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EVALUATION OF METHODS FOR QUANTIFICATION OF CL/SO4 RATIOS IRRIGATION WATER AND MUNICIPAL REFUSE COMPOST IN SOIL TOLORANCE IN BARLEY (Hordeum vulgare L.)

Mehrnoosh Eskandary Torbaghan[1], Ali reza Astaraei[2] Bahareh Eskandary Torbaghan[3], Toktam Tajgardan[4] and Massoud Eskandary Torbaghan [5]

[1]Researcher of North Khorasan of Agriculture and Natural Resource Research Center, E-mail: mehrnoosh_eskandary@yahoo.com
[2] Academic member of Soil Science Department-College of Agriculture-Ferdowsi University, E-mail:alirezaastaraei@yahoo.com
[3.] MSc Student of Civil Engineering of University of Malaya, E-mail: bahar57_e@yahoo.com
[4.] Former MSc student, Department of Soil Science, Gorgan University of Agriculture and Natural Resources, Gorgan, Iran.
[5.] Avademic Member of North Khorasan of Agriculture and Natural Resource Research Center, E-mail:tem3431@yahoo.com

Abstract*. Salinity is a major problem in reducing most of agronomic crop production in the world. Chloride and Sulfate toxicities in waters and soils are the main factor in reducing growth and yield of most of plants. Tolerance and sensitive indices related to CL and SO4 in irrigation water and effect of municipal refuse compost on barley yield was evaluated in a Completely Randomized Design (Factorial) with three replications, under greenhouse condition. Quantity tolerance and susceptibility indices such as Mean Productivity (MP), Tolerance Index (TOL), Geometric Mean Productivity (GMP), Stress Susceptibility Index (SSI), Reduction Yield Ratio (Yr) and Stress Tolerance Index on the bases of plant yield with (Ys) and without stress (Yp) conditions were determined. Results showed that STI, MP and GMP had positive and high significant correlations with grain and plant biomass yields among other indices. Also CL/SO4 anion ratios 2:1 and 3:1 in grain yield and 3:1 , 2:1 and 1:2 in plant biomass yield imposed highest tolerant in salinity compared to non tolerant stress conditions.*
Keywords*: Tolerance indices, CL/SO4 ratios, Compost, Barley*

Introduction

Salinity stress and contrast with it is main problem that human had always faced with it and it is one of the land capability reduction factors for agricultural crop production. Ionic compound is important for best selection in salinity tolerance on root zone as different ions in soil solution have different characteristics in uptake and transmission. For example, Cl^- uptake by plant root usually is more than $SO_4^=$ uptake and so in iso osmotic solution that Cl^- ion is predominant to $SO_4^=$ ion salinity harm is severe (Manchanda and Sharma, 1989).Stress tolerance is wild varieties usually describe as survival in unsuitable condition but in cultural plant is production in unsuitable condition (Clark et al, 1992).In Most improving programs, grain yield and yield stability in stress condition explain as main selection scale to stress tolerance. Yield stability is maximum different between yield potential and real yield potential in different conditions (Blum, 1980) that it can result from special genetic condition, yield component compensation, stress tolerance and fast recovery capacity next to stress on in corporation of them (Heinnrich et al, 1983) .High yield in stress condition can have due to salinity tolerance or have high yield potential or both of them as mechanisms (Fischer and Maurer,1978). Different indexes for evaluation of plant interaction and measurement of tolerance and susceptibility amount have said in different condition.

Rosielle and Hamblin purposed tolerance index (TOL) and mean productivity (MP). Tolerance index is crop yield difference in two different condition and MP is mean productivity in stress and none-stress condition. High amounts of TOL were showed plant susceptibility to stress and selection was based on low amounts of TOL. High amounts of mean productivity also show more tolerance to stress.

The other indexes for plant evaluation in different condition is stress susceptibility index (SSI) that on it grain yield in each plant measure under suitable condition and stress intensity determined based on mean yield of plant under suitable and stress condition . Low amounts of SSI is due to low change of plant yield in stress condition compare of non stress condition and result in more tolerance in plant (Fischer and Maurer,1978).

