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镉胁迫对不同杂交水稻品种Cd、Zn吸收与积累的影响

Effect of cadmium stress on Cd and Zn uptake and accumulation of different cultivars of hybrid rice

关键词: [镉](#) [锌](#) [籽粒](#) [健康风险](#)

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摘要: 土壤-作物-食品是人类摄取Cd的重要途径.水稻是Cd积累能力最强的粮食作物,且水稻对Cd的吸收常伴随Zn缺乏,这对人类健康具有潜在的暴露风险.因此,本文选择2种杂交水稻(普通杂交稻材料"J196"和超级稻品种"中浙优1号")为供试水稻,以红壤性水稻土为供试土壤,采用添加Cd( $2.5 \text{ mg} \cdot \text{kg}^{-1}$ )和不添加Cd( $0 \text{ mg} \cdot \text{kg}^{-1}$ )处理进行盆栽试验,研究了水稻在成熟期对土壤中Cd的吸收分配及籽粒中Cd、Zn的积累特点.结果表明,添加Cd处理的水稻籽粒Cd积累量为未加Cd处理的6~10倍.在供试土壤Cd污染条件下,超级稻表现出对Cd具有较强的吸收能力,其籽粒中的Cd积累量也可高达 $1.83 \text{ mg} \cdot \text{kg}^{-1}$ ,就地消费人群的籽粒Cd暴露风险水平为人体安全临界摄入量水平的数倍.Zn存在相对缺乏的食物安全风险.中浙优1号具有较强的籽粒Cd分配能力和较弱的籽粒Zn转运能力,而加Cd处理下,其对Cd、Zn的根部、茎叶滞留能力更强,这也正是高籽粒含量品种籽粒Cd积累强而Cd/Zn比高的原因.因此,在高产水稻育种中必须考虑水稻对Cd、Zn吸收的品种差异与籽粒Cd暴露、Zn缺乏的风险.为降低镉暴露风险,推广高产杂交水稻时应考虑Cd的吸收特性,同时在土壤-品种间进行合理布局,并进行膳食结构优化以增加人体对Zn的摄入.

**Abstract:** Cd transfer among soil, crop and food is an important approach of ingestion by human being. Rice is the crop with the highest capacity in accumulating Cd. The Cd uptake in rice is often concurrent with Zn absence, which poses potential risks to human health. A pilot experiment was conducted using two cultivars of hybrid rice (General hybrid rice J196 and super hybrid rice Zhongzheyou 1) and acidic red soil.  $2.5 \text{ mg} \cdot \text{kg}^{-1}$  was added in treatment group and no Cd was added in control. The Cd and Zn accumulation in rice grains and the Cd partition in soil were investigated during the maturation stage of rice. The results showed that the Cd concentrations in rice grains in the treatment group were 6~10 times those in the control. The super hybrid rice presented robust ability to accumulate Cd. The maximum Cd concentration in the super hybrid rice grains was  $1.83 \text{ mg} \cdot \text{kg}^{-1}$ , which led to the Cd exposure risks of local publics several folds higher than the dose of safe intake standard. The grain of super hybrid rice Zhongzheyou 1 has stronger ability of Cd partition and weaker ability of Zn transportation. In the treatment group, the roots and stems of both cultivars have high capacities to retain Cd and Zn, resulting in high Cd concentration and Cd/Zn in grains. Therefore, the uptakes of Cd and Zn in different rice species, Cd exposure and Zn absence in grains should be considered when culturing high production rice. It was suggested that the Cd uptake characteristics in soil and rice and the suitable adjustment of food structure should be addressed so as to reduce Cd exposure risks when popularizing the high production hybrid rice.

**Key words:** [Cd](#) [Zn](#) [rice grain](#) [health risks](#)

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