Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.4, No.11, 2014

Effect of Salinity on Cotton Seed Germination and Seedling Survival

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Abstract
Salinity is a major threat in Pakistan due to use of low quality water. Present study was conducted to evaluate MNH-886 at different salinity levels by using 3 different experiment. In first experiment seed of MNH-886 was grown in Petri dishes and data of germination was taken by applying 23 NaCl treatments from 0-1300 mM. Results showed that germination is get hampered by high salt concentration. Even at the concentration of 100 mM it lowered to 80% and become zero at 700 mM NaCl solution. In second and third experiment seedling survival was tested in MS media and hydroponic. From both of these experiment it was found that survival rate decrease greatly with increase in salt concentration. On the basis of hydroponic results it is assumed that MNH-886 is not good performer under salinity stress
Keywords: MNH-886, Germination, survival, hydroponic media

Introduction

Pakistan is an agriculture state and cotton is not only important for farmers but also consider the back bone of national economy (Tuttle *et al.,* 2008; Iqbal *et al.,*2011; Shah *et al.,* 2011). At the moment in Pakistan cotton production is threaten by low seed germination and weak seedling emergence which leads to death of plants at early stage especially under salinity conditions. Commonly cotton is consider as salt-tolerant crops and help in reclamation of saline soils (Maas, 1990), But its germination growth and yield negatively affected by high accumulation of salt grow excessive salts in the soil (Higbie et al., 2010; Qadir and Shams, 1997). In Pakistan irrigated agricultural areas has greatly threatened by salt accumulation in soils due to the poor irrigation management especially by use of tube-well water. With the increasing population and limited land resources and water, it is requirement of time that we use salt effected and marginal lands to increase production. (Jones, 1981). Generally cotton plants are more prone to salinity during seed germination and seedling development stage (Hoffman and Shannon, 1986). Due to large variability in soil salinity and high cost it is difficult to study salt effect on seedling development (Ibrahim, 2003). To overcome these problems nutrient media may also be used to study different genotypes at desired salinity level. This technique is more reliable and realistic. The present study was conducted to check the salinity effect on cotton germination and it seedling growth sown in solid media and nutrient media hydroponics by following the the same procedure as by Sattar *et al.,* 2010.

