EFFECT OF SALT STRESS ON THE MORPHOLOGICAL TRAITS OF MAIZ (*ZEA MAYS)*

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Abstract

salinity have a negative impact on plant growth. The present research work was conducted at Botanical Garden Department of Botany, University of Malakand, Khyber Pakhtunkhwa Pakistan. Different maize verities at morphological level are treated with different salt stress as compare to control environment. After germination we evaluated four maize for morphological study. different concentration (0, 50, 100 and 200) MNaCl were applied at appropriate stages. Salt stress show reduction in growth of all maize varieties**.** plant height incase control and with salt treated mean value was 31.27, with standard error 1.16, coefficient of variance was 26.94, range from Minimum 25cm and maximum 32cm, leaf length incase control and with salt treated mean value was 21.50, with standard error 1.74, coefficient of variance was 33.45, range from Minimum8.00cm and maximum 32.00cm, leaf width incase control and with salt treated mean value was 0.37, with standard error 0.02, coefficient of variance was 0.00, range from Minimum0.30cm and maximum 0.50 respectively. All varieties were compared under different salt stresses to control condition.

Key words: Nacl, Plant height, Leaf length, Leaf width

Introduction

The maize is one in three crops that are the most important as a food resource for the people (FAO 1996) and is widely cultivated crop in Pakistan. Maize provide many essentials mineral, multiple vitamins B, and is a good fibers source but is lacking in vitamin C, vitamin B12, calcium and iron etc. The occurrence of salinity in unwanted amount in soil which change plants normal growth and change normal physiological functions. Salinity is one of the most serious abiotic stress factors that decrease crop production. Salinity affect plants several techniques has propose for improvemet of plant performance in saline environments (Munns, 2002). During salinity stress photosynthesis is one of the most effected procese (Sudhir and Murthy, 2004),in which cause decrease level of chlorophyll and inhibitions that the key photosynthetic enzymes, Rubisco (Soussi *et al.,* 1998). This processes effects plant growth and production. The saline water inhabit development in two aspects. The roots ability to retain water which interrupted by high salt cosentration in soil water (Munns and James, 2003).Plant responsce to salinity is mainly reflected in morphological, physiological and some other changes.e.g, salinity stresses that result in osmotic stress, ion toxicity, and nutritional imbalances that reduces growth and alters the levels of cell metabolites.Salinity is a major abiotic stress that inhibits plant growth and reduces crop yield.Worldwide the major problems of irrigation is salinity. It is a serious biotic stress causes huge decline in growth and pruductivity. Worldwide 602 to 832 hectares' area is effected by salinity. Globally About 10% of land area in each year is damaged by salinity (Saboora 2006). Pakistan is an agricultural country which improvements and developments is depends upon agricultural sector.Agriculture of Pakistan is in risk by number of reasons like change in climate, low and high-water stress and soil salinity.Comparison is according to economic survey(2016-17, 2017-18) of Pakistan, crop production was decrease around 4.4 percent in a year.

Methods and Materials

This study was carried out in Glasshouse, University of Malakand Botanical Garden Herberium. maize improved varieties was collected from the Plant Genetic Resources Institute (PGRI) Islamabad. It was cultivated to apply salt stress to evaluate resistant and susceptible varieties was reported. Four seeds were selected were sown the pote in equal proportion of sand. After fifteen days of germiniation two uniform plants were selected from each pot for further reacerch. Irrigation was given both replications of control and treated plants. The salt stress treatment was given alternatively for 28 days. During maturity stage different morphological and physiological traits were studied. Salt tolerance capacity was tested on four-week-old seedlings cultivated in the glasshouse. All pots with tested lines treated for 28 days with 200 mMNaCl. Control pots were irrigated with the same amount of water.

