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Physiological Responses and Ion Accumulation of Twelve Sweet Potato Clone Subjected to Salinity

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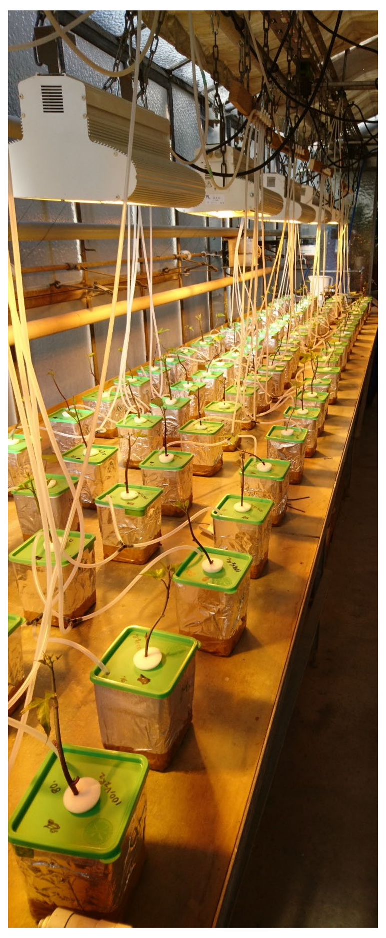
Introduction

Salinity is a severe threat to coastal agriculture in mega deltas of Asian large rivers. Here, dry season agriculture often includes tuber crops such as sweet potato, threatened by salt intrusion either from inherent soil salinity or through irrigation.

Screening tools to identify sweet potato varieties relatively tolerant to salinity are urgently needed for future food security.

In this study, we subjected 12 contrasting sweet potato clones from the Bangladesh Agricultural Research Institute to elucidate potential salt tolerance mechanisms suitable for screening.



Conclusions

- In general, sweet potato responds strongly to moderate levels of salinity
- Genotypes differ strongly in salinity threshold and slope
- Potassium uptake is severely affected by salinity
- Total shoot K/Na ratio under moderate salinity may serve as a proxy to identify tolerant genotypes
- More research is needed to elucidate the mechanisms behind differences in slope

Results and Discussion

Table 1 Mean genotypic responses of sweet potato to various levels of salinity. Means of 12 varieties ± standard error N = 36

	Treatment, NaCl (mM)				
Unit	0	50	100	150	LSD
Dry weight, mg	7058 a±197	6712 a±166	4735 b±205	2784 c±161	404
Vine length, cm	73 a±4	68 a±4	56 b±3	43 c±3	7
Leaf area, cm^2	689 a±27	626 b±43	438 c±38	176 d±34	56
Leaf dry weight, mg	1934 a±109	1630 b±117	1015 c±100	442 d±85	175
Specific leaf area, cm^2g^{-1}	384 ab±20	400 a±21	342 b±29	188 c±31	49
SPAD	114 a±4	95 b±5	76 c±7	37 d±7	11
Leaf number	21 a±1	18 b±1	14 c±1	6 d±1d	2
Root dry weight, mg	1008 a±60	1075 a±58	764 b±47	421 c±28	92

Means across all genotypes showed, salinity significantly negatively affected all morphological traits studied.

With increasing salinity K uptake was linearly reduced. Na and Cl uptake did not differ much among salinity levels

