Salinity stress-mediated phenotypic, biochemical and microscopic assessment of two flaxseed cultivars having contrasting lignan content

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Abstract:

On the verge of the United Nations' predicted upcoming food scarcity, research regarding plants' potentiality to withstand environmental stresses to provide better yield has immense importance. In this context, plant lignans are such substances of great potential that possess multifunctional roles towards different organisms including plants and humans. Lignans accumulate in plants and primarily act as defence substances during abiotic stresses. Flaxseed (*Linum usitatissimum* L.) is a rich source of lignans. However, the lignan contents are dependent on plant genotypes. Therefore, this report searched for the answer to the question – "under salinity stress, how much better a high lignan-containing flaxseed genotype adapt than a low lignan-containing flaxseed genotype?". Various phenotypical, biochemical and microscopic assays were applied to determine the salinity stress-responsiveness between the two chosen flaxseed genotypes, Flanders and Astella, having contrasting lignan content. Comparative phenotypic analyses for shoot length, root length, root diameter, root volume, root branches, leaf number and leaf relative water content revealed a differential morphological expression between the two genotypes under stress. ROS-related biochemical assays depicted higher quantities of total contents of antioxidants, polyphenols and phenolic acids in Flanders under stress, indicating a better ROS mitigation capability. FDA-PI staining-coupled fluorescence microscopy of stressed root visualized stress-induced cell damage, especially in the peripheral sections of the roots. However, despite salt stress-induced cell death, the root tip was alive, possibly to mitigate the harmful effect of salt stress and to search for nutrients to keep the plant alive. The results depict that flaxseed genotypes having contrasting lignan content react differently under stress. More biochemical and genomic analyses are needed to assess the actual stress-mitigating capabilities of these two genotypes.

Keywords: flaxseed; salinity stress; lignan; plant phenotyping; ROS; FDA; PI