Stress tolerance index (STI) function is base of yield in each plant in two suitable and stress condition and mean square of yield in all experimental plant in suitable condition. STI amount is always positive and if STI amount

is higher, it shows high plant tolerance to stress. Farshadfar et al (2001) in evaluation of twenty one chickpea line purpose harmonic mean, mean productivity; harmonic mean production and stress tolerance index are the best suitable index for chickpea line selection to drought tolerance. Kanoni et al (2002) purpose stress tolerance index and mean productivity are the best suitable index for varieties recognition with high yield in two condition dry land farming (with stress) and irrigated (without stress). Parvizi almani (1998) in the study of drought tolerance index in sugar beet identified stress tolerance index as suitable index for identification and tolerant genotype grouping. Samie zade (1996) in most suitable selection of stress susceptibility indexes in white chickpea variety base of correlation between yield in stress and non stress condition and drought tolerance indexes resulted that GMP and STI are suitable index for estimation, yield stability and reaching to varieties with high yield.
Salinity has decreased micronutrients activity such as Fe, Zn, Mn and Cu and it caused plant deficiency (Richards et al., 2004). Several studies had shown that compost usage in addition to improving of soil biological and physiological properties can have important resource of P, S, Ca and Mg for plants and it provide some micronutrients such as B and Zn (Gallardo-lara and Nogales, 1987).
The goal of this study is "evaluation of methods for quantification of CL/SO4 ratios irrigation water and municipal refuse compost in soil tolerance in barley (Hordeum vulgare L.)".

Materials and Method

To study of the effect of $Cl^-/SO_4^=$ ratios irrigation water and municipal refuse compost amounts in soil on barley yield and evaluation of susceptibility and tolerance amount of plant and best index selection for separation of $Cl^-/SO_4^=$ anion ratios effect in plant yield and experiment conducted with six $Cl^-/SO_4^=$ ratios consist of 1) control (C0S0) 2) 1:1 ratios (C1S1) 3) 1:2 ratios (C1S2) 4) 1:3 ratios (C1S3) 5) 2:1 ratios (C2S1) 6) 3:1 ratios (C3S1) with CaCl2 and CaSO4 salts usage and two refuse municipal compost levels 15 (M1) and 30 (M2) Ton/ha as completely randomized design (factorial) with tree replication for each treatment in greenhouse condition. Also, for comparing of compost levels and quantification tolerance index measurement, used control (with none usage compost) with tree replication. Soil properties of experiment exist in table (1). For barley planting plastic pots used with 8 Kg soil in each treatment. In order to utilizating organic fertilizer compost, with water percent calculating, enough compost for each pot calculated and mixed with soil before planting (compost usage parameters described in table 2) .Nine sterilized barley seeds of karron dar kavir variety was planted in each pot and was irrigated with drinking water. In two leaf stage of plant, irrigation had done with saline water (6 dS/m) and $Cl^-/SO_4^=$ anion ratios. Necessary amounts of salt for saline water production with different $Cl^-/SO_4^=$ anion ratios based of equation calculation for this salts in irrigation period. One month after planting, plants per pots decreased to five numbers. After, physiological stage of plant, at the end of growth period (115 after planting) some parameters such as plant biomass weight, grain weight per pot measured and noted. Harvested plant transmitted to laboratory for measuring of plant nutrition. Data were analyzed with MSTAT-C and data mean were compared with Duncan Multiple Test in 5% level.

Table1 Soil properties before start of Experiment

Texture	-	Loam
pH	-	7.6
EC	dSm^{-1}	1.8
N	%	0.043
P	$mg\ Kg^{-1}$	3.5
K	$mg\ Kg^{-1}$	185
Ca	$meql^{-1}$	3.5
Mg	$meql^{-1}$	2.5
Na	$meql^{-1}$	8.7
SAR	-	5
Fe	$mg\ Kg^{-1}$	7.4
Mn	$mg\ Kg^{-1}$	20
Zn	$mg\ Kg^{-1}$	0.45
Cu	$mg\ Kg^{-1}$	0.66
$CaCO_3$	%	15.5

Table2 Municipal compost refuse properties

Parameters	Production compost sample	Range
pH	7.5	6-7.7
EC(dSm^{-1})	13.5	9-16
C/N	19.8	19-26
Water (%)	14.9	8-20
N (%)	0.94	0.59-0.95
Na (%)	0.9	0.7-0.9
K (%)	0.8	0.5-0.9
Mg (%)	0.36	0.26-0.4
Ca (%)	2.8	2/0-3.2
Organic carbon	14.3	8-15
CL^- ($meql^{-1}$)	50	42-58
$SO4^=$ ($meql^{-1}$)	32	27-35

With due attention to grain weight and biomass weight per plant in stress condition ($Cl^-/SO_4^=$ ratios irrigation water) and none stress (control), different susceptibility and tolerance indexes calculated based of under equation (Rosielle and Hamblin, 1981; Fernandez, 1992; Clark et al., 1992b; Clark et al., 1992a).