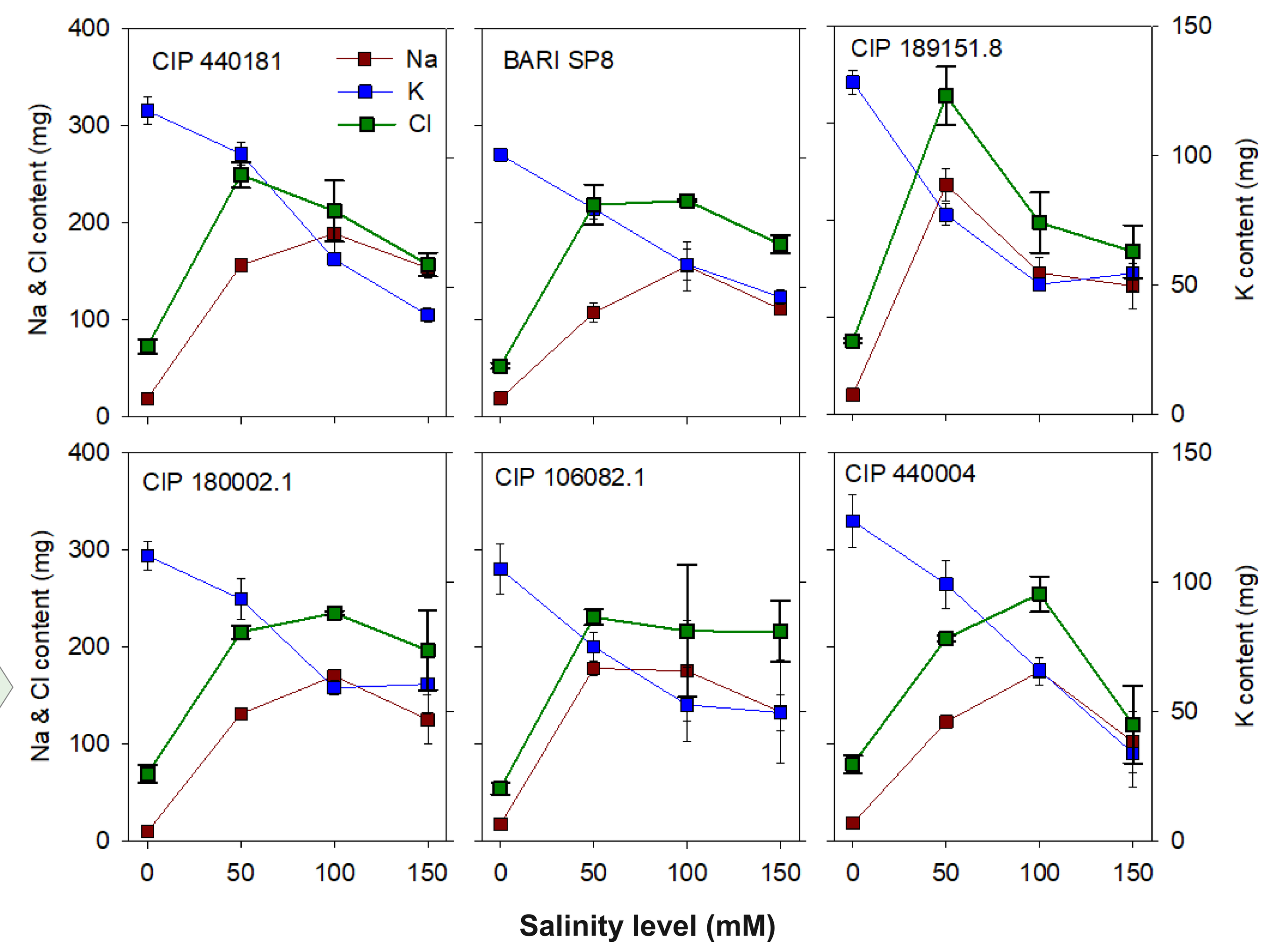


Figure 2 Total shoot K, Na and Cl uptake, exemplarily shown for 6 genotypes subjected to increasing levels of salinity. Values represent genotypic means, error bars = SE, n = 3

