

The environmental and agronomic impacts of γ -PGA on agricultural soils

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To demonstrate the responses of plant (Pakchoi) and soil to poly- γ -glutamic acid (γ -PGA) is essential to better understand the pathways of the promotional effect of γ -PGA on plant growth. In this study, the effects of γ -PGA on soil nutrient availability, plant nutrient uptake ability, plant metabolism and its distribution in a plant-soil system were tested using labeled γ -PGA synthesized from ¹³C₁-¹⁵N-L-glutamic acid (L-Glu). γ -PGA significantly improved plant uptake of nitrogen (N), phosphorus (P), and potassium (K) and hence increased plant biomass. γ -PGA greatly strengthened the plant nutrient uptake capacity through enhancing both root biomass and activity. γ -PGA affected carbon (C) and N metabolism in plant, which was evidenced with increased soluble sugar contents and decreased nitrate and free amino acids contents. About 26.5% of the γ -PGA-N uptake during the first 24 h, after γ -PGA application, was in the form of intact organic molecular. At plant harvest, 29.7% and 59.4% of γ -PGA-¹⁵N was recovered in plant and soil, respectively, with a 5.64% of plant N nutrition being derived from γ -PGA-N. The improved plant nutrient uptake capacity and soil nutrient availability by γ -PGA may partly explain the promotional effect of γ -PGA, however, the underlying reason may be closely related to L-Glu.