1) TOL = $Y_p - Y_S$

2) $MP = \frac{Y_S - Y_P}{2}$

3) GMP = $\sqrt{Y_S \times Y_P}$

4) Yr = 1-(Y_S / Y_P)

5) SSI = 1- (Y_S / Y_P) /D

6) STI = $\frac{Y_S \times Y_P}{(\bar{Y}_P)^2}$

On above equation Ys and Yp are grain and straw yield in stress condition ($Cl^-/SO_4^=$ ratios irrigation water) and none stress condition. Susceptibility and tolerance indexes calculated based on equations and their correlation coefficient with yield also calculated with MSTAT-C software. To determining calculating relationship among treatments and drawing scatter graph used STATISTICA software.

Results

Compare of experiment results (Fig 1) showed that plant biomass weight per pot under effect of $Cl^-/SO_4^=$ ratios did not show any significant difference ($p \leq 0.05$). Maximum of grain weight per pot (Fig 2) under effect of $Cl^-/SO_4^=$ ratios showed in C_1S_2 and C_1S_3 treatments with 4 and 2.8% increase to control respectively and none significant difference with each other. Maximum of grain weight per pot showed in C3S1 treatment with 16.2 decreases to control ($p \leq 0.05$). Grain weight per pot did not show any significant difference with each other in other experimental treatments in 5% level.

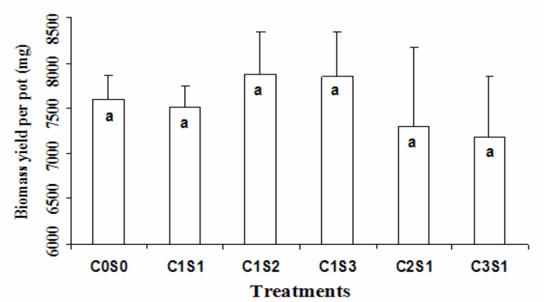


Fig 1 effect of experimental treatments on plant biomass weight (mg)

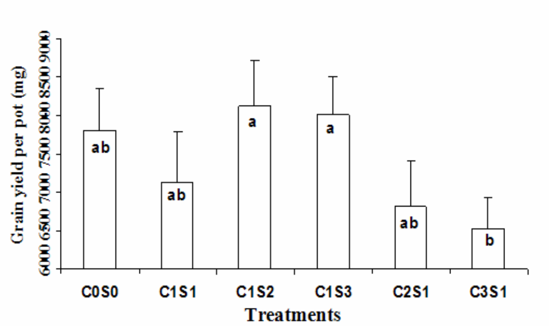


Fig 2 effect of experimental treatments on plant grain weight (mg)

Maximum and minimum plant biomass weight per pot (Fig 3) under effect of $Cl^-/SO_4^=$ ratios irrigation water and compost showed in $C_1S_3M_2$ and $C_3S_1M_1$ treatments respectively that they had 23.4 and 42.5% decrease to none fertilizer control. Comparing of other treatments with each other did not show any significant difference in 5% level (Fig3).

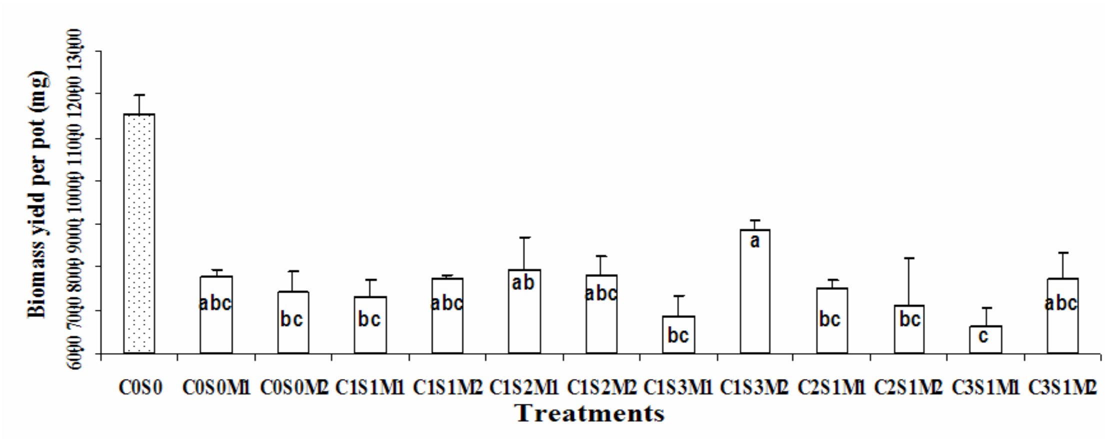


Fig 3 effect of anion ratios and compost levels on plant biomass weight (mg)

