Combined effects of biostimulants, N level and drought stress on yield, quality and physiology of greenhouse-grown basil

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Precise nitrogen (N) supply is an agronomic practice of crucial importance to achieve optimal crop performance without compromising product quality. However, excessive use of synthetic N fertilizers may have deleterious effects on both agroecosystem and human health. Thus, the development and use of strategies aiming to ameliorate the losses caused by water constraints and N deficiency are essential for fostering resilient and sustainable agroecosystems. In this regard, the impact of three drought stress levels (DS) [100%, 80% and 60% of the field capacity (FC)] in combination with four N supply rates (0, 50, 100 and 150 kg ha^{-1}) on sweet basil cultivated in a protected environment was investigated. The interactive biostimulatory action of Kelpstar® seaweed extract (SWE) and Tyson® protein hydrolysate (PH) was also explored. The study focused on the effects of these treatments on yield, physiological attributes, functional traits, and volatile compounds profile. Drought stress led to a reduction in yield by 12.5% and 21.1% under irrigation at 80% and 60% FC, respectively, compared to well-watered plots (100% FC). Furthermore, DS levels linearly decreased total leaf area, stomatal conductance, nitrogen use efficiency (NUE), and volatile compounds. Conversely, an increase in N application rate positively influenced yield, total leaf area, specific leaf area (SLA), total chlorophyll, nitrate content, and the presence of specific volatile compounds, such as 1-octen-3-ol and α-bergamotene, when compared to no N application. The SwE application caused an upsurge in yield, stomatal conductance, WP, total chlorophyll, nitrate, phenolics, ascorbic acid, as well as, 1-octen-3-ol, β-cis-ocimene, linalool and eugenol, compared to the control. Similarly, PH increased yield, stomatal conductance, WP, total chlorophyll, phenolics, ascorbic acid, β-cis-ocimene and eugenol, compared to the control. Notably, the increased yield, improved quality, and enchanced physiological traits observed after biostimulant application, especially under drought stress or N deficiency conditions, underscore the potential role of biostimulants in increasing resilience of basil plants. Thus, the foliar application of SWE and PH offer a valuable strategy for enhancing plant yield and quality under sub-optimal conditions, while simultaneously enhancing water and N use efficiency.