The Effect of Salinity on Vegetative Growth of Three Finger Millet (*Eleusine coracana* L. Gaerth) Varieties

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Abstract

Salinity is a major environmental stress that inhibits plant growth and development. Salt affected areas in the world are also increasing year by year thus limiting the agricultural production. Salt tolerant crops are advantageous under such conditions as they can cope up with soil salinity. Therefore, it is important to investigate the effect of salt on growth performances of targeted crop species. The experiment was carried out to evaluate the growth performance of three finger millet varieties *(Rawana, Ravi* and *Oshada)* under different salinity levels. The experiment was conducted using completely randomized design with three replicates per treatment. Five different salinity levels were used for the experiment (0, 2, 4, 6, 8 ds/cm). 21-day-old nursery seedlings were transplanted in polythene bags filled only with sand. One week after transplanting recommended amount of Albert solution (10g dissolved in 4.5l of water) was added twice a week. Salt water with different concentrations was applied once in two days. Plants were uprooted two months after transplanting for data collection. According to the results of analysis of variance interaction of salinity and varietal effect was significant for shoot height, root dry weight and number of leaves per plant. Significantly higher shoot height was observed in variety *Rawana* and *Oshada* at 2ds/cm. Root dry weight of all three varieties showed significant increase with increasing salinity level up to 4ds/cm and then decreased. Variety *Oshada* exhibited the best growth performance compared to other two varieties in all salinity levels. Results revealed that finger millet is moderately tolerant to salinity and for better growth performance need slightly saline soils.

Key words: Finger millet, Salinity, Growth performances, Salt tolerance

Introduction

Soil salinity is one of the major agricultural problems affecting crop productivity worldwide and adversely affects the plant growth and development. Salinity impairs plant growth through osmotic effects, specific ion toxicities, and induced nutrient deficiencies (Munns, 2003).

Cereals are the world's major source of food for human nutrition. Among these, finger millet is grown as an important food crop in many developing countries of the tropics mainly in Africa and Asia. Millets are store-houses of nutrition. Hundred gram of finger millet contains 7.3 of protein (g), 3.6 of fiber (g), 2.7 of minerals (g), 3.9 of Iron(mg) and 344 Calcium(mg).Finger millet can be stored for many years under normal room temperature (Shobana *et al.*, 2013). It is extraordinarily superior to rice and wheat and therefore it is a good solution for the malnutrition and thus would highly contribute for the food security.

Finger millet can be grown on low fertility soils and grows better in the absence of chemical fertilizers in dry lands. It is popular among most of the dry zone farmers in Sri Lanka due to this low input nature of the crop. It has been reported that the soil salinity levels are increasing in the most of cultivating lands in dry zone (Thiruchelvam and Pathmarajah, 2000). These areas remained underutilized because most crops were unsuitable for growing under saline conditions. Therefore, it is important to identify any putative salinity tolerant or resistant finger millet varieties for cultivating in saline soils. Therefore, the present study was conducted to evaluate the vegetative growth performances of three finger millet varieties under different salinity levels.

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Materials and Methods

The research was carried out at Faculty of Agriculture, University of Ruhuna, Mapalana, Sri Lanka. Three finger millet varieties (Oshada, Ravi and Rawana) were used for this experiment and seeds were collected from *Angunakolapalassa* Research Station of the Department of Agriculture. Seeds were allowed to germinate in nursery trays and after 21 days, seedlings were transplanted to polythene bags which were filled only with sand. Diluted concentration of Albert solution was added once in two days before adding recommended concentrations to acclimate plants.

One week after transplanting recommended amount (10g dissolved in 4.5l of water) of Albert solution was added twice a week. Different salinity levels (0, 2, 4, 6, 8 ds/cm) were prepared by diluting sea water. Different concentrations of salt water were applied once in two days. Plants were uprooted two months after transplanting, number of leaves per plant, shoot height, shoot dry weight and root dry weight were recorded.

The experiment was designed as completely randomized design with three replicates. Data were analyzed using analysis of variance (ANOVA) and Duncan's New Multiple Range Test (DNMRT) at $P \leq 0.05$ was used as the mean separation technique.

Results and Discussion

According to the results of analysis of variance, interaction of salinity and varietal effect was significant for shoot height, root dry weight and number of leaves per plant. No significant effect of salinity on shoot dry weight was observed in any of the three varieties tested. Significantly higher shoot height was observed in variety Rawana and Oshada at 2ds/cm. Root dry weight of all three varieties showed increasing trend with increasing salinity level up to 4ds/cm and then decreased. When comparing all three varieties, variety Oshada showed significantly higher shoot weight, root weight, shoot height and number of leavers per plant and exhibited the best growth performance compared to other two varieties (Figure 1).

