Mitigation of salinity stress in sorghum (S*orghum bicolor* L. Moench) using phytohormones

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Introduction: Salinity stress is one of most detrimental abiotic stressors at the forefront of deterring crop productivity and, subsequently threatens food-security globally. Arable lands are expected to deteriorate due to increasing salinisation. Additionally, a severe influx in crop productivity is required to feed the expected 9.8 billion people by 2050 (*UN DESA*, 2017). More than 50% of crops have been lost due to drought and salinity stress and is expected to worsen due to the changing climate (Shrivastava & Kumar, 2015). Salinity stress management is therefore, one of the important topics that should be prioritised by research to strengthen food security. Plants have adapted various coping mechanisms under stressful conditions. One of which is elevated levels of signalling molecules such as phytohormones triggering a network of molecules to alleviate the effects of stress. This study is aimed at investigating the effect of methyl jasmonate (MeJA), a phytohormone on the growth and development of *Sorghum bicolor* under saline conditions.

Methodology: *S. bicolor* was pre-treated with various concentrations of MeJA (10, 15 and 20 µM), grown in pottingsoil and exposed to various salt concentrations (0, 100 and 200 mM NaCl). The biochemical responses of *S. bicolor* were analysed by measuring osmolyte, oxidative stress, and photosynthetic pigments parameters. Physiological and morphological behaviour was assayed including biomass, epidermal imaging and elemental accumulation using Scanning Electron Microscopy-Energy Dispersive X-ray spectroscopy. The transcript levels of various jasmonate related genes of *S. bicolor* including lipoxygenase (*SbLOX*), allene oxide cyclase (*SbAOC*), allene oxide synthase (*SbAOS*) and oxophytodienoic acid reductase (*SbOPDR*) was quantified using Real Time-quantitative polymerase chain reaction (RT-QPCR).

Results: Salinity stress induced reactive oxygen species (ROS) indicated by increased H_2O_2 precipitation on leaves, and damage to membrane lipids indicated of increased malondialdehyde content (45.76%). Salinity also increased proline content (203.08%), while chlorophyll content (44.57%) reduced. Methyl jasmonate pretreated *S. bicolor* showed improved growth and development under salinity stress, as indicated by induced biomass. It furtherled to the reversal of many deleterious effects of salinity stress on plant metabolism such as reduced H_2O_2 precipitation, MDA content, proline content, whereas chlorophyll content was increased. *SbLOX*, *SbAOC*, *SbAOS* and *SbOPDR* transcript levels were induced in the shoots of *S. bicolor* seedlings exposed to salt stress and a further increase in JA-related genes was observed in MeJA pre-treated *S. bicolor* under salt stress.

Discussion and conclusion: High levels of salinity stress proved detrimental to *S. bicolor,* but pre-treatment with MeJA was able to ameliorate the harsh effects of salinity on *S. bicolor*. Findings in this study will help in fully elucidating the mechanism of MeJA in conferring stress tolerance to plants. The innovative information will aid in the establishment of crops with enhanced quality and yield, and ultimately in strengthening food security globally.

References

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World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100. United Nations Department of Economic and Social affairs [UN DESA] (2017). New York, NY. Available at https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html.. [Accessed December 06, 2021]