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Influence of GA3 (Gibberellic Acid) and Salinity on Seeds Germination Indices and Seedling Characteristics of Wheat (*Triticum aestivum* L.)

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Abstract:- A Petri dishes laboratory experiment of RCBD with three replicates was conducted during 2023/2024 winter season at Faculty of Agriculture, University of Kassala, New Halfa, Sudan. to investigate the effect of (GA3) on seed germination and seedling of wheat plant under salinity levels. GA3 treatments are four rates of GA3 G_0,G_{100}, G_{150} and G_{200} corresponding to (0,100,150 and 200 p.p.m) and three levels of salinity S_0, S_{50} and S_{100} corresponding to (0, 50 and 100 milimose) prepared from equal equivalents of NaCl. The results revealed that, both of salinity and GA3 treatments affected final germination percentage (FGP%), mean germination time (MGT), Speed of Daily germination (DGS) and index of seedling vigor (SVI). Increasing GA3 level up to 150 p.p.m increased FGP,DGS,MGT and SVI. On contrast, increasing salt concentration resulting up to 1oo milimoses in decreased of FGP,DGS and SVI. In conclusion, it was concluded that applied of GA3 at recommended levels lessened the harmful of salinity on germination indices and growth of seedling in wheat seeds.

Keywords:- *Wheat; Gabralline GA3; Salinity, Germination Indices and Seedling Vigor.*

I. INTRODUCTION

Wheat (***Triticum aestivum* L.**) belonged to Graminae family [1]. It is widely adapted plant grown in different environments (humid and dry [2]. It is the most important cereal crop grown all over the world. Wheat is low cost of production crop which adapted to various climates[3]. Many investigators [4-6] studied the hormones effect on germination of seed, they reported that, during the embryo development, endogenous plant hormones Gibberellins (GA3) increase in the embryo while the developing embryo is heterotrophic (dependant on the mother tissue for support). High levels of GA3 increased all indices of germination and characters growth of seedlings on contrast increasing levels of salinity decreased these characters in maize [7]. Recently [8] reported significant differences in germination indices due to application of gibberellic acid[8]. However, increasing GA3concentration to high salinity levels treatment decreased germination days [9]. About 7% of land area in the world is affected by salinity and wheat growth and yield were affected by salinity [10-12]. Salinity, in general, has inhibitory Also, other researchers reported the adverse effects of salinity on seed germination [13-15]. Application of GA3 reduced the adverse effect of [16-17]. Different strategies have been employed to enhanced germination of seed and growth of seedling under saline conditions. Few studies, In Sudan, have been conducted to study effects of growth hormones compared to control on seeds germination particularly under saline water. Hence these factors interrelate providing an important insight to the study of their interaction on seeds germination and seedling growth. So, the this study was conducted to determine if salinity stress can be modified by GA3 application through investigating the interactive effects of salt stress and GA3 on germination of seeds and seedlings growth of wheat.

II. MATERIALS AND METHODS

A Petri dishes laboratory experiment of RCBD with three replicates was conducted during 2023/2024 winter season at Faculty of Agriculture, University of Kassala, New Halfa, Sudan. to investigate the effect of (GA3) on seed germination and seedling of wheat plant under salinity levels. GA3 treatments are four rates of GA3 G_0,G_{100}, G_{150} and G_{200} corresponding to (0,100,150 and 200 p.p.m) and three levels of salinity S_0, S_{50} and S_{100} corresponding to (0, 50 and 100 mM) prepared from equal equivalents of NaCl.

➢ *Germination Test*

3% sodium hypochlorite was used for sterilizing seeds for 3 minutes then washed with distilled water. In a glass petri dish of 9 cm diameter with filter paper, 10 seeds were placed and 16 ml salinity solution of desired treatment was added. Germination of Seed was recorded daily at a certain time. After the 12th day, radicle and plumule lengths were measured.

➢ *The Following Germination Traits were Measured:*

Final Germination percentage (FGP) [%]] using the formula described by [18], Mean germination time (MGT) [Days] using the formula described by[19],

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Germination energy (GE) [%] and Daily germination speed (DGS): using the formulas described by[20]. Also, Seedling vigor index(SVI) Calculated as follows.

SVI = (Radicle length+ plumule length) × FEP% as described by [20].

- *Statistical Analysis*

All data were analyzed according to (ANOVA) for RCBD using statistical analysis package(Statisticx 10). Duncan's Multiple Range Test (DMRT) used for mean comparisons at 5% probability level.

