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Effect of addition of EDTA on calcium absorption by mung plants (*Vigna radiata*)

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Soil is capable of supporting plant life by supplying various factors including water and nutrients. Soil contains various mineral species such as H^+, Ca^{2+}, Mg^{2+}, K^+, Na^+, Fe^{2+}, Mn^{2+} that adhere to the soil particles and most are present as free ions in the aqueous portion of soil. Calcium is a unique and essential macronutrient for plants. It is required for physiological and biochemical processes and is a defensive agent as well. Insufficient calcium leads to deterioration of the cell membrane. Hence calcium is an important structural component of plants. It acts as a secondary messenger and regulates functions inside the plant cells. Availability of Ca^{2+} for plants is reduced due to the formation of stable, insoluble complexes with PO_4^{3-} or other ions present in soil. Chelation of Ca^{2+} with EDTA to form the Ca-EDTA complex increases its solubility and mobility, thus increasing the availability for crops. It is a currently used technique in large scale agricultural fields. However an in-depth study of the effect of addition of excess EDTA has not been reported.

An EDTA concentration series with the combination of several Ca^{2+} concentrations were used for the study to investigate the effect caused by EDTA on calcium absorption, using pot experiments with mung bean (*Vigna radiata*) as the experimental plant. Planted soil after 10, 20 and 30 days of plantation was tested for conductivity, water soluble and exchangeable Ca^{+2} in soil.

The maximum tolerable EDTA concentration for the selected mung plants was 1.00 mmol/kg and tolerable Ca^{2+} concentration was less than 0.025 mol/kg, under experimental conditions. Higher soil conductivity was shown for the 0.50, 0.75 and 1.00 mmol/kg EDTA concentrations with the combination of 12.50 and 18.75 mmol/kg Ca^{2+}. The highest value was recorded for the 1.00 mmol/kg EDTA- 18.75 mmol/kg Ca^{2+} combination. The increased water solubility of Ca^{2+} was recorded with the increased EDTA concentrations and the maximum value was shown in the 1.00 mmol/kg EDTA- 18.75 mmol/kg Ca^{2+} combination. Similarly the maximum exchangeable Ca^{2+} was also found in the same combination. A higher deposition of Ca^{2+} was found in plant shoots than in roots and the maximum absorption was shown in 1.00 mmol/kg EDTA, with each Ca^{2+} series. The overall results showed higher availability of Ca^{2+} in soil due to the addition of EDTA. However, the addition of excess EDTA can reduce the available Ca^{2+} under field conditions due to leaching. Increased EDTA concentrations increased the availability of the Ca^{2+} but very high levels were toxic.

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