Survival rates was examined after the treatment and images will be captured to reveal visible phenotypes.Under control environment, various morphological characteristics of the selected varieties were recorded. For example, Fresh and Dry Weight, Plant Length and Fresh weights of roots and shoots was determined. Plant length is measure by metric scale in centimeter.The shoot and root length will be measured in centi meter at the time of experiment termination by using scales.Roots and shoots separate from each other and weight them in grams (g) with on digital balance. Than Roots and shoots was dry in oven at 80^{0}C for 72 hours and measure dry weight by digital balance.At each pot the plant height was measured from the base up to upper tips through meter.The data were analyze through excel sheet in form replicate and SPSS and statistica software

Result

This experiment was conducted at Botanical Garden University of Malakand to perform the response of selected genotype under stress of different concentrations of salts. Four verieties were collected from different location of Dir lower. The seeds were grown in pots. Four seed sown in pot. After that two plants are select for further reaserch to investigate the effects salt (NaCl) on morphological characters of maize under the salt stress. At each stage of germination shoot and root length, total plant length were measure and count. After that the followings morphologicals parameters were studied.

Table 3.1: Descriptive Statistic from morphological traits.

Traits	Mean	Standard Error	Variance	Minimum	Maximum	CV%
PH	31.27	1.16	14.82	25.00	37.00	26.94
LL	21.50	1.74	33.45	8.00	32.00	12.33
LW	0.37	0.02	0.05	0.30	0.50	19.12
NO.L	3.73	0.24	0.62	2.00	5.00	15.72
RL	5.15	0.47	2.39	3.40	9.00	11.03
NO.R	4.82	0.23	0.56	4.00	6.00	21.29

3.2 Plant height

Salinity cause plant height decrease of all genotype except LP which show positive responce towards salt stress as we increase concentration (0, 50mM, 100mM and 200mM) show little resistance incase LP (32cm, 32cm, 26cm, 23), and DLW in case of control (31cm) treatment one (32cm), treatment two 26cm and treatment three 25cm. DLH the control 33cm, treatment one 24, treatment 27 and treatment three 32cm, while in Malakand genotype control 35cm, treatment one 35cm, treatment two 24cm , treatment three 27cm which shown in the table (3.2).Descriptive statistic for plant height incase control and with salt treated mean value was 31.27, with standard error 1.16, coefficient of variance was 26.94, range from Minimum 25cm and maximum 32cm shown in table no 3.1.

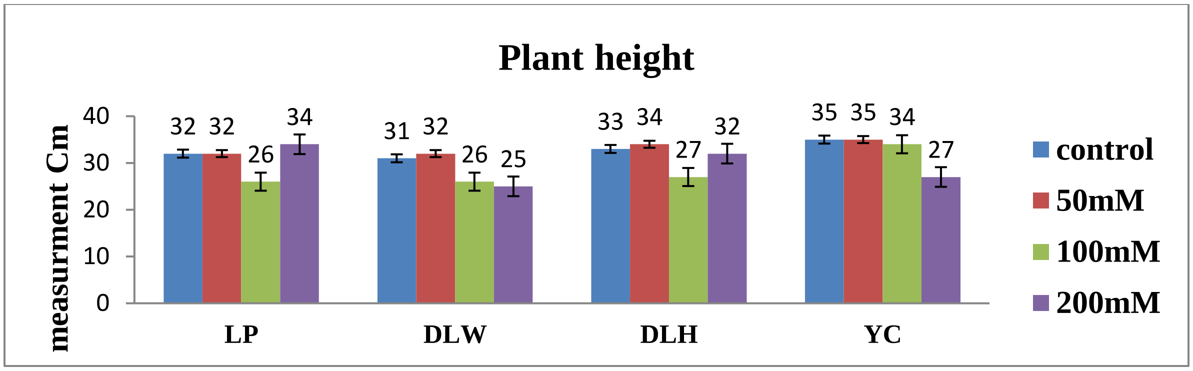

Figure 3.1. Graphical representation of plant height of four different regions under control and salt stress.