III. RESULTS AND DISCUSSION

Treatments of both GA3 and salinity were showed significant effects on all studied traits but their interaction was significant only on DGS (Table 1). In this regard, Increasing GA3 level up to 150 p.p.m resulted in increased of FGP,DGS,MGT and SVI as compared to its relative treatments (figures 1,2,3,4). But Application of GA3at lower level (100 p.p.m) gave highest values on GE as compared to G150,G200 and control treatments(fig 5). These results confirm the role of gibberellins in increasing the germination indices. These results were in line with the concept that when application of GA3 to the seeds can enhance the SVI, and DGS as reported by [21-22]. On contrast, increasing salt concentration resulting up to 1oo milimoses in decreased of FGP,DGS and SVI (Figures 6,7 and 9) but increased MGT and GE as compared to control treatments(Figures 8 and 10). These results could be due to negative effects of salinity because salinity prevents water intake particularly with high salinity levels, and this causes enzymes inhibition and consequence leads to restriction of germination and seedling growth and increased germination time. Also, our results were in line with results found by previous workers [6] who stated that, increasing levels of salinity reduced in seed germination and affected growth of seedling in wheat. As mentioned earlier, the interaction effect was significant only on DGS. In this regard, application of Ga3at 150 p.p.m decreased the salinity negative effects (Table2). Although GAxS had none significant effects on PGP,GE, MGT and SVI but application of high levels of GA3 decreased the harmful of salinity on seed germination and affected growth of seedling (Table 2). This result might be confirmed with those reported by [16,23] who showed that, application of GA under salinity stress due to 100 mM NaCl alleviated the inhibitory effect of salinity leading to an increase in the rate of germination wheat seed. In conclusion, it was concluded that applied of GA3 at recommended levels lessened the harmful of salinity on germination indices and growth of seedling in wheat seeds.

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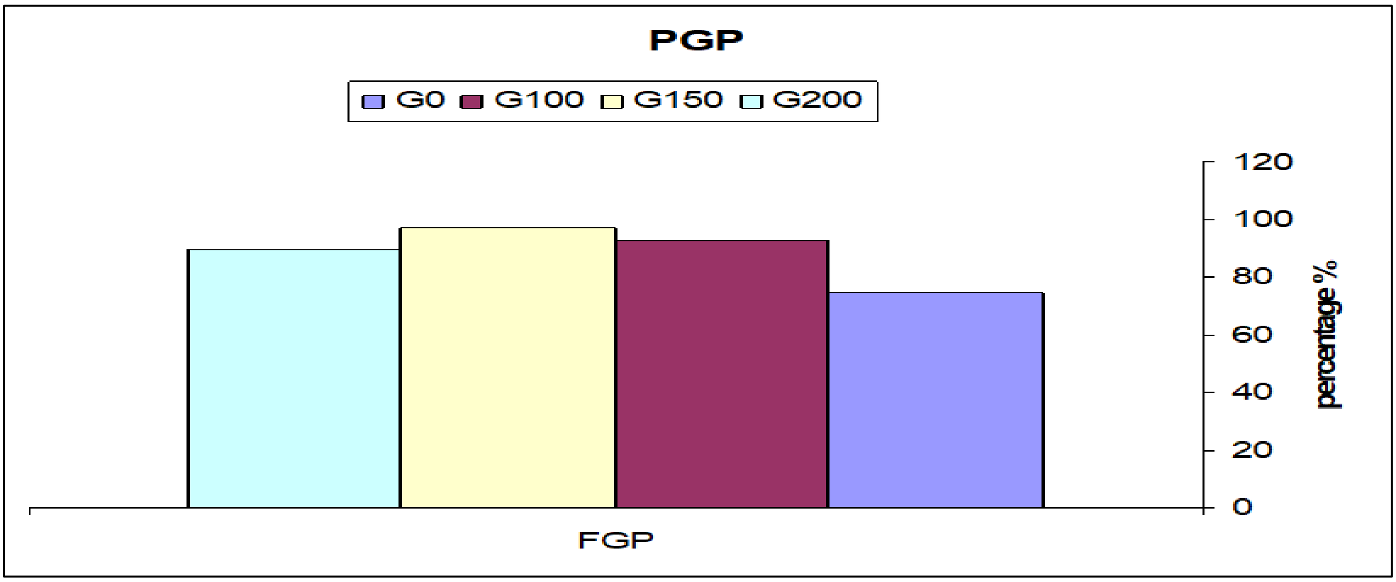

