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Effect of Wheat-*Solanum nigrum* L. intercropping on Cd accumulation by plants and soil bacterial community under Cd contaminated soil

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ABSTRACT

Using accumulators for intercropping in agricultural production can change the heavy metal concentration in the target plants. This study aims to investigate how intercropping wheat (*Triticum aestivum* L.) and *Solanum nigrum* L. affects soil bacterial community and cadmium (Cd) absorption in response to Cd-contaminated soil. We compared the concentrations and accumulations of Cd by plants, the activities of soil enzymes and the bacterial community structures of rhizosphere soil in monoculture and intercropping system. Principal component analysis (PCA) ordinations showed that soil bacterial communities were significantly separated by MW and IW, which illustrated intercropping with *Solanum nigrum* L. impacted the bacterial community structure of wheat. Firstly, the results showed that the biomass of shoots and roots in intercropped wheat (IW) were significantly decreased by 16.19% and 29.38% compared with monoculture wheat (MW) after 60 days after transplanting (DAT). Secondly, the Cd concentration and accumulation of shoots in IW was higher than MW. The Cd accumulation of IW shoots and roots were increased 12.87% and 0.98%, respectively after 60 days DAT. Besides, the enzymes activity [catalase (CAT), urease (UA) and alkaline phosphatase (ALP)] of IW were decreased 35%, 6% and 21%, respectively after 60 days DAT. Finally, the diversity indexes [Abundance-based Coverage Estimator (ACE), Chao and InvSimpson] of IW were lower than MW. These results indicated that intercropping with *Solanum nigrum* L. inhibited the wheat growth and decreased the bacterial community diversity in wheat rhizosphere, increased the Cd concentration and accumulation in plant tissues of wheat. Therefore, intercropping *Solanum nigrum* L. and wheat with Cd-contaminated soil might increase the risk of excessive Cd in wheat.

1. Introduction

Soil heavy metal contamination is a serious global environmental problem. Cadmium (Cd) is one of the highly phytotoxic metals and nonessential elements in organism , which will damage cell metabolism and threat human health and safety of ecological environment. (Clemens et al., 2013). Therefore, it is vital important to control the potential risk in the Cd contaminated soil. Among various chemical, physical and biological techniques to remedy the Cd-contaminated soil, phytoremediation is an efficient and cost-effective approach to remove, stabilize the metal or render it less toxic in situ and has received increasing attention in recent years (Wang et al., 2017). However, the limitation lies in the fact that the efficiency of phytoremediation is influenced by many factors. For instance, plant growth and biomass decreased with increasing Cd levels in the growth medium compared to the control (Xu and Wang, 2014). Therefore, it is necessary to combine this technology with other measures to improve the efficiency of heavy metal remediation.

Intercropping has been widely used in agricultural production, which improves the effective use of light, soil fertility, and space by plants, and has shown a great contribution to modern and sustainable agriculture. Intercropping could impact the bacterial community and

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