3.3 Leaf length

Salinity cause leaf lenth decrease of all genotype except LP which show positive responce towards salts stress as we increase stress the leaf length show little resistance incase LP (25.2cm, 19cm, 21.9cm, 19.1cm), and DLWincase of control (31cm) treatment one (30cm), treatment two 32cm and treatment three 27.1cm. DLH the control 25.2cm, treatment one 23cm, treatment two 21cm and treatment three 21cm, while in Malakand genotype control 32cm, treatment one 25cm, treatment two 20cm , treatment three 22cm which shown in the table (3.3). Descriptive statistica for leaf length incase control and with salt treated mean value was 21.50, with standered error 1.74, coefficient of variance was 33.45, range from Minimum 8.00cm and maximum 32.00cm shown in table 3.1.

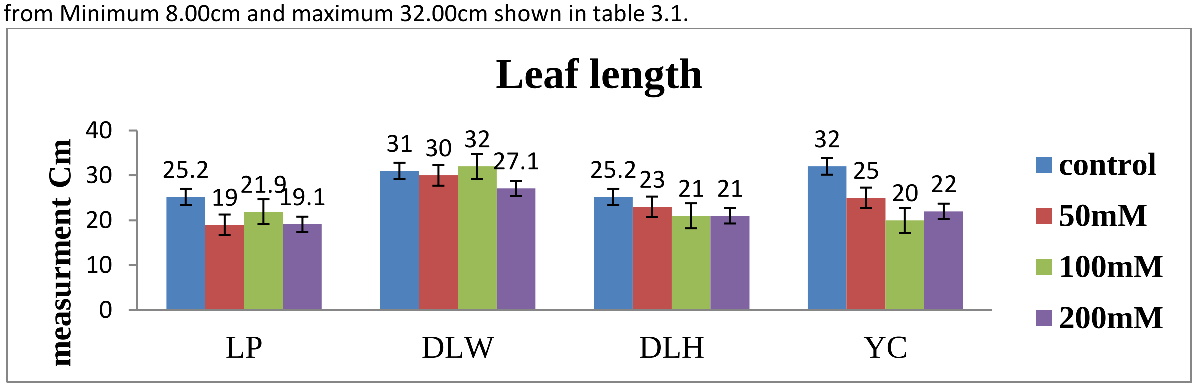

Figure 3.2. Graphical representation of leaf length of four different regions under control and salt stress.

3.4 Leaf width

Salinity cause leaf width decrease of all genotype except LP which show positive responce towards salts we increase stress (0, 50mM, 100mM and 200mM) show little resistance incase LP(o.4cm,0.3cm,0.4cm,0.4cm), and DLWpperincase of control (0.4cm) treatment one (0.4cm), treatment two 0.3cm and treatment three 0.4cm. DLH the control 0.4cm, treatment one 0.4cm, treatment two 0.3cm and treatment three 0.3cm, while in Malakand genotype control 0.5cm, treatment one 0.4cm, treatment two 0.3cm , treatment three 0.4cm which shown in the table (3.4).Descriptive statistica for leaf width incase control and with salt treated mean value was 0.37, with standard error 0.02, coefficient of variance was 0.00, range from Manimum0.30cm and maximum 0.50 shown in table 3.1.

