.3	13.3±2.1	74.5
Control	8.0±0.3	83.3	7.4±0.6	84.2	12.5±1.8	81.6	13.5±1.8	83.0	13.2±2.1	70.0
GA_3 50	11.4±0.7	82.6	9.7±1.3	81.8	15.9±3.8	77.7	16.3±3.0	80.6	14.2±1.6	72.3
GA_3 100	12.9±2.0	83.7	13.1±0.8	83.5	16.9±3.5	81.3	16.2±3.0	81.8	16.9±2.1	71.2
CCC 500	9.1±1.7	73.3	6.9±0.3	82.5	13.6±1.6	74.2	14.5±1.2	80.4	12.7±2.0	71.4
CCC 750	9.6±1.9	77.5	5.9±1.1	80.0	14.1±1.1	78.2	15.2±2.6	79.0	13.9±1.8	71.0
Control	--	--	--	--	--	--	--	--	--	--
GA_3 50	11.0±1.5	85.7	8.3±0.7	81.8	15.0±2.6	76.3	14.3±1.5	80.5	13 ±1.6	66.0
GA_3 100	13.2±2.1	85.0	9.8±1.4	82.7	17.0±3.6	75.0	15.6±2.3	81.4	15.3±3.2	62.5
CCC 500	9.1±1.8	80.0	4.8±0.9	80.5	13.1±4.4	61.7	13.6±4.1	79.6	12.3±1.2	60.0
CCC 750	11.0±1.9	72.5	3.0±0.4	81.3	15.0±2.6	68.3	14.3±1.5	80.0	13.3±1.0	60.6

* Means and standard deviation of 20 plants.

Table (3)*: Effect of the interaction between salinity and growth substances on fresh weight(g/plant) and dry weight (g/plant) of five Glycine max cultivars.

Treatments		Columbus		Calnnd		Issex		Clark		Crawford	
Nacl ppm	Growth subs. ppm	Fr.wt. g/plant	Dry wt. g/plant	Fr.wt. g/plant	Dry.wt. g/plant	Fr.wt. g/plant	Dry wt. g/plant	Fr.wt. g/plant	Dry wt. g/plant	Fr.wt. g/plant	Dry wt g/plan
0	Control	2.40±0.2	0.5	2.10±0.1	0.39	2.20±0.12	0.38	3.19±0.18	0.44	3.25±0.4	0.57
	GA_3 50	2.21±.03	0.4	2.40±0.3	0.40	2.60±0.4	0.56	3.20±0.37	0.49	2.80±0.21	0.60
	GA_3 100	2.92±.0.2	0.6	2.30±0.3	0.35	2.80±0.46	0.46	2.88±0.4	0.47	2.24±1.0	0.56
	CCC 500	1.82± 0.1	0.41	2.21±0.4	0.40	2.50±0.2	0.48	3.01±0.29	0.58	2.10±0.14	0.54
	CCC 750	2.30±.21	0.52	2.29±0.4	0.44	2.90±0.1	0.52	3.09±0.3	0.56	3.24±0.3	0.57
3000	Control	1.50±.12	0.25	1.80± .01	0.26	2.50±.21	0.36	3.33±0.08	0.52	3.04±5.0	0.58
	GA_3 50	1.90±.02	0.30	2.20± .34	0.41	2.53±1.4	0.43	4.23±0.5	0.50	2.20±0.23	0.60
	GA_3 100	2.00±.04	0.36	2.50± .32	0.41	2.95±0.85	0.48	3.12±0.06	0.52	1.90±0.01	0.56
	CCC 500	1.39±.32	0.26	1.90± .25	0.35	2.48±1.2	0.43	2.65±0.04	0.48	2.00±0.21	0.55
	CCC 750	1.58±.51	0.31	2.30± .4	0.42	2.91±1.0	0.47	3.00±0.03	0.53	2.20±0.42	0.56
6000	Control	0. 9±.01	0.15	1.46±0.5	0.22	1.96±0.04	0.36	2.83±0.02	0.48	1.80±0.12	0.54
	GA_3 50	1. 4±.25	0.24	2.42±0.2	0.44	1.84±0.1	0.41	2.84±0.3	0.55	2.02±0.98	0.56
	GA_3 100	1. 6±.43	0.26	2.36±1.2	0.39	2.24±0.21	0.42	2.76±1.2	0.50	1.98±1.2	0.5
	CCC 500	0. 6±.02	0.16	1.95±0.3	0.34	1.82±0.05	0.47	2.30± .25	0.45	1.85±0.88	0.5
	CCC 750	0. 8± 0.1	0.18	1.60±0.1	0.32	1.70±0.03	0.37	2.0 ±1.0	0.42	1.97±0.92	0.5
9000	Control	--	--	--	--	--	--	--	--	--	--
	GA_3 50	0. 7±.002	0.10	1.60± .61	0.29	1.35±0.01	0.32	1.80±0.9	0.35	1.50±0.3	0.4
	GA_3 100	0. 8±.04	0.12	1.91± .09	0.33	1.32±0.12	0.33	2.10±1.2	0.39	1.20±0.11	0.4
	CCC 500	0. 4±.03	0.08	1.95± .3	0.38	0.94±0.03	0.36	2.10±0.32	0.44	1.10±0.19	0.4
	CCC 750	0. 4±.02	0.11	1.50± .01	0.28	1.20±0.015	0.38	1.70±0.15	0.34	1.32±0.21	0.5

* Means and standard deviation of 20 plants.