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ORIGINAL PAPER

Evaluation of the effects of molybdenum on the growth and development of cotton (*Gossypium hirsutum* l.) plant grown in calcareous soils, and on soil enzyme activity*

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Abstract

This study evaluated the effects of molybdenum (Mo) applications at different doses (via seed, foliar, and soil routes) on cotton plant growth and development, and on the soil parameters. The plant traits examined included plant height, fresh and dry weight of the plant, root length, fresh and dry root weight, stomatal conductance, SPAD value, leaf area, while the soil parameters consisted of the activities of soil enzymes (urease, dehydrogenase, and catalase), soil pH, and electrical conductivity (EC). The results demonstrated that Mo applications significantly improved plant height, root length, fresh and dry root weight, as well as fresh and dry plant weight. The greatest improvements in these parameters were induced by an application of 50 μg kg^{-1} Mo to the soil, while the lowest increase was recorded following a foliar application of 25 μg kg^{-1} Mo. The soil application of 50 μg kg^{-1} Mo resulted in significant increases, particularly in plant height, root length, and biomass (fresh and dry weight). In terms of stomatal conductance, SPAD value, and leaf area, increases were observed across all application methods. The highest SPAD value was obtained with a foliar application of 50 μg kg^{-1} Mo, while the most significant increases in stomatal conductance and leaf area were induced by the same dose applied to the soil. Regarding soil enzyme activities, soil application of Mo ensured the highest increases in urease and catalase activities, highlighting its role in the nutrient cycling and organic matter decomposition. The greatest increase in dehydrogenase activity was recorded after a foliar application of 50 μg kg^{-1} Mo. Overall, the findings showed that the most pronounced improvements in plant growth, biomass, and soil enzyme activity parameters were achieved with the soil application of 50 μg kg^{-1} Mo. These results emphasize the critical role of soil-based molybdenum supplementation in optimizing plant growth, enhancing yield, and promoting soil health. Molybdenum is highlighted as a vital component in sustainable agricultural practice and soil fertility management.

Keywords: soil enzymes, plant growth, foliar fertilization, pH, molybdenum

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