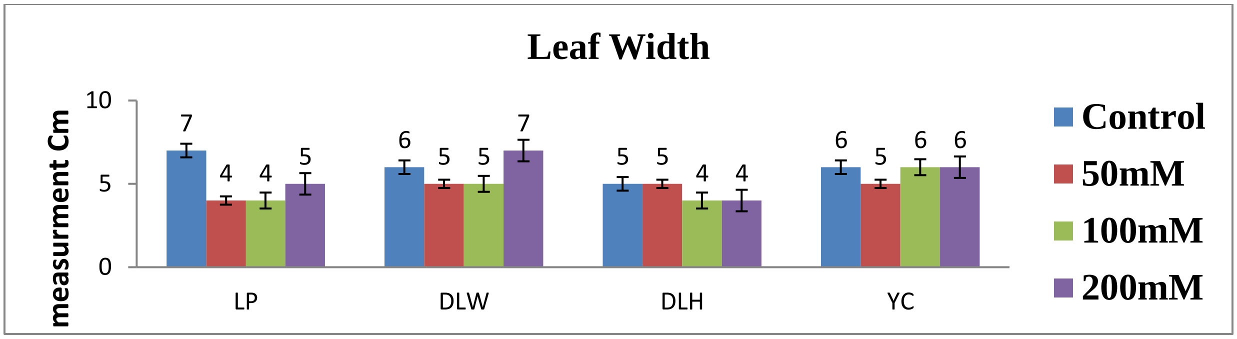

Figure 3.3. Graphical representation of Leaf width of four different regions under control and salt stress.

3.5 No of leaves

Salinity cause no of leaves decrease of all genotype except LP which show positive responce towards salts stress we increase stress (0, 50mM, 100mM and 200mM) show little resistance incase LP(3,2,4,3), and DLWpper in case of control (3) treatment one (4), treatment two 4 and treatment three 3. DLH the control 4, treatment one 4, treatment two 3 and treatment three 5, while in Malakand genotype control 4, treatment one 4, treatment two 4, treatment three 4 which shown in the table(3.5).Descriptive statistica for No of leaves incase control and with salt treated mean value was 3.73, with standered error 0.24, coefficient of variance was 0.62, range from Manimum2.00cm and maximum 5.00 shown in table 3.1.

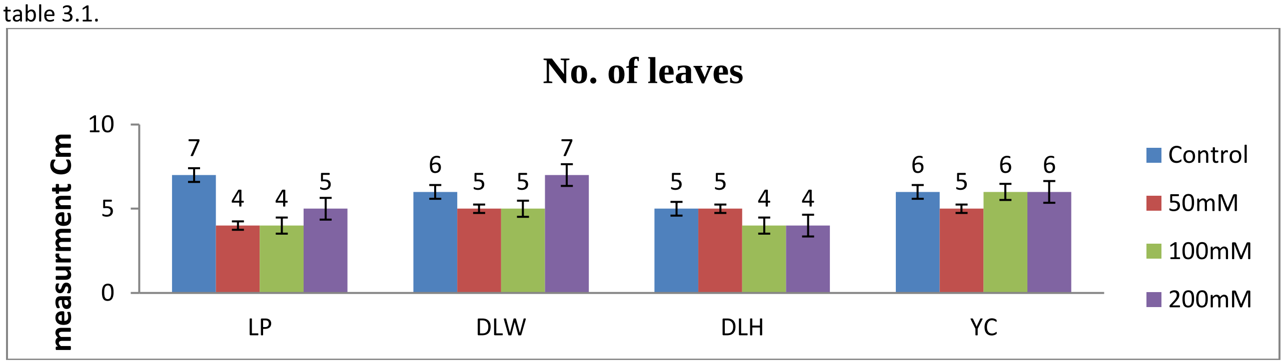

Figure 3.4. Graphical representation of number of leaves of four different regions under control and salt stress.

3.6 Root length

In case of root length stress cause decrease of all genotype except LP which show positive responce towards salts stress we increase stress (0, 50mM, 100mM and 200mM) show little resistance incase LP (5.1cm,3.4cm,6cm,5cm) and DLW in case of control (5cm) treatment one (4cm), treatment two 5cm, and treatment three 6cm. DLH the control 4cm, treatment one 9cm, treatment two 4.8cm and treatment three 3.4cm, while in Malakand genotype control 6cm, treatment one 5cm, treatment two 5cm , treatment three 5cm which shown in the table(3.6).Descriptive statistica for root length incase control and with salt treated mean value was 5.15, with standered error 0.47, coefficient of variance was 2.39, range from Minimum 3.40cm and maximum 9.00 shown in table 3.1.