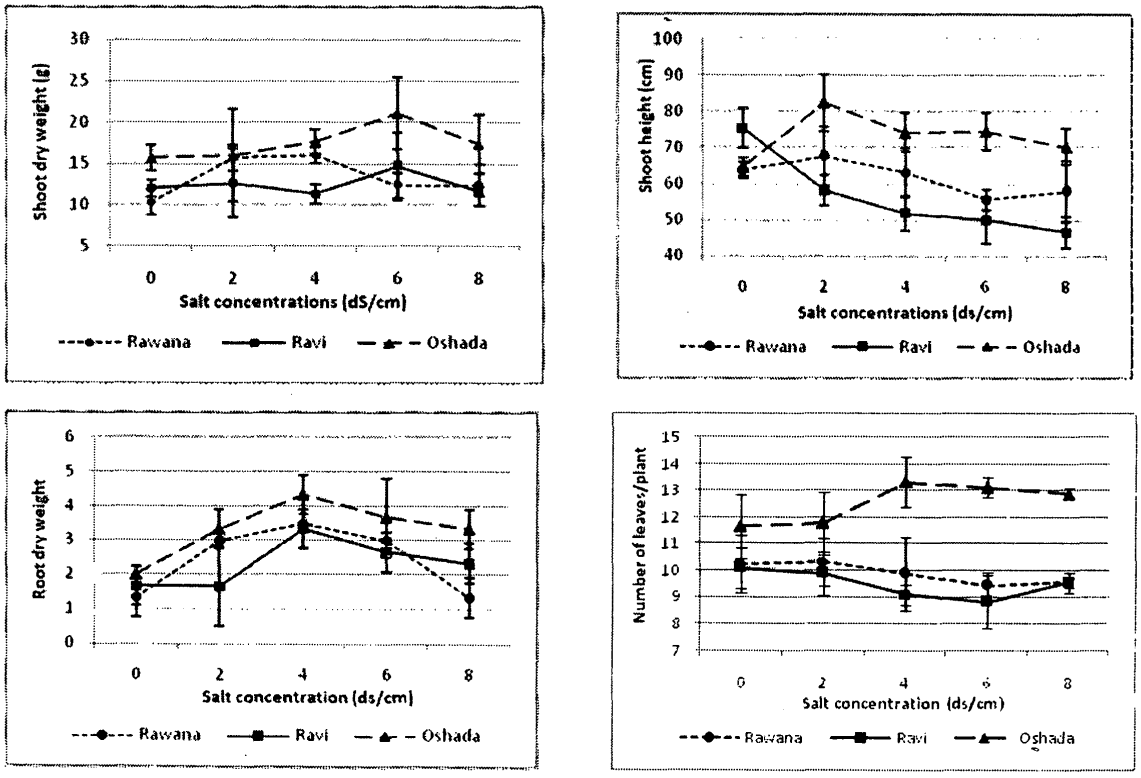

Figure 1. Effect of salt concentration on growth performances of three finger millet varieties

Reduction of growth and yield is a common response under saline conditions in most crops due to osmotic stress and the accumulation of toxic ions (Munns, 2013). According to an experiment conducted for three cowpea varieties by Hadi *et al.* (2012) under five NaCl salinity levels of 10, 20, 30, 40 and 50 mM the growth of cowpea decreased with increasing salinity levels. At 50 mM NaCl all varieties exhibited extremely poor performances. Yakubu *et al.* (2010) also reported that germination percentage, plant height, shoot and root dry weights significantly decreased in pearl millet with increasing soil salinity. Growth and grain yield of wheat significantly decreased with increasing salinity (Munns, 2003).

However, according to the results from the present experiment, finger millet is able to tolerate salinity condition up to some extent. Plants growing in a saline or sodic environment may face certain limitations, particularly in terms of root establishment and biomass production. Therefore, plant species that are able to colonize in salt affected soils without the need of external application of any chemical amendments are important for the stabilization and reclamation of the soil too. In this regard, finger millet is one of the most useful crops in reclaiming saline soils prior to growing other crops or pasture (Qadir and Qureshi, 1996).

According to the results, finger millet is moderately tolerant to moderate levels of salinity as it showed slightly better growth under slightly saline conditions. However, further studies should be carried out to evaluate growth performances as well as yield aspects of finger millet under different saline conditions. Out of the three varieties tested variety *Oshada* showed some degree of salt tolerance compared to varieties *Ravi* and *Rawana.*

References

Munns R, James RA 2003 Screening methods for salinity tolerance: A case study with tetraploid wheat. Plant Soil 253: 201–203.

Qadir, M. and Qureshi, R.H. 1996. Salt Tolerant Forage Cultivation on a Saline Sodic field for Biomass Production and Soil Reclamation. Land Degradation and Development.7: 11

Shobana, S., Krishnaswamy, K., Sudha, V., Malleshi, N.G., Anjana, R.M., Palaniappan, L., Mohan, V. 2013. Finger millet (Ragi, Eleusinecoracana L.): a review of its nutritional properties, processing, and plausible health benefits. *Adv Food Nutr Res.*69:12

Thiruchelvam, S. and Pathmarajah, S. 2000. An economic analysis of salinity problem in the mahawelli river H irrigation scheme in Sr Lanka. International Development Research Centre, Ottawa, Canad. www. tropicalclimate. org/mahawelisalinityreport.htm

Yakubu, H., Ngala, A.L. and Dugje, I.Y. 2010. Screening of Millet (Pennisetumglaucum L.)Varieties for Salt Tolerance in Semi-Arid Soil of Northern Nigeria. World Journal of Agricultural Sciences 6 (4): 374