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Nitrogen Use Efficiency of Rice under Cd Contamination: Impact of Rice Cultivar versus Soil Type^{*1}

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ABSTRACT

There are increasing pressures to select rice cultivars with high yields and nitrogen use efficiency (NUE), but with low Cd accumulation in Cd-contaminated paddy soils. To investigate the relative effects of rice genotype, soil type and Cd contamination on the rice grain yield and NUE, a pot experiment consisting of nine rice cultivars was conducted in two types of paddy soils, red paddy soil (RS) and yellow paddy soil (YS), with or without Cd spiked at 0.6 mg kg⁻¹, respectively. Considering the nitrogen supply from both the soil organic N pools and N fertilizers, the NUE was defined as the grain yield per unit of total crop-available N in the soil. Cd contamination decreased the grain yield and NUE in most of the rice cultivars, which was mainly related to the reduced N-uptake efficiency (NpUE, percentage of N taken up by the crop per unit of soil available N). However, Cd contamination enhanced the N-utilization efficiency (NtUE, grain yield per unit of N taken up by the crop) by 21.9% on average in all of the tested rice cultivars. The NpUE was mainly affected by the soil type, whereas the NtUE was affected by the rice cultivar. The hybrid cultivars had higher NUEs than the japonica and indica cultivars because of their greater biomass and higher tolerance to Cd contamination. Reduction of the NUE after Cd addition was stronger in RS than in YS, which was related to the lower absorption capacity for Cd in the former soil. Canonical correspondence analysis-based variation partitioning analysis showed that the cultivar type had a larger impact (34.4%) on the NUE, followed by Cd addition (15.2%) and soil type (10.0%).

Key words: cadmium, N-uptake efficiency, N-utilization efficiency, rice cultivar, soil type, soil available N

INTRODUCTION

Rice is the staple food for more than 50% of the world's population (Ladha *et al.*, 2005). In China, paddy fields are suffering increasing heavy metal pollution as a consequence of

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