Evaluation of Sorghum Genotypes (*Sorghum Bicolor*. L. *Spp)* for Salt Tolerance

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Introduction

- Sorghum (*Sorghum bicolor* L. Moench) is ranked 4th Globally and consumed by about 30% of the total world population
- Because the the crop is resilient to climatic changes and grows in many AEZs in Kenya, supporting many livelihoods, its taken as a climate smart crop
- Despite its importance and potential, salinity is a major abiotic challenge limiting its production mostly in the drylands
- Salinity has to be addressed, to increase its adoption, increase agricultural productivity and improve food security for the communities living in the ASALs
- This research is screening various sorghum varieties for their salinity and drought tolerance. This varieties will be important for food security in the marginal drylands of the rift valley

Study Objectives

Overall objective

To contribute to increased food security and enhanced resilience of households to the effects of climate change through adoption of saline tolerant sorghum genotypes.

Specific objectives

1. To determine the effect of Na^+ and Cl^- ions on seed germination and seedling establishment of sorghum genotypes

2. To determine the effect of saline soils on growth and yield of sorghum genotypes.

3. To determine physiological and biochemical processes of salt tolerance in sorghum genotypes.

Materials and methods

- Study site: Baringo County
- The study used 250 genotypes, selected on the basis of origin to capture possible traits diversity.
- Lab experiment laid down in CRD factorial arrangement, 4 NaCl levels (0, 3, 5, 7) dSm^{-1} dissolved with distilled water until the level is reached by checking using Electrical Conductivity (EC) meter
- Ten seeds per genotype were placed in petri dishes, moistened and place in an incubator to germinate for 3 days
- Germinated seed determine daily for 3 days
- 4 Seedlings of each germinated genotype, transplanted into test tubes for 5 days. Full strength hydro A and B nutrients.
- Data collection: germination percentage, root length, shoot length and root hairs number
- Data analyzed using SAS version 9.2

Results and Discussions

Fig 1.1: Effects of salinity on germination of sorghum genotypes

- Germination was negatively affected by salinity at $P<0.05$ and $P<0.01$
- At higher salinity levels, tolerant genotypes exhibited higher percentage
- Salinity stress act as inhibitor by stopping germination without loss of viability or delaying where not avoided
- Reducing osmotic potential and water absorption causing embryo toxicity (Bajji *et al*., 2002, khayamim *et al*., 2018)

Results and discussion

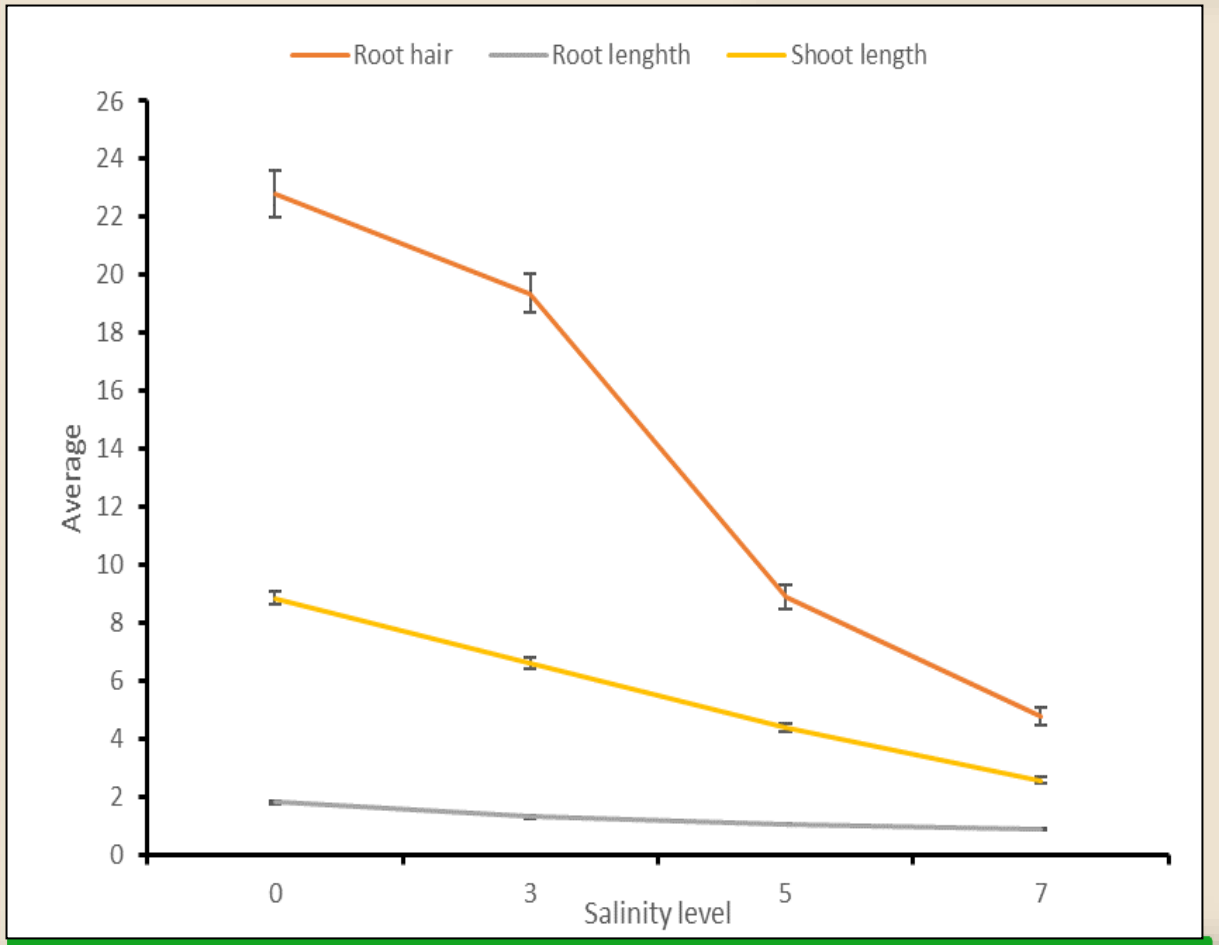

Fig 1.2: Effect of salinity on the number of root hairs, root length and shoot length of sorghum genotypes

- Increased NaCl concentration reduced root and shoot growth at $P<0.05$ and $P<0.01$
- However, percent reduction was lower in salt tolerant genotypes
- Reduction in growth is due to osmotic injury or ion toxicity (zhang *et al*., 2014)
- Increased tissue maintenance as a mechanism for tolerance

Results and Discussions

Variables	Root hair	Root length	Shoot length	Germination
Root hair				
Root length	0.73***			
Shoot length	0.27***	0.37***		
Germination	0.23***	0.25***	0.13***	

Table 1: Pearson correlation matrix between number of root hairs, root length and shoot length and germination. ***, significant at P≤0.001

- Positive correlation between germination percent and root hairs number, root length and shoot length
- The high effect on root hairs and root length can be ascribed to direct salinity exposure
- Decreased relative water content, reduced potential water gradient, reduced shoot length (Nxele *et* al., 2017, Mbinda & Kimtai 2019)

Conclusion and Recommendations

- *Sorghum's* tolerance to salinity is highly genotype based, differential in germination and early seedling development
- There is existence of large genetic variation for salt tolerance among the genotypes that can be used for the development of varieties suitable for the marginal areas. This will contriobute to food security
- Variability can be explored during early seedling development
- To identify sources of tolerance, larger number of *Sorghum* genotypes be considered in future research

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