Maximum grain weight in plant under effect of $Cl^{-}/SO_4^{=}$ ratios irrigation water and compost (Fig 4) showed in $C_1S_2M_2$ with 24% increase to control and then in $C_1S_3M_2$ and $C_0S_0M_1$ treatments with 16.8 and 15% increasing than to none fertilizer to control (Fig 4). Maximum of plant grain weight under effect of different anion ratios and compost showed in $C_2S_1M_2$ with 11.6% decrease to none fertilizer control.

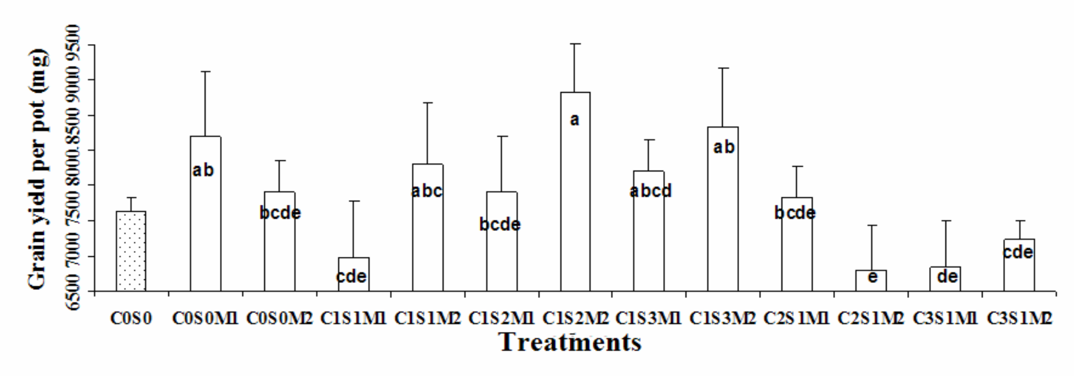


Fig 4 effect of anion ratios and compost levels on plant grain weight (mg)

Mean comparing of susceptibility and tolerance quantification indexes to stress for plant biomass weight (Table 3) showed that all calculated indexes had none significant difference under effect of anion ratios in 5% level. Maximum of TOL index and Maximum of MP, GMP and STI indexes amount showed in C_1S_3 and C_1S_2 treatments respectively.

Table 3 Mean comparing of tolerance indexes to stress for biomass plant weight (mg)

Treatment	TOL	MP	GMP	Yr	SSI	STI
C_0S_0	-533.3 a	7333 a	7326 a	-0.07924 a	15.22 a	1.077 a
C_1S_1	-450 a	7292 a	7283 a	-0.069 a	15.09 a	1.064 a
C_1S_2	-750 a	7442 a	7426 a	-.01123 a	15.66 a	1.105 a
C_1S_3	-783.3 a	7458 a	7428 a	-0.1166 a	15.72 a	1.11 a
C_2S_1	-483.3 a	7308 a	7293 a	-0.07358 a	15.15 a	1.068 a
C_3S_1	-216.7 a	7175 a	7164 a	-0.03656 a	14.66 a	1.03 a

Means within a column followed by the same letter are not significantly different at p = o.o5

Mean comparing of indexes for grain weight of plant under effect of different anion ratios showed that minimum of TOL index and maximum of MP, GMP and STI indexes amounts without any significant difference ($p \leq 0.05$) showed in C_1S_2, C_1S_3, C_0S_0 and C_1S_1 respectively (Fig 4) .Maximum TOL index and Minimum of MP, GMP and STI indexes showed in C_3S_1 that it showed there was maximum plant yield susceptibility to this anion ratios due to decreasing yield. Study of the SSI index for grain and biomass weight (Table 3 and 4) did not show any suitable and justifiable process.

Table 4 Mean comparing of tolerance indexes to stress for grain plant weight (mg)

Treatment	TOL	MP	GMP	Yr	SSI	STI
C_0S_0	-2450 b	6558 a	6437 a	-0.4595 b	4.525 a	1.46 a
C_1S_1	-2300 b	6483 a	6378 a	-0.4326 b	4.46 a	1.431 a
C_1S_2	-2783 b	6725 a	6570 a	-0.5235 b	4.679 a	1.521 a
C_1S_3	-2683 b	6675 a	6533 a	-0.5046 b	4.634 a	1.502 a
C_2S_1	-1983 ab	6325 ab	6228 ab	-0.3708 ab	4.31ab	1.374 ab
C_3S_1	-1050 a	5858 b	5834 b	-0.1961 a	3.889 b	1.198 b

Means within a column followed by the same letter are not significantly different at p = o.o5

Study of mean comparing of indexes under effect of two compost level (Table 5 and 6) did not show any significant difference for any quantification tolerance index and yield under these levels at 5% level.

