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Influence of Gibberellic Acid Growth Regulator on Sunflower Seed Emergence Indices and Seedling Characters under Salinity Stress

Hanim Mohi Elden Ahmed Matter[1]; Badr ELdin Abdelgadir Mohammed Ahmed[2] and Abdelmalik Omar Ahmed Idris[2®].
[1] PhD student, Faculty of Education, Biology Dept., Gadarif University, Sudan
[2] Assoc. Prof Dept. of Crop Sciences, Agriculture Faculty, Kassala University, Sudan
[2®] Assoc. Prof. Faculty of Education, Biology Dept., Gadarif University, Sudan

Abstract:- Salinity stress is one of factors limiting seed germination and seedling development in sunflower at New halfa scheme in East of Sudan. The objective of this study was evaluation germination indices and seedling parameters of sunflower seed under salinity stress with varying concentrations of synthetic growth regulator namely GA3. From 16-30 November 2019 a laboratory experiment (in Petri dishes) of randomized complete blocks design (RCBD) with three replicates was carried out. Treatments were consisted of (four levels of GA3 were 0, 50,75 and 100 p.pm) designated as G0,G50,G75 and G100,respectively, under five levels of salinity (0, 0.5, 1.0, 1.5 and 2%) designated as Na0, Na1.0 ,Na1.5 and Na2.0. This study examined Emergence indices: Seed Emergence percentage EP%, Mean emergence time (MET), Mean daily germination (MDG), Energy of germination was(EE), Emergence index(EI), Daily germination speed (DGS), Emergence coefficient of uniformity (ECU), vigour index of seed(VIS) and seedling characters also were determined. The results indicated that application of GA3 at 50 p.pm resulted in high EP, MDG, MET and SVI as compared with other related treatments. Also application of (G75 and G100) resulted in higher values of DGS, ECU and EI. Application of high levels of salinity treatments resulted in decreasing of all germination indices in this study. The interaction treatment (G50xNa0) on MDG had significant differences in this study. In condition, GA3 increasing up germination indices and promoting growth and compromised seedling vigor while salinity hindered seed emergence and seedling characters of sunflower.

Keywords:- *Sunflower; Gabralline; Salinity, Germination Indices and Seedling Vigor.*

I.INTORODUCTION

Sunflower helianthus annus is an annual oil crop one of the member of the family compositae. According to[1] the production of sunflower reached 50.22 million metric tons from cultivated areas of 27.87 million hectares. There are three phases of sunflower crop establishment, germination and seedling development stages were two of these phases while dormancy affected these stage as reported by[2,3]. Furthermore, many researchers[4-6] investigated the role of GA3 in seed germination indices improvement(emergence index, speed of germination, co-efficient of germination) and seedling development(shoot length) in sunflower plant. On the other hand,[7-10] stated that, salinity stress as a result of osmotic effects, could affected seed germination and early growth of seedling. Many researchers [11] concluded that, GA3 may delay a diverse effects of salinity stress. Now a days concentrated attempts have been made to mitigate the harmful effects of salinity by application of plant growth regulators. Hence, this study was undertaken to examine whether injurious effects induced by salinity stress could be mitigated using exogenous application of growth hormone as a synthetic growth stimulators. Therefore, the objective of this study was evaluation of germination indices and seedling characters of sunflower under salinity stress with varying concentrations of synthetic growth regulator namely GA3.

II.MATERIALS AND METHODS

A laboratory experiment (in Petri dishes) laid out in randomized complete blocks design with three replicates was carried out during winter of 2018 at Faculty of Agriculture, Kassala University in New Halfa, Sudan, evaluate germination indices and seedling parameters of sunflower under salinity stress with varying concentrations of synthetic growth regulator namely GA3.Treatments were consisted of (four levels of GA3 were 0, 50,75 and 100 p.pm) designated as G0,G50,G75 and G100,respectively, while the five levels of salinity were (0, 0.5, 1.0, 1.5 and 2%) designated as Na0, Na1.0 ,Na1.5 and Na2.0. The five levels of salinity were prepared from equal equivalents of NaCl.

- *Germination Test*

Ten seeds of sunflower were placed on filter paper in a glass Petri dish of 9 cm diameter after sterilized with 3% sodium hypochlorite for three minutes then washed with distilled water. The salinity solution of desired treatment were added.

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In this study germination attributes were(MET, EE, MDG, DGs and VIS) measured according to equations stated by [12,13] while indices(EI and ECU) were calculated as reported by[15] and final emergence percentage was calculated as described by [14]

Seedling length (cm) and Radical length(cm);Were measured using a meter tape.

Shoot fresh and dry weight(g) of seedling were taken using electrical weighing balance. Then accordingly Shoot/radical ratio was calculated.

- *Statistical Analysis*

Data of germination indices transferred using ARC Sin equation and then all data were analyzed using computer statistical program (STATISTIX 9) at 5% level of probability.