Fig 1 Means FGP as affected by GA3

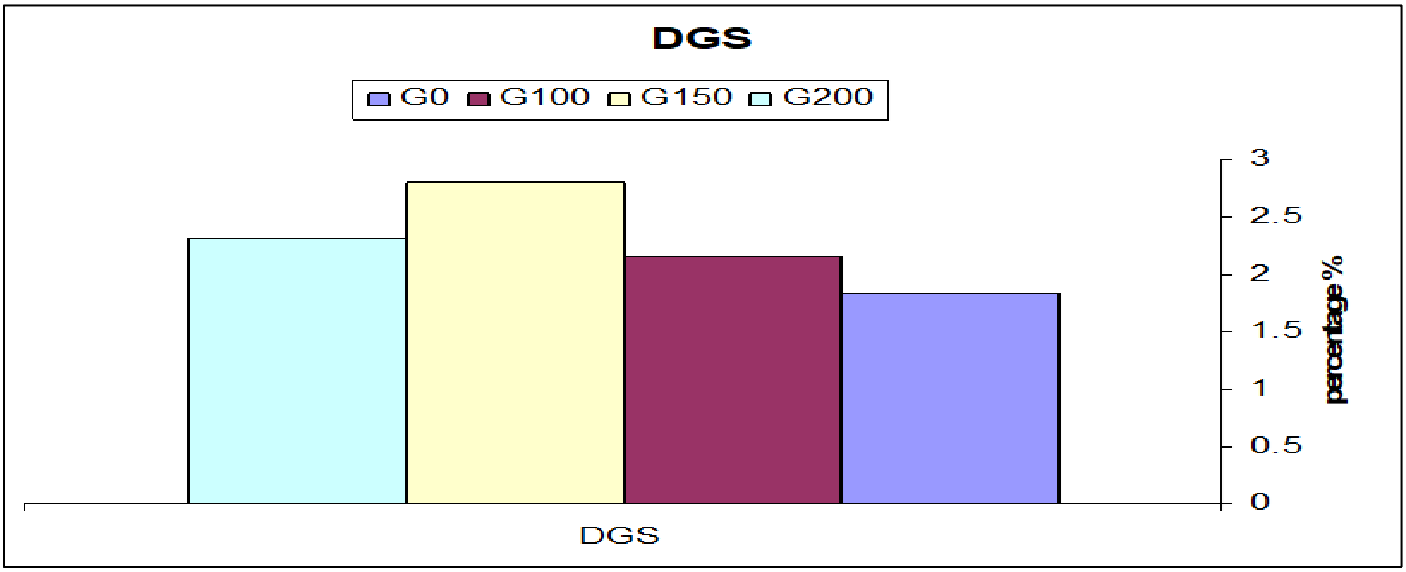

Fig 2 Means DGS as affected by GA3

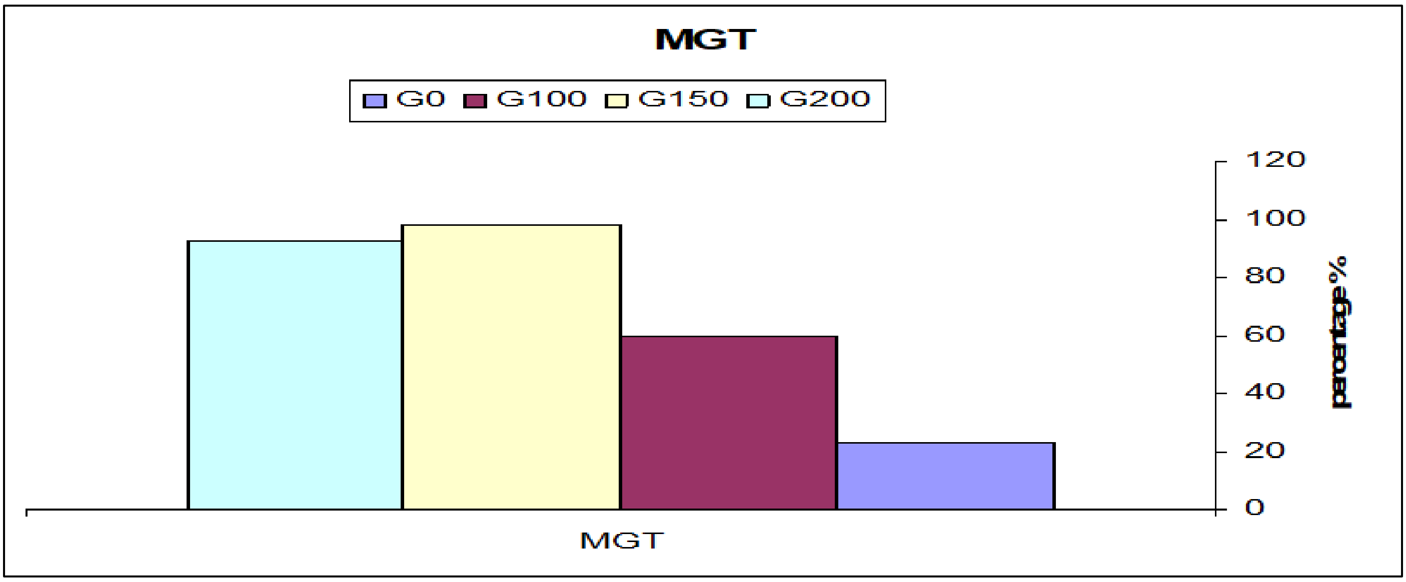