Table 5 Mean comparing of tolerance indexes to stress for biomass plant weight (mg) under effect of two levels compost (M_1=15 and M_2=30 Ton/ha)

Treatment	Straw Yield (mg)	TOL	MP	GMP	Yr	SSI	STI
M_1	7433.3 a	-366.667 a	7250 a	7240.003 a	-0.056 a	14.924 a	1.052 a
M_2	7772.2 a	-705.556 a	7419.4 a	7399.632 a	-0.106 a	15.576 a	1.099 a

Means within a column followed by the same letter are not significantly different at p = o.o5

Table 6 Mean comparing of tolerance indexes to stress for grain plant weight (mg) under effect of two levels compost (M_1=15 and M_2=30 Ton/ha)

Treatment	Seed Yield (mg)	TOL	MP	GMP	Yr	SSI	STI
M_1	7572.2 a	-2238.88 a	6452.7 a	6345.92 a	-0.420 a	4.429 a	1.42 a
M_2	7511.1 a	-2177.77 a	6422.2 a	6313.87 a	-0.409 a	4.403 a	1.408 a

Means within a column followed by the same letter are not significantly different at p = o.o5

Minimum TOL index and maximum MP, GMP, and STI indexes for biomass plant weight showed in $C_1S_3M_2$ treatment and then $C_2S_1M_1$ treatment (Table 7).
Results of experiment in comparing of quantification indexes for grain weight of plant (Table 8) also showed that minimum TOL index and maximum MP, GMP and STI indexes showed in $C_1S_2M_2$ and then $C_2S_1M_1$, $C_1S_3M_2$ and $C_0S_0M_1$ respectively.

Table 7 Mean comparing of tolerance indexes to stress for Biomass plant weight (mg) under effect of anion ratios and two levels compost (M_1=15 and M_2=30 Ton/ha)

Treatment	TOL	MP	GMP	Yr	SSI	STI
$C_0S_0M_1$	-700 abc	7417 abc	7406 abc	-0.1027 ab	15.53 ab	1.101 ab
$C_0S_0M_2$	-366.7 ab	7250 bc	7245 bc	-0.05574 a	14.91 b	1.053 b
$C_1S_1M_1$	-233.3 ab	7183 bc	7179 bc	-0.03720 a	14.67 b	1.034 b
$C_1S_1M_2$	-666.7abc	7400 bc	7386 abc	-0.1008 ab	15.51 ab	1.093 ab
$C_1S_2M_1$	-766.7 abc	7450 abc	7433 abc	-0.115 ab	15.70 ab	1.107 ab
$C_1S_2M_2$	-733.3 abc	7433 abc	7419 abc	-0.1095 ab	15.62 ab	1.103 ab
$C_1S_3M_1$	200 ab	6967 c	6959 bc	0.02241 a	13.88 b	0.9705 b
$C_1S_3M_2$	-1767 c	7950 a	7896 a	-0.2557 b	17.55 a	1.25 a
$C_2S_1M_1$	-933.3 bc	7533 ab	7516 ab	-0.1354 ab	15.96 ab	1.134 ab
$C_2S_1M_2$	-33.33 ab	7083 bc	7070 bc	-0.01179 a	14.33 b	1.002 b
$C_3S_1M_1$	233.3 a	6950 c	6964 c	-0.02920 a	13.79 b	0.9679 b
$C_3S_1M_2$	-666.7 abc	7400 bc	7382 abc	-0.1013 ab	15.53 ab	1.092 ab

Means within a column followed by the same letter are not significantly different at p = o.o5

Table 8 Mean comparing of tolerance indexes to stress for grain plant weight (mg) under effect of anion ratios and two levels compost (M_1=15 and M_2=30 Ton/ha)