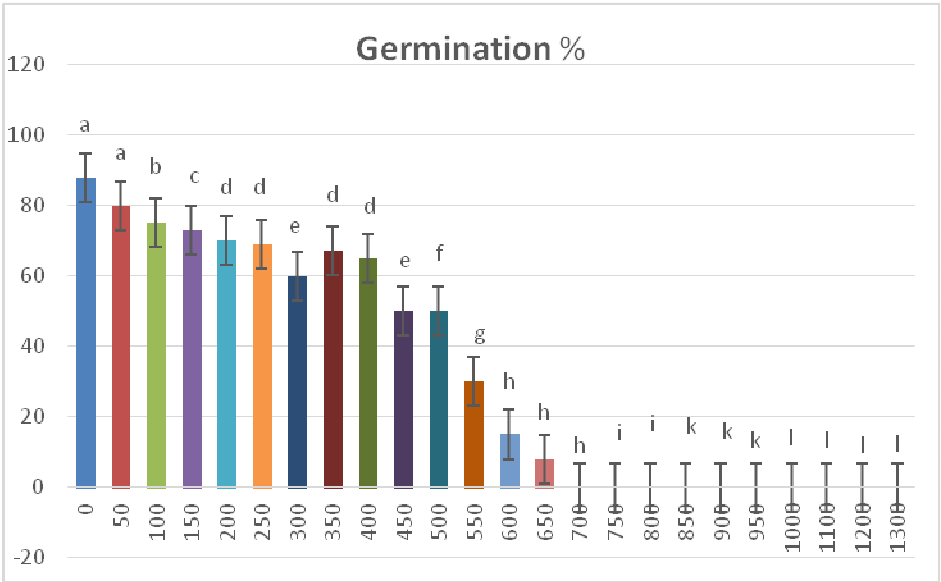
Material and Method

Delinting of cotton: seed Of MNH 886 was delinted by using H_2SO_4 at the rate of 100 ml/kg as recommended by government ministry of agriculture Pakistan. For the acid is added in a container having seed and stirred continuously, after 5 minutes seed is removed and wash three time checking the pH by litmus paper. Only sinker seed was used and the seed floated on water surface was removed.
Germination of seed: Fifty delinted cotton seed was taken and placed between two layers of whatman No.1 filter paperused as seedbed and covered by another layer of filter paper in petri dish with 23 treatments and 1 control, applied to these petri with 3 replication of each treatment in CRD. Twenty three treatments of NaCl solution was 50,100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 950, 1000, 1100, 1200 and 1300 mM. Twenty ml solution of each concentration was added to each patri dish of particular treatment. These petri dishes was placed in an incubator at 32 C. After 4 days number of seed germinated was counted and analyzed. Seed was considered as germinated when radicle had emerged more than 2 mm.

Study of Growth in MS medium:
MS (Murashige and Skoog) medium was prepared by disloving 5g of MS basal medium and 40 g of sucrose keeping the pH at 6. Then 3 g of phytagel was \poured in test tube.in control treatment No NaCl (sodium chloride) solution was added . For the thirteen salt treatments NaCl is dissolved in water and required solutions was prepared 50,100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 950, 1000, 1100, 1200 and 1300 mM . After autoclave, seed germinated in petri dish was placed into the test tubes prepared by MS media at room temperature.. The experiment was designed in CRD with 1 control and 23 salt treatments. There were total four replications of each treatment and 10 test tubes in each replication. Test tubes were plugged and kept in room temperature for 8 days.. Data regarding seedling survival were recorded for 10 days.
Study of Growth in hydroponics:
Five g of MS basal medium and 40 g of sucrose was dissolved by 1.0 L of distilled water for Hydroponics. For the thirteen salt treatments medium was fortified with given quantity of NaCl to prepare 50,100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 950, 1000, 1100, 1200 and 1300 mM salt solutions no salt in control. After autoclave, medium was pourd into test tubes. Seedlings were grown in growth chamber in Ms media and taken at 10-days about 3 leaf stage. All the seedlings were washed properly and immersed in nutrient media in such a way that only roots dips in hydroponic broth media.. There were four replicates of each treatment with 10 test tubes in each replicate. Data of seedlings survivals were recorded. Duncan's Multiple Range Test is used to treatment means (Steel *et al.,* 1997).

RESULTS AND DISCUSSION:
Germination
At control condition germination is above 95 % which more than good in cotton Fig.1. As the concentration increase germination start decreasing as the weak seeds are unable to germinate under stress conditions. Germination of cotton seed reach about 50% under salt stress of 550 mM and goes to zero at 100 mM.an un expeted result is found at 300 mM treatment where germination decrease suddenly and further increase in next treatments. Cotton seed germination remain above 90% up to salt stress of 300 mM. The results alike the previous work of satar *et al* 2010.
Seedling survival.
In Fig. 2. If we look at the behavior of cotton seedling survival it is maximum at control and continuously decrease towards zero with increasing dose of NaCl. All the concentrations have effect on seedling survival but survival rate is become lower than 50% at 600-700 mM treatment and become zero at 900 mM solution treatment.
Similarly in Hydroponic at every step survivals of seedling decrease and become zero at 700 mM solution. If we compare solid media and hydroponic the result showed that survival rate is less in hydroponics whom results are though more reliable. High salt accumulation in roots increase resulting decrease in water availability and nutrients.

Fig. 1: Effect of different concentrations of NaCl solution on germination of cotton seeds.