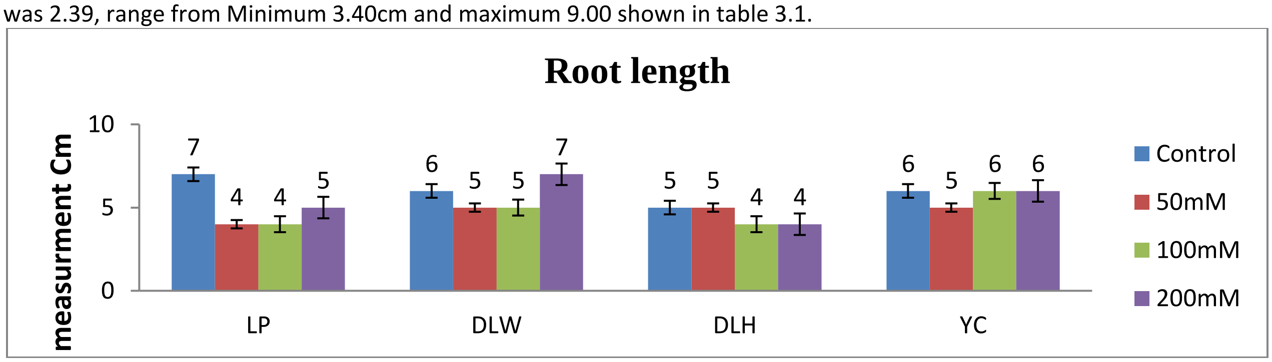

Figure 3.5. Graphical representation of root length of four different regions under control and salt stress

3.7 No of roots

Genotype except LP which show positive responce towards salts stress we increase stress (0, 50mM, 100mM and 200mM) show little resistance incase LP (7,4,4,5) and DL Wincase of control (6) treatment one (5), treatment two 5, and treatment three 7. DLH the control 5, treatment one 5, treatment two 4, and treatment three 4, while in Malakand genotype control 6, treatment one 5, treatment two 6, treatment three 6, which shown in the table (3.7).Descriptive statistica for no of roots incase control and with salt treated mean value was 4.82, with slandered error 0.23, coefficient of variance was 0.56, range from Minimum 4.00cm and maximum 6.00 shown in table 3.1.

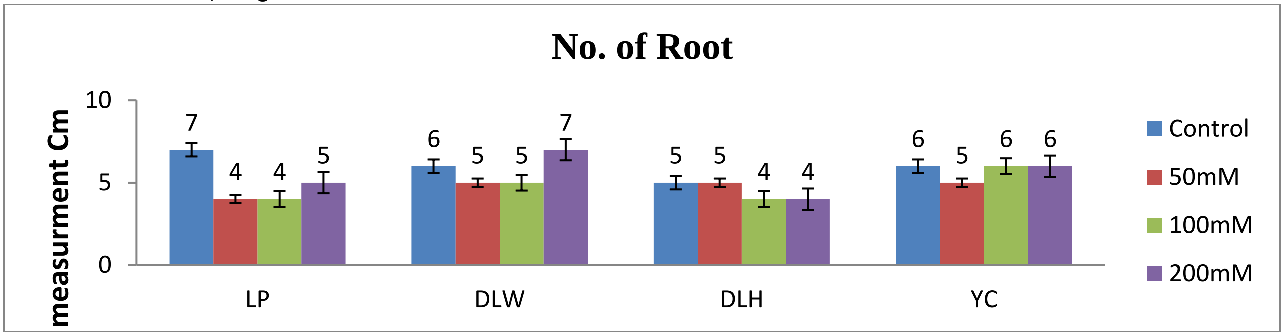

Figure 3.6. Graphical representation of number of roots of four different regions under control and salt stress.

Table 3.8: Correlation for morphological traits of maize genotype.

