

Impact of Folic Acid in Modulating Antioxidant Activity, Osmoprotectants, Anatomical Responses, and Photosynthetic Efficiency of *Plectranthus amboinicus* Under Salinity Conditions

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Salinity is a major threat to the sustainability of agricultural production systems. Salt stress has unfavorable implications on various plant physio-morphological and biochemical reactions, causing osmotic and ionic stress. Exogenously applied folic acid (FA) may at least provide one mechanism to evade the injurious stress effects of saline irrigation water on *Plectranthus amboinicus*. In this regard, two pot trials were performed during the 2018–2019 and 2019–2020 seasons in an open greenhouse of an experimental farm (29°17'N; 30°53'E) in Fayoum, Egypt. We tested four levels of saline irrigation water (SW): 34, 68, and 102mM NaCl, plus tap water as the control = 0), combined with FA at three concentrations (25 and 50µM, plus spray with distilled water as the control = 0). The growth parameters, biochemistry, physiology, elemental leaf status, essential oil content, and anatomical responses were assessed. Salt markedly reduced photosynthetic productivity [Fv/Fm and performance index (PI)], total chlorophyll [soil plant analysis development (SPAD)], and leaf osmoprotectant compounds, i.e., total soluble sugars (TSS), free amino acids, proline, and total phenolics, thus hampering *P. amboinicus* growth and essential oil yield. However, the addition of FA as a foliar spray to *P. amboinicus* irrigated with saline water induced increases in Fv/Fm, SPAD, and PI. These were linked with enriched stem anatomical structures, leaf osmoprotectant compounds, and enhanced leaf enzymatic activity, e.g., superoxide dismutase, catalase, ascorbate peroxidase, glutathione reductase, glutathione, ascorbic acid, and antioxidant content. Under salt stress, supplementation of 25 and 50µM FA increased the growth and production of essential oil by 27.8 and 55.6%, respectively, compared with no applied FA. The highest growth characteristics and elemental leaf contents were obtained when *P. amboinicus* was irrigated with 0mM saline water and treated foliarly with 50µM of FA compared with non-treated plants. Overall, these data showed that foliar spraying with FA reduces the impact of salt stress on *P. amboinicus* irrigated with saline water.