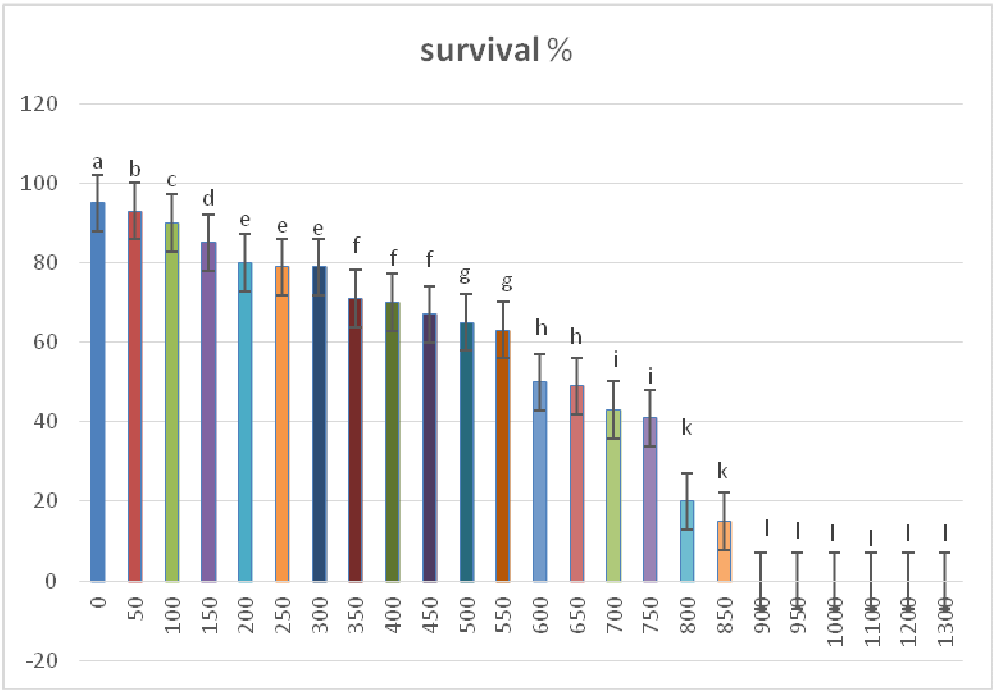


Fig. 2: Effect of different concentrations of NaCl solution on survival of cotton seedling in MS solid media

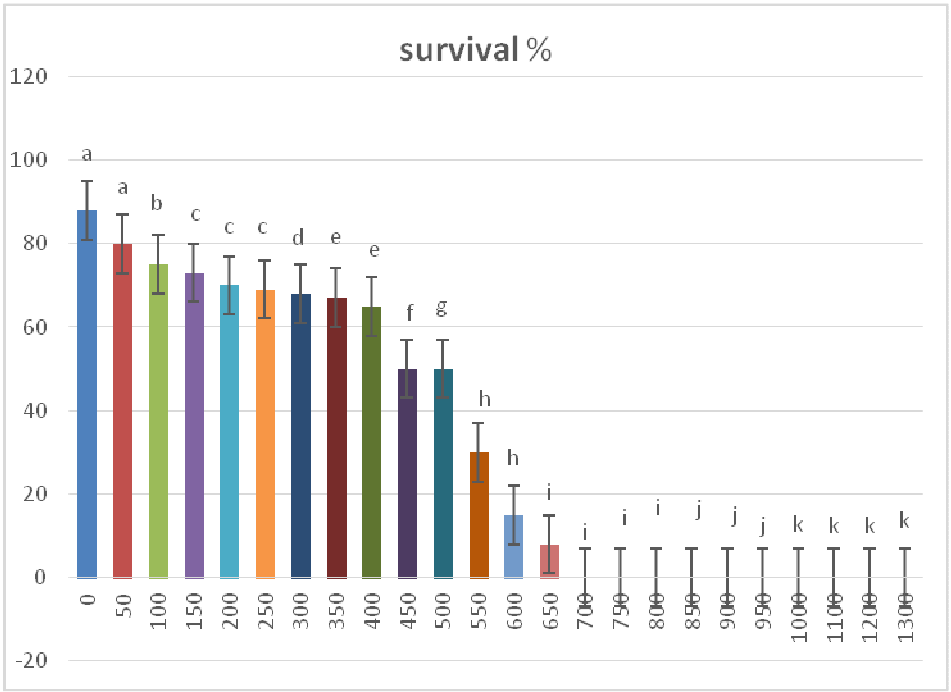


Fig. 3: Effect of different concentrations of NaCl solution on survival of cotton seedling in Hydroponic. At **P≤0.05 value showing same latter have non-significant difference.**

Conclusion

Cotton is consider as a salt tolerant crop but in Pakistan even our high performing varieties are not breed for salinity stress. It is the need of time to develop such varieties which can tolerate high salt accumulation in roots. We have to screen out all the germplasm by hydroponic as it could prove to be a good method for screening at desired salinity level.

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