Treatment	TOL	MP	GMP	Yr	SSI	STI
$C_0S_0M_1$	-2867 cde	6767 ab	6610 ab	-0.5372 cd	4.712 ab	1.539 ab
$C_0S_0M_2$	-2033 bc	6350 bc	6265 bc	-0.3818 bc	4.337 bc	1.381 bcde
$C_1S_1M_1$	-2133 cd	6400 b	6307 b	-0.4016 c	4.385 b	1.399 bc
$C_1S_1M_2$	-2467 cd	6567 b	6448 ab	-0.4637 c	4.535 b	1.462 ab
$C_1S_2M_1$	-2067 cd	6367 bc	6278 bc	-0.3894 bc	4.356 bc	1.386 bcd
$C_1S_2M_2$	-3500 e	7083 a	6863 a	-0.6577 d	5.003 a	1.656 a
$C_1S_3M_1$	2367 cd	6517 b	6407 b	0.4435 c	4.486 b	1.445 b
$C_1S_3M_2$	-3000 de	6833 ab	6658 ab	-0.5658 cd	4.781 ab	1.56 ab
$C_2S_1M_1$	-3000 de	6833 ab	6662 ab	-0.5606 cd	4.769 ab	1.565 ab
$C_2S_1M_2$	-966.7 a	5817 d	5794 d	-0.1809 a	3.852 d	1.182 e
$C_3S_1M_1$	-1000 a	5833 d	5812 d	-0.1871 a	3.867 d	1.189 de
$C_3S_1M_2$	-1100 ab	5883 cd	5856 cd	-0.2051 ab	3.91 cd	1.208 cde

Means within a column followed by the same letter are not significantly different at p = o.o5

Study of correlation coefficient matrix between plant biomass and grain yield with quantification tolerance indexes (Table 9 and 10) showed all indexes had high correlation with biomass weight (70-80%) and grain weight (90-100%). Correlation among two indexes (TOL and Yr) with plant biomass and grain weight was high and negative but it had high, positive and significant in other indexes.
Study of the results also showed that STI index with MP and GMP indexes had positive and significant correlation and SSI index with two indexes (TOL and Yr) had very high correlation but it had negative.

Table 9 Correlation coefficients between tolerance indexes to stress and biomass plant weight (mg)

Variable	Straw Yield	TOL	MP	GMP	Yr	SSI	STI
Straw Yield	1.00						
TOL	-0.77**	1.00					
MP	0.754**	-0.162	1.00				
GMP	0.731**	-0.128	0.999**	1.00			
Yr	-0.747**	0.998**	-0.128	-0.092	1.00		
SSI	0.747**	-0.998**	0.128	0.092	-1.00**	1.00	
STI	0.731**	-0.129	0.998**	0.999**	-0.093	0.093	1.00

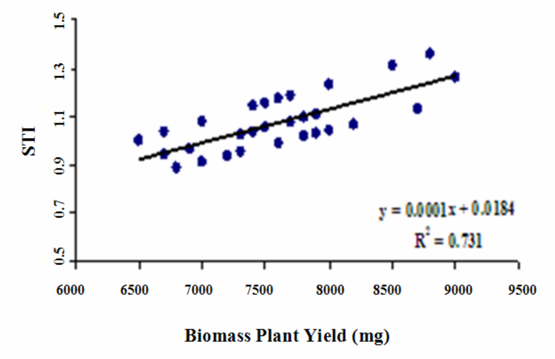
* and ** are significant difference at 5 and 1 % levels respectively

Table 10 Correlation coefficients between tolerance indexes to stress and grain plant weight (mg)

Variable	Seed Yield	TOL	MP	GMP	Yr	SSI	STI
Seed Yield	1.00						
TOL	-0.991**	1.00					
MP	0.991**	-0.965**	1.00				
GMP	0.982**	-0.947**	0.998**	1.00			
Yr	-0.982**	0.998**	-0.949**	-0.929**	1.00		
SSI	0.982**	-0.998**	0.949**	0.929**	-1.00**	1.00	
STI	0.982**	-0.949**	0.998**	0.999**	-0.093**	0.093**	1.00

* and ** are significant difference at 5 and 1 % levels respectively

Figures (5 and 6) show liner regression equation between biomass and grain weight with STI index that STI had highest correlation among other indexes. Based of it, more than 70% of changing in STI index with biomass plant weight and 98% of changing in STI index with grain plant weight is justifiable with two equations.



