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MITIGATION OF HEAVY METAL ACCUMULATION IN RICE GRAIN WITH SILICON IN ANIMAL MANURE FERTILIZED FIELD

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Abstract

Animal manure is widely used as organic fertilizer for crops. However, high concentrations of heavy metals in animal manure are of great concern. In this study, we found that chicken and pig manure compost contain high concentrations of arsenic (As), cadmium (Cd), copper (Cu) and zinc (Zn), and the concentrations of these heavy metals in the pig manure were higher than those in the chicken manure. Chicken or pig manure compost fertilization elevated the concentrations of these heavy metals in the paddy soil and polished rice grains. Silicon (Si) application at the tilling stage significantly mitigated the accumulation of As, Cd, Ni, Cu and Zn in polished rice grains. In the chicken manure-fertilized rice grains, Si application decreased As, Cd, Ni, Cu and Zn concentrations by 25.9%, 29.6%, 33.4%, 17.0% and 16.3%, respectively. In the pig manure fertilized rice grains, these parameters decreased by 23.2%, 29.8%, 30.8%, 18.7% and 16.4%, respectively. These results indicate that Si application could be a feasible and effective approach to mitigate heavy metal accumulation in the rice grains produced in animal manure-fertilized paddy fields.

Key words: Animal manure, heavy metal, rice, silicon

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