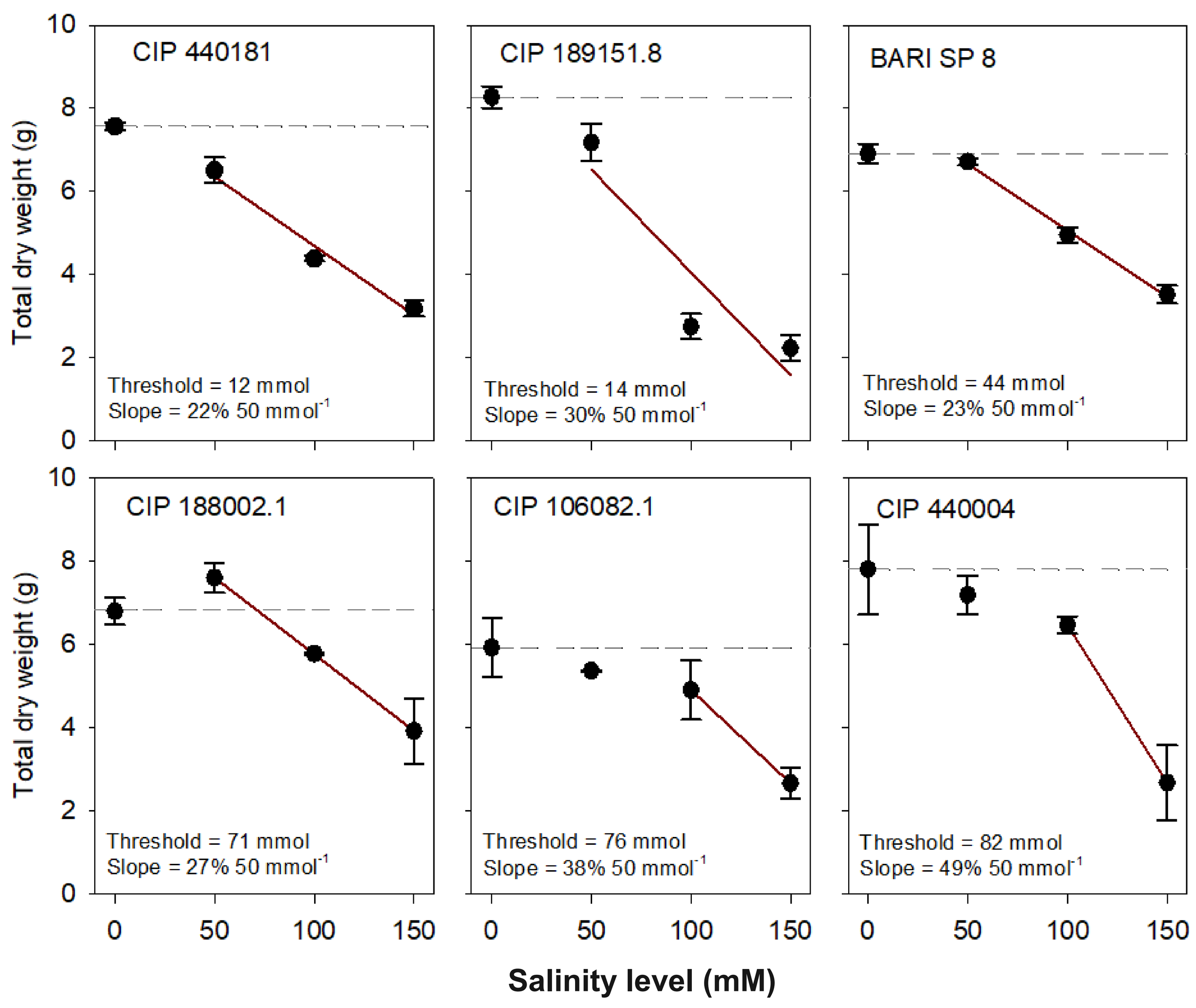


Figure 1 Threshold and slope derived exemplarily shown for six contrasting genotypes by regression analysis. Values represent genotypic means, error bars = SE, n = 3

Genotypes differed strongly in the treshold for salinity damage and the slope for dry matter reduction at increasing salinity.

Regression analysis revealed the K/Na ratio at the genotypic thresholds. This K/Na ratio was negatively linearly correlated with the genotypic threshold

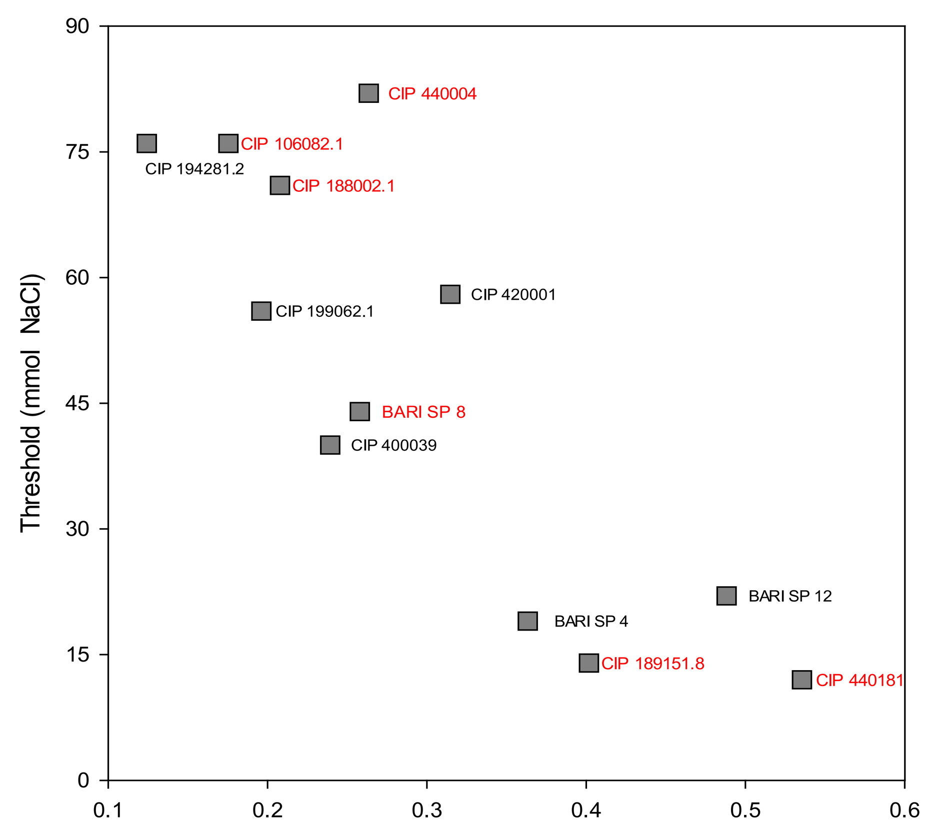


Fig 3 K/Na ratio vs threshold accros all the genotzpes where red color indicates six selected clones.sweet potato genotypes were measured for ion concentrationand different ratios under different salt levels. Mean ± S.E (n=3), each sample contained roots at least three plants.

Materials and Methods

In a greenhouse study at the University of Hohenheim, 12 contrasting clones of sweet potato were subjected to 0mM, 50mM,100mM and 150mM salt stress under hydroponic conditions. Plants were sampled after three weeks of salt stress. Dry matter was determined after drying to constant weight at 75°C. Finely ground samples were extracted by autoclave. K and Na were determined by flame photometry and Cl was determined using an autoanalyzer.