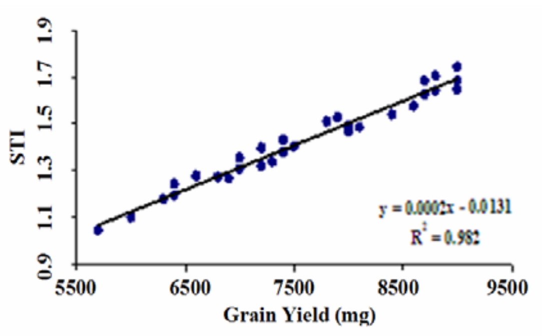
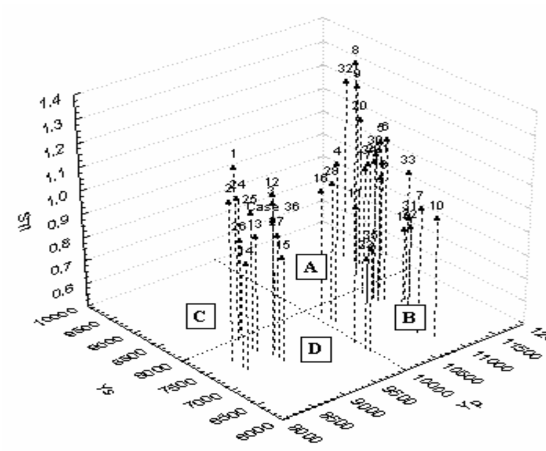


Fig 5 Relationship between biomass plant weight with STI index   Fig 6 Relationship between grain plant grain with STI index

Three dimensions graphs (scatter) show relationship between three variable, yield in stress condition (Ys) , yield in none stress condition (Yp) and STI index with biomass weight (Fig 7) and grain weight (Fig 8).
In three dimensions scatter graph with distribution of low surface scatter (surface of X with Y) to four equal parts, treatments divided to four apart groups.



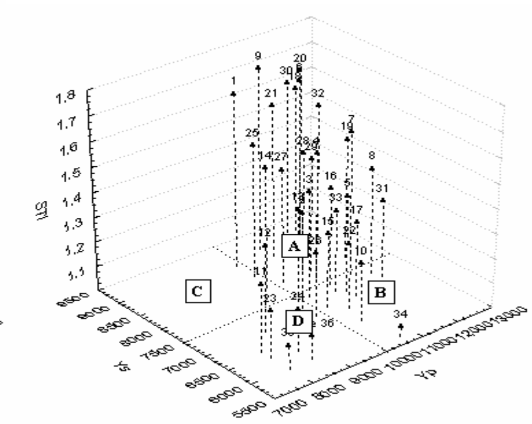


Fig 7 Scatter plot between Yp, Ys and STI index on biomass weight

Fig 8 Scatter plot between Yp, Ys and STI index on grain weight

(A) Group had high yield in two conditions (stress and none stress) , (B) group had high yield in none stress condition and low yield in none stress condition, (C) group had high yield in stress condition and low yield in none stress condition and finally, (D) group had low yield in two conditions.

1	$C_0S_0M_1R_1$	13	$C_0S_0M_1R_2$	25	$C_0S_0M_1R_3$
2	$C_0S_0M_2R_1$	14	$C_0S_0M_2R_2$	26	$C_0S_0M_2R_3$
3	$C_1S_1M_1R_1$	15	$C_1S_1M_1R_2$	27	$C_1S_1M_1R_3$
4	$C_1S_1M_2R_1$	16	$C_1S_1M_2R_2$	28	$C_1S_1M_2R_3$
5	$C_1S_2M_1R_1$	17	$C_1S_2M_1R_2$	29	$C_1S_2M_1R_3$
6	$C_1S_2M_2R_1$	18	$C_1S_2M_2R_2$	30	$C_1S_2M_2R_3$
7	$C_1S_3M_1R_1$	19	$C_1S_3M_1R_2$	31	$C_1S_3M_1R_3$
8	$C_1S_3M_2R_1$	20	$C_1S_3M_2R_2$	32	$C_1S_3M_2R_3$
9	$C_2S_1M_1R_1$	21	$C_2S_1M_1R_2$	33	$C_2S_1M_1R_3$
10	$C_2S_1M_2R_1$	22	$C_2S_1M_2R_2$	34	$C_2S_1M_2R_3$
11	$C_3S_1M_1R_1$	23	$C_3S_1M_1R_2$	35	$C_3S_1M_1R_3$
12	$C_3S_1M_2R_1$	24	$C_3S_1M_2R_2$	36	$C_3S_1M_2R_3$

Table 11 Grouping data on based of experimental treatments

Fernandez (1992) announced that the best index foe evaluation to stress is index that can separate (A) group from other groups. Results of evaluation (Fig 7) showed that $C_1S_3M_2$ and $C_2S_1M_1$ treatments were in (A) group and four treatments $C_0S_0M_1$, $C_0S_0M_2$, $C_1S_1M_1$ and $C_3S_1M_2$ were in (D) group.
Other experimental treatments were in (B) group. Study of Fig 8 showed that most of experimental treatments were in (A) group for plant grain weight. Only two treatments $C_3S_1M_1$ and $C_3S_1M_2$ were in (D) group and fore treatments $C_1S_2M_1$, $C_1S_3M_1$, ${}_1S_3M_2$ and $C_2S_1M_2$ were in (B) group.