III.RESULTS AND DISCUSSION

Statistical analysis on germination showed significant effects, due to application of growth regulator (gabralinne) GA3 and salinity sodium chloride Na, on most of germination indices parameters i.e. final germination percentage (FEP), mean emergency time (MET), daily germination speed (DGS), emergency index (EI), emergency of coefficient of uniformity (ECU) and vigor index of seedling (Table1). Increasing GA3 rate from 50 to100 p.pm significantly increased most of the aforementioned characters (Table1). Application of 50 p.pm of GA3 resulted in high FEP, MDG, MET and VIS as compared with other related treatments. Also application of high GA3 doses (G75 and G100) resulted in higher values of DGS, ECU and EI. Application of high levels of salinity treatments resulted in decreasing of all germination indices in this study. On contrast the high values of these germination indices were observed at low levels of salinity treatments (Table2). The interaction treatment (G50xNa0) on MDG had significant differences in this study, while other interaction treatments had none significant effects but the higher values of FEP, ECU, MET and EI were observed in treatments (G50 x Na0, G50 x Na0.5, G75 x Na0 and G100 x Na0) as shown in (Table2). Moreover, application of G50 growth hormone significantly increased the radical and shoot length of the seedling particularly without saline water, while application of Na1.5, Na2 salinity levels resulted in decreasing of radical length, fresh weight and low value of shoot radical ratio (Table3).

The increasing of all indices of emergence in present investigation due to application of GA3 could be due to its positive role on breaking seed dormancy as reported by [16]. So the effect of GA3 on germination parameters like FEP, DGS, EI, ECU and SVI indicated that these parameters significantly different due to growth regulator treatments. GA3 plays fundamental roles in almost every aspect of plant growth and development, including cell elongation, cell expansion this might explain the increase of growth parameters of seed lining observed in this study. This results consistent with these reported by[17]. Seed germination adversely affected by salinity stress[18]. The decrease in emergence indices observed in this study in high levels of salinity treatments might be due to the reason that, at early seedling development salinity affected growth of the seedlings that showed in form of lower dry meter production and as a result inhabiting germination as reported by [19]. Also, the decrease in radical length, fresh weight and shoot/radical ratio in this study due to increasing of concentration of Na CL was agreed with those results reported by[20]. These finding suggest that salinity can have a detrimental effects on germination indices of sunflower seeds.

In condition, GA3 increasing up germination indices and promoting growth and compromised seedling vigor while salinity hindered seed emergence and seedling characters of sunflower.

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Table (1): Mean Squares of Germination Indices of Sunflower Affected by Growth Regulators and Salinity During Winter Season 2019

*,** ≡ Significant at 5% and 1% Levels of Probability Respectively; NS ≡ None Significant

S.Of.V	**DF**	**ECU**	**EI**	**MET**	**FEP**	**DGS**	**MDG**	**EE**	**VIS**
Rep	2	9.5	8.15	131.66	104.48	9.65	0.97	222.08	322810
G	3	4.1 **	32.99**	38.99**	432.1**	3.85**	2.99 **	370.7**	218417**
Na	4	1.55 *	7.89 ^{NS}	120.71*	213.9**	2.12 **	1.48 **	103.2 ^{NS}	608257**
G *Na	12	6.47^{NS}	5.74 ^{NS}	64.282 ^{NS}	56.9 ^{NS}	5.96^{NS}	0.39 **	69.84^{NS}	204773^{NS}
Error	38	5.64	4.60	42.096	58.24	6.15	0.4	60.32	127349
Total	59	_	_	_	_	_	_	_	_
Cv%	_	13.84	19.29	13.18	11.68	13.31	11.69	16.49	31.03
S.Of.V	DF	CUE	EI	MET	FGP	DGS	MDG	EE	SVI
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Table (2): Mean Percentages of Emergence Time (MET), Mean Daily Germination (MDG), Daily Germination Speed (DGS), Final Emergence Percentage (FEP), Emergence Energy (EE) Emergence Coefficient of Uniformity of (ECU), Emergence Index (EI) and Vigor Index of Seeding (VIS) of Sunflower