Fig 3 Means MGT as affected by GA3

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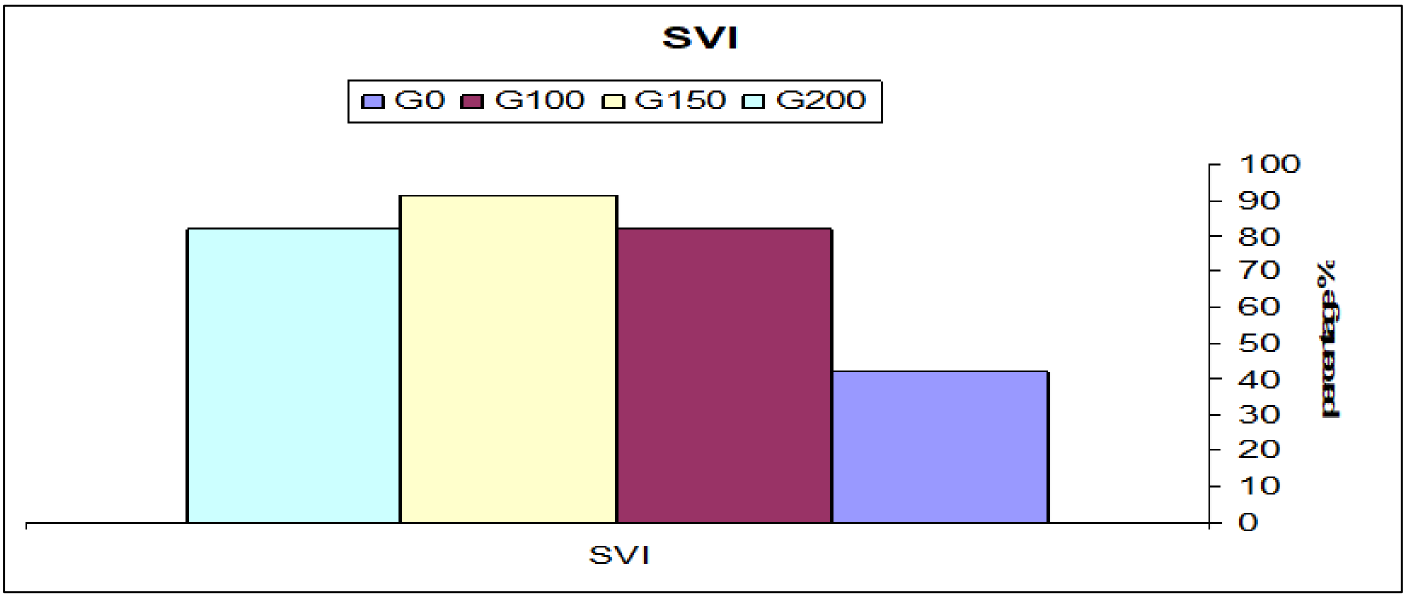