Discussion

Maximum of grain weight per pot showed in $Cl^-/SO_4^=$ ratios (C_1S_2 and C_1S_3) and minimum of it in C_3S_1 treatment showed that it shows negative effect of Cl^- is more than $SO_4^=$ ion. Richards et al. (2003) showed that it had negative correlation among salt concentration in soil and number of grain, biomass of wheat, barley and tritikum and their reaction to salt concentration will be different due to type of salt. Also, chloride salt faster limit plants growth more than $SO_4^=$ salt.

Biomass and grain weight of plant under interaction effects of anion ratios and compost also followed to similar process of grain yield under effect of anion ratios. As, with increasing in $Cl^-/SO_4^=$ anion ratios especially grain weight showed decreasing process.

Although, study of interaction effects of anion ratios and two levels composts showed that increasing in $Cl^-/SO_4^=$ anion ratios to antiseptic amounts had positive effect. Fatti et al. (1991) showed that growth of root wheat related to type of salt and special ion effects and KCl salt decreased more than K_2SO_4 root growth.

Regarding to none signification of plant biomass weight under effect of $Cl^-/SO_4^=$ anion ratios, all stress tolerance indexes (Table 3) also had not significant difference statistically, however two ratios (C_1S_3 and C_1S_2) for biomass weight and these two ratios with reverse type for plant grain weight were the best suitable $Cl^-/SO_4^=$ anion ratios that they tolerated salinity stress.

Chauhan et al. (2003) and Manchanda et al. (1982) in study of interaction effect among salinity, phosphoric fertilizer and $Cl^-/SO_4^=$ anion ratios showed that increasing in water irrigation salinity caused soil salinity and wheat yield decreasing.

Increasing in $Cl^-/SO_4^=$ anion ratio from 1:1 to 3:1 in water irrigation decreased grain yield about 5.7%. Their research also showed that plant wheat in high salinity condition with low $Cl^-/SO_4^=$ anion ratios or phosphoric fertilizer usage will be far yield.

Compost usage caused increasing barley yield than to none fertilizer control. But, results of experiment did not show any significant difference between two levels composts (15 and 30 Kg/ha) in 5% level. It maybe was as reason of period experiment reduction, slow analyzing time and affecting of compost fertilizer on plant. Tsadilias (2005) reported that compost increasing next to third experiment year significantly increased cotton crop yield, total nitrogen in soil, P, Fe, Zn, B nutrients availability and these nutrients correlation with cotton yield.

Study of the indexes in table 7 and 8 show that increasing compost level from 15 to 30 Kg/ha some deal decreased $Cl^-/SO_4^=$ anion ratios stress on plant yield as C_2S_1 ratio and then C_1S_2 and C_1S_3 ratios have tolerance on salinity stress.

Study of indexes and these correlation coefficient of three indexes (STI, MP and GMP) showed these indexes were suitability and best indexes in evolution of $Cl^-/SO_4^=$ anion ratios as result of maximum barley yield. Golparvar et al. (2004) and Golabadi et al. (2006) in their studies showed that MP , GMP and STI indexes had positive and more significantly with grain yield in stress and none stress condition and they acted successfully than other indexes.

Totaly, researchers beliefed that the best index for sieving plant in stress condition is index that have high correlation with grain yield in two (stress and none stress) condition (Farshadfar et al.,2001 ; Nourmand,1997).

Study of figures 5 and 6 shows that with increasing in biomass weight and grain weight of plant also increase with STI index. This index also justifies maximum percent of plant yield under effect of anion ratios. Noriniya et al.(2004) in their study on barley and none capsule barley used of high amounts of STI index for genotype selection to salinity tolerance.

Finally, study of scatter graph for plant biomass weight (Fig 7) boded on C_1S_3, C_1S_2 and C_2S_1 anion ratios selection as the best ratios in salinity stress tolerance in barley.

Scatter graph for plant grain weight in two stress and none stress condition (Fig 8) showed that treatments with low $Cl^-/SO_4^=$ anion ratios were in (A) group that it boded on $SO_4^=$ ion predominant than to Cl^- ion in barley root condition for obtaining high yield.

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