Physiological parameters of salt tolerance of Sorghum: water status and gas exchanges

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INTRODUCTION

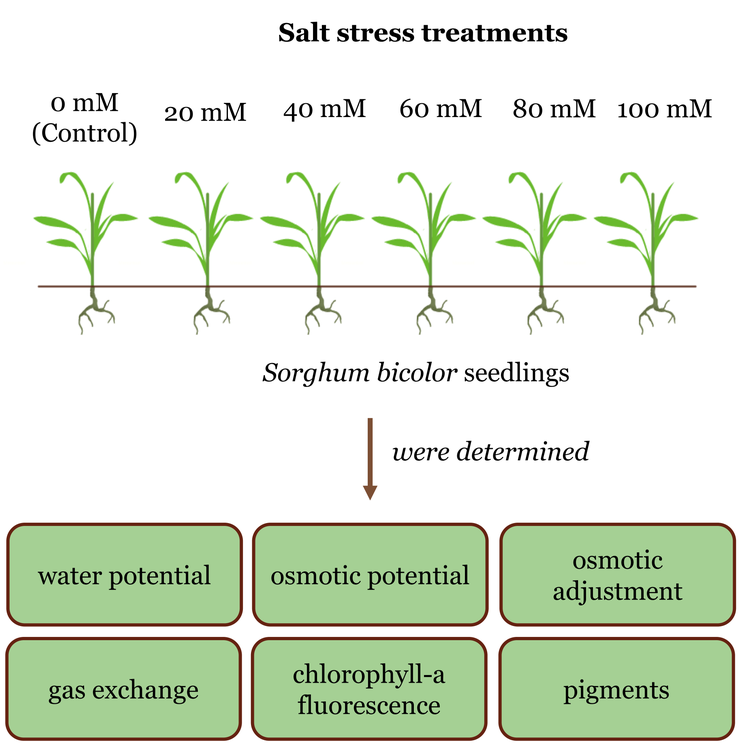
Salinity is one of the major environmental constraints, compromises soil quality and consequently agricultural productivity worldwide.

Sorghum bicolor (L.) Moench is a C4 fodder with moderate resistance to salinity; however, the mechanisms underlying the salt tolerance in sorghum plants need further investigation.

In this study, we aimed to elucidate mechanisms regulating the adaptability *S. bicolor* to salt stress.

METHODOLOGY

The experiment was designed in a randomized block design, with 5 replicates. Sorghum seedlings grown in greenhouse and were treated with seven concentrations of NaCl saline solution (0, 20, 40, 60, 80 and 100 mM).



The data were analysed normalized by the Kolmogorov-Smirnov test. One-way ANOVA was used to test the differences between control and NaCl-treated followed by Tukey post hoc test at $p < .05$.

Correlation tests were performed. Linear and quadratic polynomial regression analysis was performed.

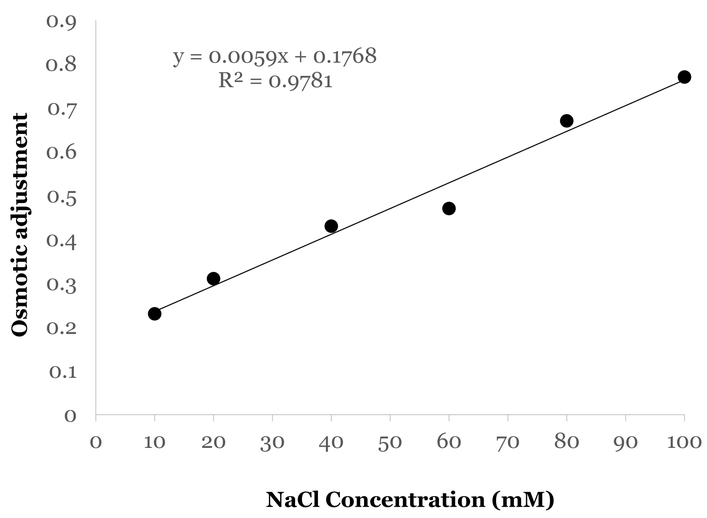


Fig 1 Osmotic adjustment (OA) of *S. bicolor* plants under different NaCl treatments for 55 days.