Fig 4 Means SVI as affected by GA3

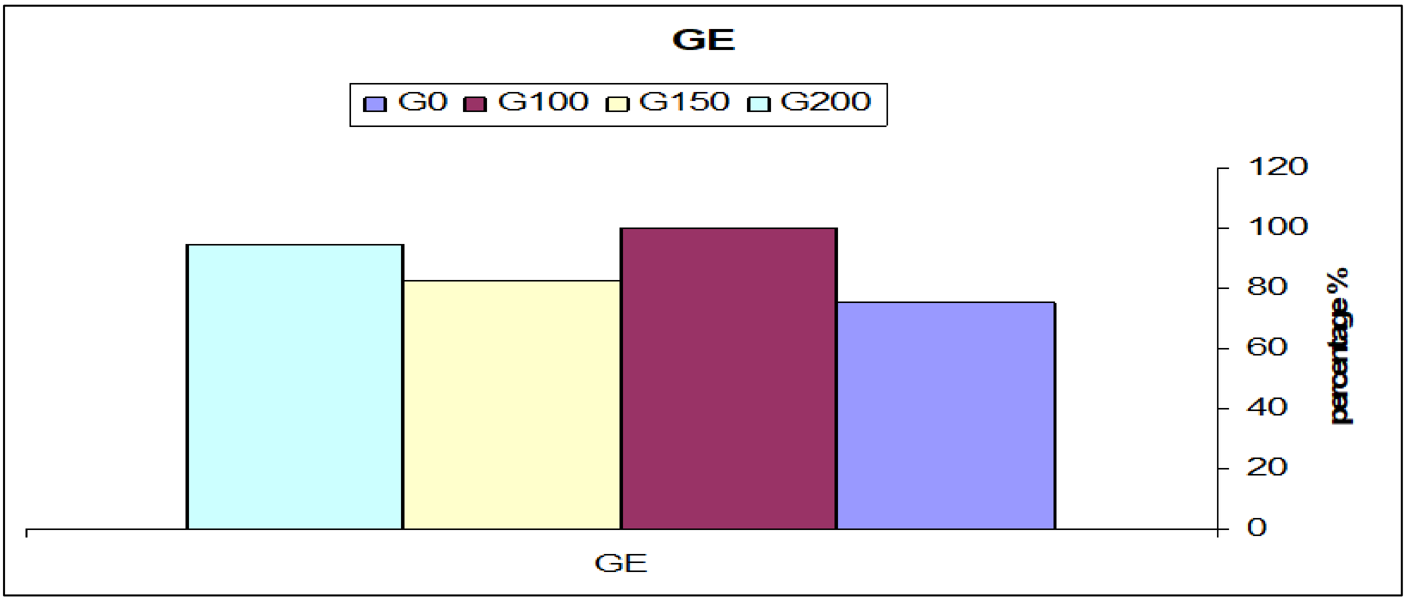

Fig 5 Means GE as affected by GA3

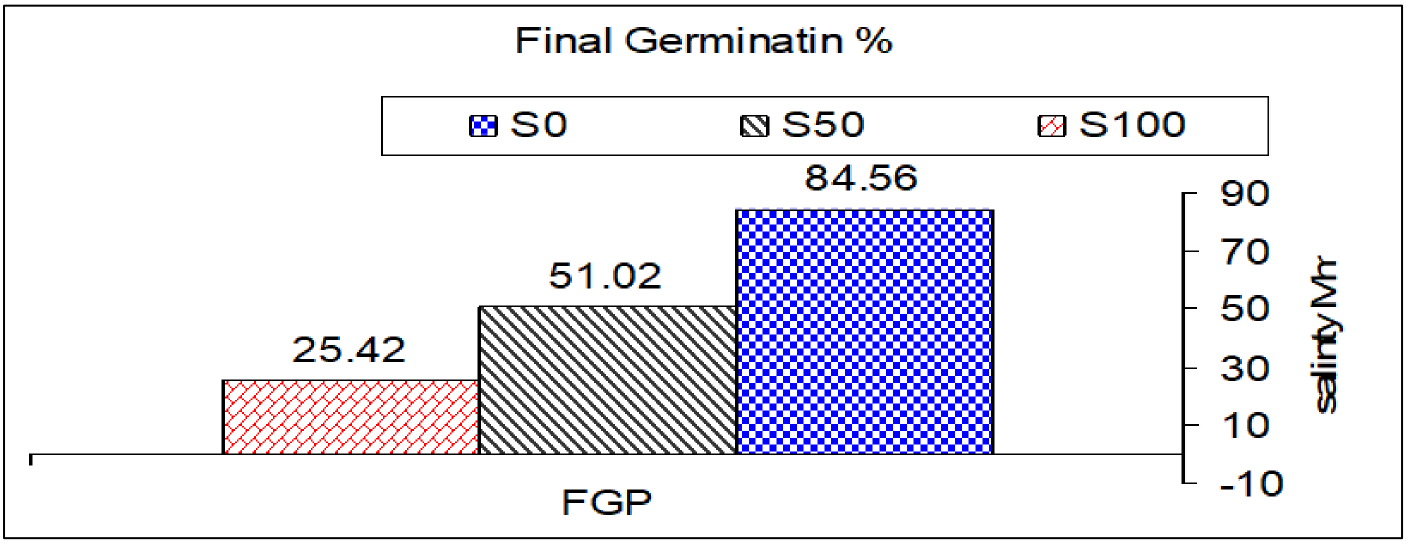