Treatment	MET	MDG	DGS	FEP	EE	ECU	EI	VIS
G0	534	5.82	0.17	69.91	51.36	0.02	8.63	1588.3
G50	587	5.83	0.17	69.96	51.41	0.02	8.58	1588.3
G75	495.9	5.06	0.19	60.75	43.39	0.03	9.17	1097.8
G100	411.7	5.04	0.19	60.54	42.23	0.03	7.91	667.9
$LSD_{0.05}$	66.8	0.47	2.12	5.64	5.74	5.55	1.58	263
Na0	554.1	5.59	0.17	67.14	48.14	0.02	7.5	1480.6
Na0.5	521.1	5.5	0.18	66.08	47.77	0.03	7.56	951.8
Na1.0	591.9	5.91	0.16	70.99	51.13	0.02	8.47	936.4
Na1.5	505.6	5.07	0.19	60.92	44.2	0.02	6.53	1140.1
Na2.0	507.6	4.71	0.21	61.33	44.24	0.02	6.55	1241.6
$LSD_{0.05}$	70.2	0.52	1.92	6.3	6.41	6.2	1.77	294.93
G0Na0	598.9	5.84	0.17	70.09	50.16	0.02	8.18	2201.8
G0Nao.5	603.4	5.84	0.17	70.09	50.16	0.02	8.37	1292.5
G0Na1.0	629.36	6.59	0.15	70.08	57.97	0.02	10.31	1376
G0Na1.5	609.49	5.66	0.16	68.11	54.18	0.02	9.73	1576.1
G0Na2.0	509.89	4.79	0.2	62.31	44.33	0.03	6.55	1495.1
G50Na0	616.11	5.64	0.17	73.38	57.97	0.02	9.23	1542.3
G50Na0,5	638.13	6.59	0.16	73.64	56.41	0.02	10,31	1089.8
G50Na1.0	548.86	5.67	0.17	68.11	48.18	0.03	7.81	1027.9
G50Na1.5	571.1	5.67	0.17	68.11	50.21	0.03	8.17	1305.2
G50Na2.0	561.13	5.56	0.17	66.8	48.23	0.03	7.98	1271.8
G75Na0	545.44	5.56	0.17	66.8	48.23	0.03	7.34	2201.8
G75Na0.5	497.71	4.64	0.21	60.36	42.17	0.03	6.52	957.2
G57Na1.0	530.29	5.36	0.18	64.4	46.31	0.03	7.2	728.6
G75Na1.5	388.13	4.31	0.23	51.82	34.13	0.04	3.17	723.6
G75Na2.0	519.66	5.03	0.19	60.36	46.14	0.05	6.81	1355.9
G100Na0	460.27	4.48	0.22	58.27	40.19	0.05	5.27	459.7
G100Na0.5	484.51	5.01	0.19	60.22	42.35	0.03	5.64	467.7
G100Na1.0	599.71	6.04	0.16	72.5	52.08	0.02	8.75	613
G100Na1.5	453.03	4.65	0.21	55.86	38.27	0.04	5.06	955.4
G100Na2.0	445.8	4.65	0.21	55.85	38.27	0.04	4.86	843.7
$LSD_{0.05}$	149.46	1.05	0.95	12.61	12.83	0.01	3.54	589.8

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Table (3): Mean Stem Diameter (cm), Radical Length (cm), Shoot Length (cm), Number of Leaves, Shoot Fresh Weight (g), Shoot Dry Weight (g) and Shoot Radical of Sunflower Seedling

Treatment	**Radical length**	**Shoot length**	**Fresh wt**	**Dwt**	**Shoot/ radical**
G0	14.12	8.84	0.74	0.11	7.03
G50	14.15	8.87	0.56	0.12	6.5
G75	10.66	7.32	0.45	0.1	6.53
G100	6.38	4.96	0.89	0.1	6.82
$LSD_{0.05}$	2.9	1.78	0.17	3.62	1.44
Na0	12.86	7.75	0.49	0.12	5.77
Na0.5	7.79	7.55	0.46	0.1	6.51
Na1.0	7.92	5.02	0.43	0.1	6.77
Na1.5	12.2	6.25	0.55	0.11	7.43
Na2.0	12.68	7.39	0.57	0.1	6.77
$LSD_{0.05}$	3.24	1.99	0.19	2.22	1.61
G0Na0	20.12	13.53	1.1	0.11	6.77
G0Nao.5	9.06	13.43	0.55	0.1	5.44
G0Na1.0	8.86	8.53	0.52	0.1	6.77
G0Na1.5	21.66	7.7	0.78	0.1	8.1
G0Na2.0	15.16	9.22	0.75	0.1	8.1
G50Na0	21.66	7.43	0.59	0.1	5.44
G50Na0,5	8.83	5.83	0.64	0.1	5.44
G50Na1.0	8.16	6.4	0.47	0.1	8.1
G50Na1.5	14.6	4.56	0.59	0.1	6.77
G50Na2.0	13.33	5.9	0.52	0.1	6.77
G75Na0	12.66	13.23	0.63	0.1	6.77
G75Na0.5	9.93	6.6	0.49	0.1	6.77
G57Na1.0	8.5	3.54	0.28	0.1	5.44
G75Na1.5	7.66	6.33	0.37	0.1	6.77
G75Na2.0	14.56	7.43	0.5	0.1	5.44
G100Na0	3.33	4.66	0.27	0.1	4.11

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G100Na0.5	3.33	4.33	0.25	0.09	8.39
G100Na1.0	6.16	2.16	0.98	0.13	8.77
G100Na1.5	10.66	6.4	0.48	0.1	8.1
G100Na2.0	8.4	7.23	0.5	0.1	6.77
$LSD_{0.05}$	6.48	3.99	0.38	0.03	0.03