

ABSTRACT

Two field experiments were conducted during 2018/2019 and 2019/2020 in a private farm, Sennouris District, Fayoum, Egypt, to study the integrative impact of sulphur and boron on morphological characteristics, Plant Water Status (RWC and MSI), leaf photosynthetic pigments content, Photosynthetic efficiency, root betalains pigment content (betacyanin and betaxanthin), leaf N, P, K, S, Ca and B contents, total soluble sugars in leaves and roots, free proline, AsA, GSH, enzymatic antioxidants assays { (SOD), (CAT), (APX), (GPX) } and protein, and yield and its segments of red beet plants (*Beta vulgaris* L. cv. Deitroit Superene). The experimental design used was a split-plot in randomized complete blocks with three replications. Sulphur levels (0 and 150 kg fed⁻¹) were distributed in the main plots, while boron concentrations (0, 50, 100, 200, 300 and 400 ppm) were randomly allocated to the sub-plots. Each experimental unit was planned to cover an area of 16.8 m² including six rows of 4 m long and 0.70 m wide. During soil preparation for planting of red beet, the sulphur were broadcasted and incorporated, while the boron concentrations were foliarly sprayed, to run off, three times; 30, 45 and 60 days after seed sowing of red beet.

The supplemented soil with 150 kg fed⁻¹ sulphur gave the highest significant values on morphological characteristics, Plant Water Status, leaf photosynthetic pigments content, Photosynthetic efficiency, root betalains pigment content, leaf N, P, K, S, Ca and B contents, total soluble sugars in leaves and roots, free proline, enzymatic antioxidants assays, and protein, and yield and its segments as compared to soil without sulphur treatment, except leaf area leaf⁻¹ and photosynthetic responses (Fv/Fm) were not significantly affected. Whereas, the supplemented soil with sulphur significantly decreased leaf chlorophyll b and roots yield fed⁻¹ of < 4 cm diameter.

Foliar application of boron at 200 ppm was significantly recorded higher mean values of previously mentioned measurements as compared to other concentrations of boron. Except for foliar spraying with boron at concentration of 50 ppm gave higher values in number of roots of < 4 cm diameter per 1 m², and the concentration of 400 ppm boron was given higher mean values in fresh weight of roots per 1 m² and fed⁻¹ of < 4 cm diameter.

Generally, soil supplemented with 150 kg fed⁻¹ sulphur in integration with foliar application of boron at 200 ppm showed enhanced availability of microelements and plant physio-biochemical components, which reflected in high growth and productivity of red beet plants under conditions of Fayoum Governorate.

Key Words: Red beet plants (*Beta vulgaris* L.), Sulphur, Boron, Morphological characters, Membrane permeability (RWC and MIS), Leaf photosynthetic pigments, Enzymatic antioxidants assays (total soluble sugars in leaves and roots, free proline, (AsA), (GSH), (SOD), (CAT), (APX), (GPX), protein), Root betalains pigment (betacyanin and betaxanthin) content, Leaf N, P, K, S, Ca and B contents and yield and its segments.