Fig 6 Means of F GP as affected by Salinity Stress

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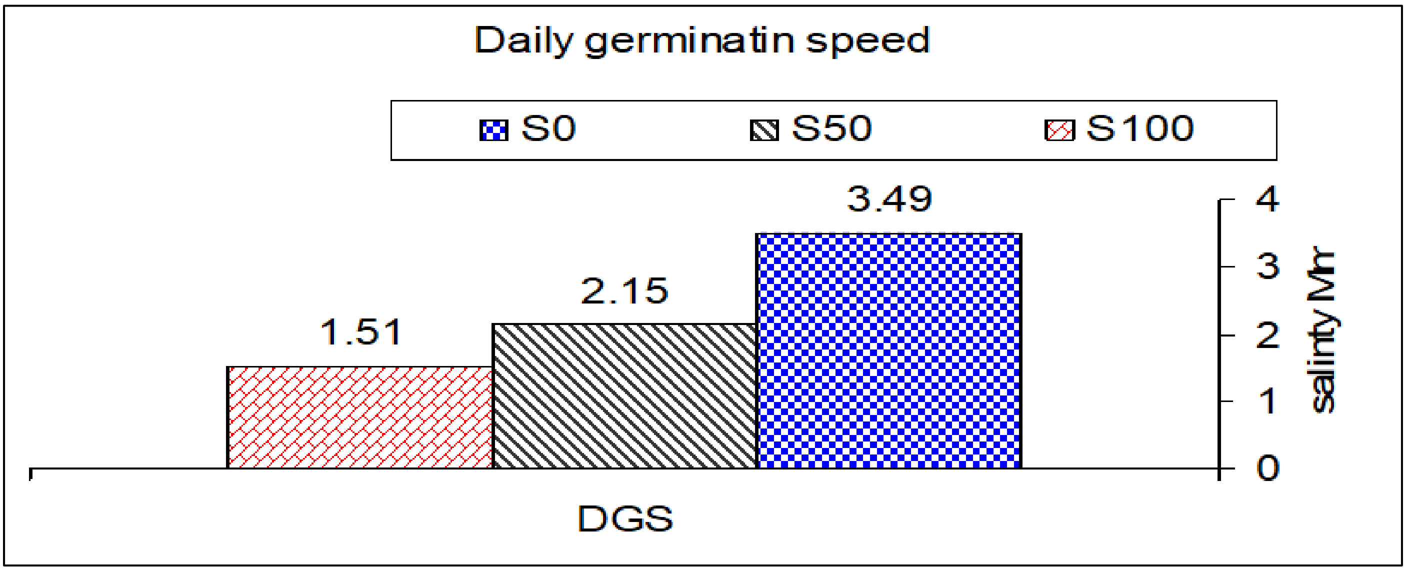