MAIN RESULTS

External NaCl treatments had no adverse impact on leaf relative water content, and this resulted from lower leaf osmotic potential.

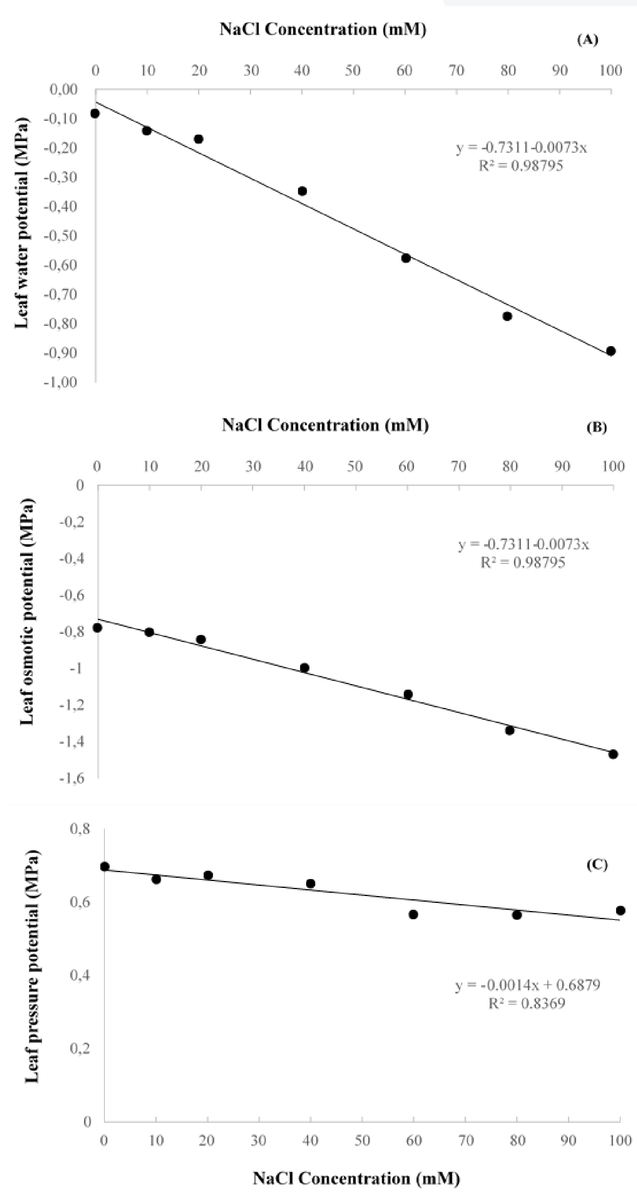


Fig 2. Water potential (A), osmotic potential (B) and pressure potential (C) in leaves of *S. bicolor* seedlings under different NaCl treatments for 55 days.

The results showed that irrigation with saline water reduced gas exchanges and increases water use efficiency.

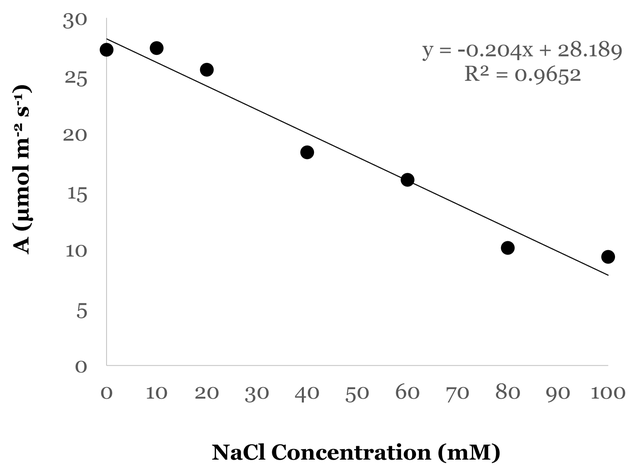


Fig 3. Net photosynthesis rate (A) of *S. bicolor* plants under different NaCl treatments for 40 days.