Traits	PH	LL	LW	NO.L	RL	NO.R
PH	1.000					
LL	0.387	1.000				
LW	0.676**	0.441*	1.000			
NO.L	0.490**	0.429**	0.232	1.000		
RL	0.278	0.205	0.483	0.184	1.000	
NO.R	0.226	0.304	0.506*	0.416	-0.164	1.000

Correlation was done for morphological traits leaf length was positive correlate with plant height (0.387), leaf width also strongly positive correlate with plant height (0.676**), no of leaves also strongly positive correlate with plant height(0.490**),root length was positive correlate with plant height (0.278),no of root also positive correlate with plant height (0.226),leaf length was positive correlate with plant height, leaf width also strongly positive correlate with plant height(0.441*),no of leaves also strongly positive correlate with plant height(0.429**),root length was positive correlate with plant height (0.205),no of roots was positive correlate with plant height (0.304),leaf width also positive correlate with plant height(1.000),no of leaves was positive correlate with plant height(0.232).root length also positive correlate with plant height(0.483),no of root also strongly correlate with plant height(0.506*), no of leaves was positive correlate with plant height, root length also positive correlate with plant height(0.184),no of root also positive correlate with plant height(0.416),root length was positive correlate with plant height, no of root also positive correlate with plant height(-0.164),no of root was positive correlate with plant height (table 3.8).

Discussion

The current experiment was carry out to determined the effects of salt stress on maiz varieties. because zea maiz is a major grain legume crop, which is third in importance after soybeans and peanuts (Sofi, 2018). The grain of maiz contain high amount of protein, therefore it was primarily grown and eaten as food legume. Different strategies of crop rotation have been used to adopt the salt stress and failure the expected economic loss of important crops (Oerke *et al*., 2012).In the present study the effect of salinity were tested in maize genotype. For this purpose a total of four verities of maize were collected from Malakand Division named (DLH,DLW,YC and LP). Seed was sown in plastic pots and different salt stresess were applied on seedling of maize. The different morphological parameters of the selected varieties was documented i.e. dry weight, leaves width, root length, leaves length and plant height, these traits were effect by salinity. Similarly, salt stresess effects developmental procese such as seed germination, growth, flowering and fruit.(Sairam *etal* 2004).The ability of plants growth is directly proportional to the moisture the of soil (Biglouei *et al*., 2010; Chartzoulakis *et al*., 2002).Salt stress cause a clear decrease of all genotype except LP which show clear positive response toward salinity as we increase stress (0, 50mM, 100mM and 200mM) the LP height show little resistance incase LP (32cm, 32cm, 30.1cm, 30), and DL Wpper incase of control (31cm) treatment one (32cm), treatment two 26cm and treatment three 25cm. DLH the control 33cm, treatment one 30, treatment 27 and treatment three 32cm, while in Malakand genotype control 35cm, treatment one 35cm, treatment two 30cm , treatment three 27cm same result was investigate reported plant height values 92.6 to 101.3 cm, correspondingly, in their study.Descriptive statistica for leaf length incase control and with salt treated mean value was 21.50, with standered error 1.74, coefficient of variance was 33.45, range from Minimum 8.00cm and maximum 32.00cm, no of roots incase control and with salt treated mean value was 4.82, with slandered error 0.23, coefficient of variance was 0.56, range from Minimum 4.00cm and maximum 6.00, Salt sress cause a clear decrease of all verities except LP which show clear positive response toward salinity as we increase stress the leaf length show little resistance incase LP (25.2cm, 19cm, 21.9cm, 19.1cm), and DL Wpper incase of control (31cm) treatment one (30cm), treatment two 32cm and treatment three 27.1cm. DLH the control 25.2cm, treatment one 23cm, treatment two 21cm and treatment three 21cm, while in Malakand genotype control 32cm, treatment one 25cm, treatment two 20cm , treatment three 22cm. Correlation was done for morphological traits leaf length was positive correlate with plant height (0.387), leaf width also strongly positive correlate with plant height (0.676**), no of leaves also strongly positive correlate with plant height(0.490**),root length was positive correlate with plant height (0.278),no of root also positive correlate with plant height (0.226),leaf length was positive correlate with plant height (1.000), leaf width also strongly positive correlate with plant height(0.441*),no of leaves also strongly positive correlate with plant height(0.429**), Abiotic stress tolarance has been observe by cultivars' capacity to sustaine chlorophyll content in leavese (Kiani *et al.,* 2014)

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