Fig 7 Means of D GS as affected by Salinity Stress

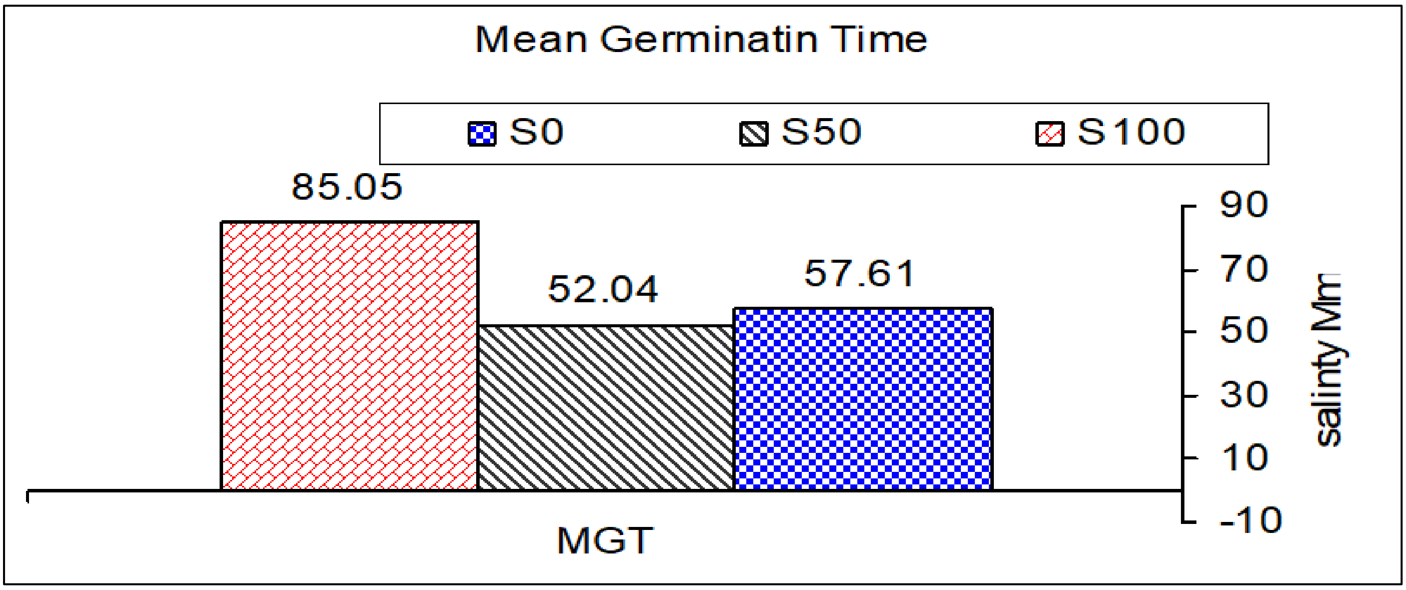

Fig 8 Means of M GT as affected by Salinity Stress

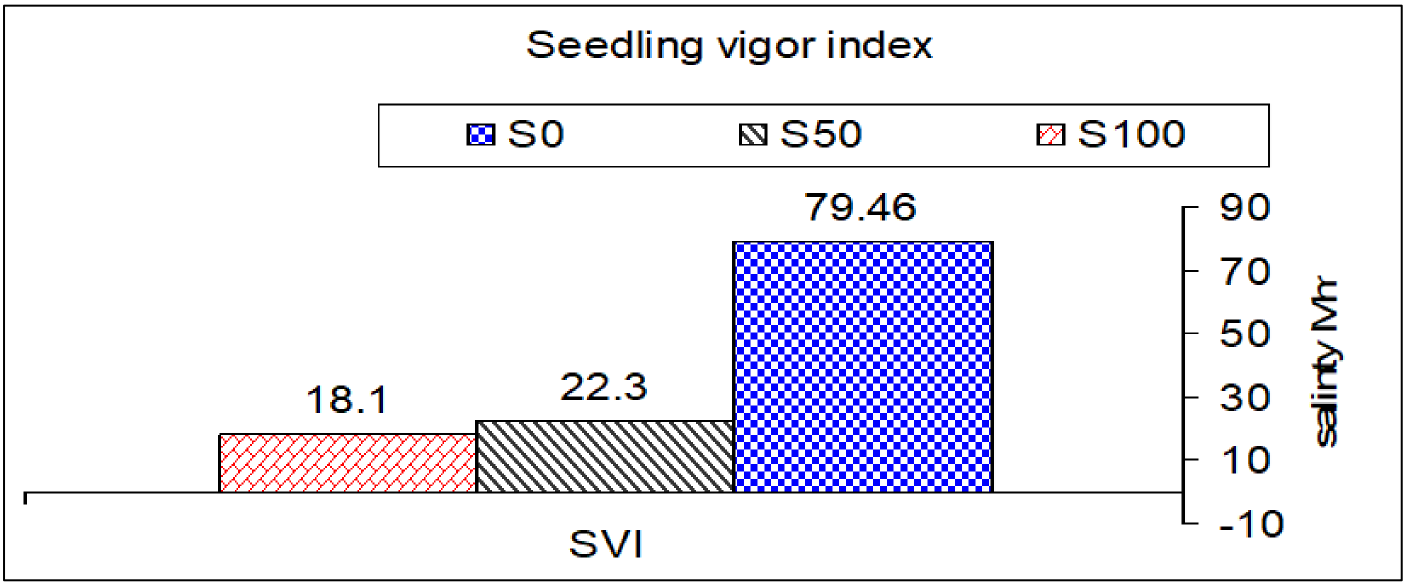

Fig 9 Means of SVI as affected by Salinity Stress

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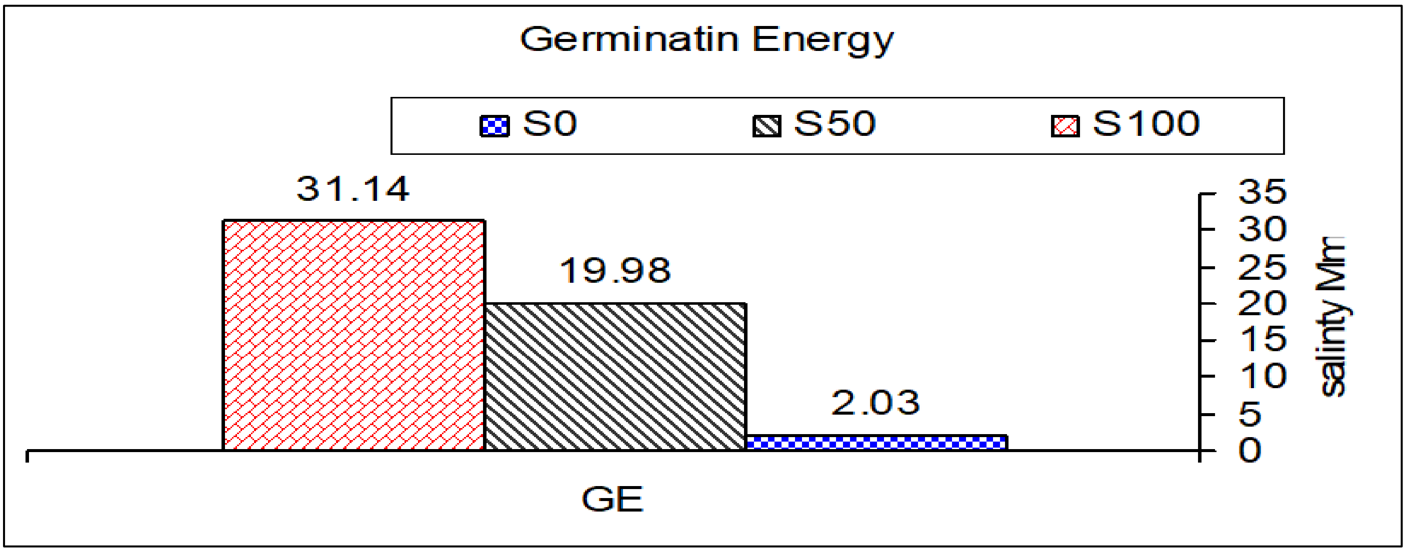

Fig 10 Means of GE as affected by Salinity Stress

Table 1 Means of Salinity x GA3 Interaction on Germination Indices and SVI of Wheat

Treatment		DGS	GE	SVI	FGP	MGT
S0	G0	2.32CD	93.37	97.16	93.37	0.01
	G100	3.57B	5.47	2.74	75.36	15.88
	G150	4.76A	45.63	53.24	99.90	99.87
	G200	3.57B	50.44	99.96	95.46	98.22
S50	G0	1.68DE	81.40	5.58	99.50	10.31
	G100	1.60DE	59.29	38.70	81.88	29.74
	G150	2.86BC	41.46	29.78	37.27	79.97
	G200	2.63BC	27.29	63.72	12.29	87.79
S100	G0	1.58DE	43.21	21.19	76.72	85.97
	G100	1.60DE	12.29	23.70	27.29	77.52
	G150	1.34E	4.98	12.30	4.98	65.20
	G200	1.51E	76.66	15.99	90.53	99.39
LSD0.05		0.08	6.79	7.44	4.11	4.63