With increasing salinity, sorghum can maintain photosynthetic efficient and enhance osmotic adjustment which contribute to improvement of plant water status.

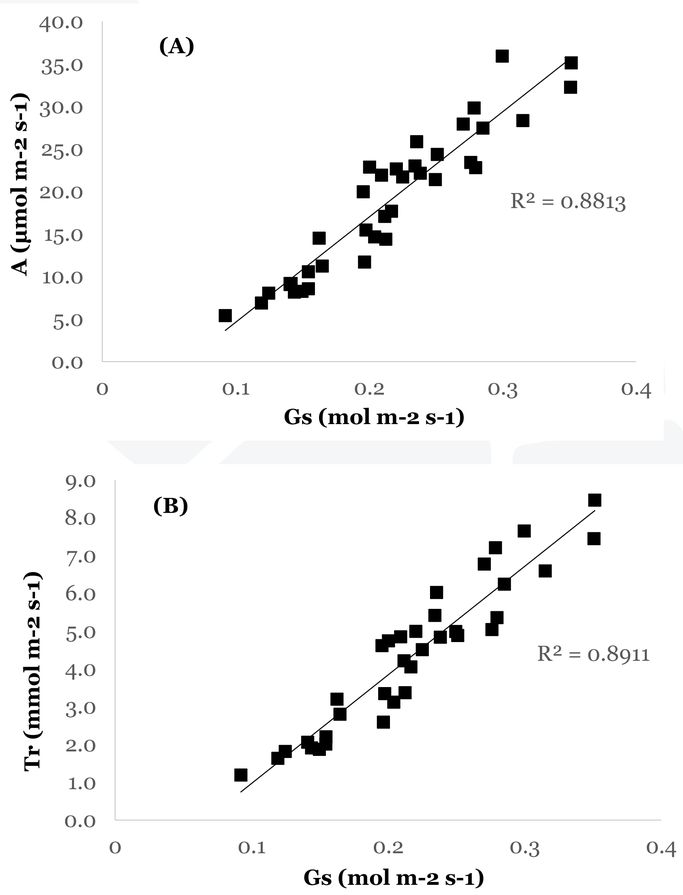


Fig 4. Correlation between rate of photosynthesis (A)-Stomatal conductance (Gs) (A) and Transpiration (Tr)-Stomatal conductance (Gs) (B) of *S. bicolor* seedlings under different NaCl treatments for 45 days.

Table 1. Chlorophyll-a fluorescence of *Sorghum bicolor* as a function of salinity of irrigation water

NaCl (mmol L⁻¹)	Fo	Fm	NPQ	Fv/Fm	Fo/Fm
0	7438 a	33995 a	0.37 a	0.78 a	0.22 a
10	6963 ab	32797 ab	0.42 a	0.78 a	0.21 a
20	6801 ab	31205 bc	0.38 a	0.78 a	0.22 a
40	6840 b	30936 bc	0.36 a	0.78 a	0.22 a
60	6704 b	30573 c	0.35 a	0.78 a	0.22 a
80	6664 b	29776 c	0.38 a	0.77 a	0.22 a
100	6578 b	29157 c	0.36 a	0.77 a	0.22 a
CV (%)	4.65	3.34	15.41	1.68	1.42

Fo = initial fluorescence (adapted in the dark); Fm = Maximum fluorescence (adapted in the dark); NPQ = non-photochemical quenching, equals (Fm-Fm')/Fm' where Fm' = maximum fluorescence (not clear); Fv/Fm = Quantum Efficiency of Photosystem (Ph) II; Fv = increase in fluorescence, is equivalent to Fo-Fm. Same letters among EC treatments did not differ from each other, by Tukey's test at 0.05.

CONCLUSIONS

The osmotic adjustment is the main strategies physiological for *Sorghum bicolor* adapting to saline environments.

The maintenance of photosynthetic efficiency could also help plants cope with salt stress, implying that can be an important mechanism in salt tolerance of *S. bicolor*.

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