Abstract No: BO-07

Alleviation of drought stress on immature tea (*Camellia sinensis*) plants by exogenous application of Abscisic acid (ABA)

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Phytohormones are chemical substances regulating various physiological and biochemical processes in plants. Abscisic acid (ABA) plays a major role in response to drought stress. This study was done to identify the role of exogenous ABA application in immature tea during progressive drought. The experiment was conducted in a glasshouse at the Tea Research Institute of Sri Lanka, using one-year-old potted tea cultivars, TRI 2025 (drought tolerant) and TRI 2023 (drought susceptible). Plants were brought to field capacity and exposed to a drying cycle by withholding water. When plants achieved moderate moisture stress (volumetric water content around 25% in soil), plants were foliar sprayed with ABA at various concentrations [0 (water-spray – WS), 50, 100, 150 and 200 ppm] along with well-watered (WW - positive control) and no-spray (NS - negative control) treatments. Data were collected at 18 hours and 3, 7, 14 and 21 Days After Spraying (DAS) from randomly selected plants arranged according to Randomized Complete Block Design with 2 blocks and 24 replicate plants per cultivar per treatment. At 21 DAS, plants were re-watered, and the recovery was visually assessed after another 7 days. Physiological and biochemical parameters were measured (9.00 am to 12.30 pm) along with soil moisture content. Maintenance of comparatively a higher relative water content was observed in tea plants treated with 100, 150 and 200 ppm ABA. Although the reduction of gas exchange parameters was initially higher in ABA treated plants, it was significantly lower at later stages with progressive drought. Application of ABA in concentrations of 100 - 200 ppm resulted in comparatively higher photosynthetic rates and stomatal conductance at latter stages (14 DAS and 21 DAS). It was observed that the application of ABA did not improve osmolytes accumulation in tea under drought. At latter stage, 100 - 200 ppm ABA treated plants exhibited comparatively higher total chlorophyll and polyphenolic content in both cultivars compared to NS and WS treatments. Similarly, ABA treatments significantly increased antioxidant activity over NS and WS treatments towards the latter stage of drought. The maintenance of significantly lower dark respiration and higher recovery percentages were also observed in ABA (100 - 200 ppm) sprayed plants. Therefore, it can be concluded that ABA foliar application improves water retention and gas exchange parameters while preserving antioxidant capacity resulting restricted risk of oxidative damage under drought. The exogenous ABA application ameliorates the adverse effects of drought stress and improves drought tolerance in immature tea plants. The levels of 100 - 200 ppm concentration of ABA was better in terms of physiological and biochemical alteration and recovery under drought stress in both tea cultivars. Accordingly, considering the cost factor, the application of 100 ppm ABA can be recommended to use as a potential tool to minimize the drought stress effects in immature tea plants.

Keywords: Abscisic acid, Drought, Immature tea, Physiological responses, Plant hormones,

Acknowledgement: Financial assistance from the Tea Research Institute is acknowledged.