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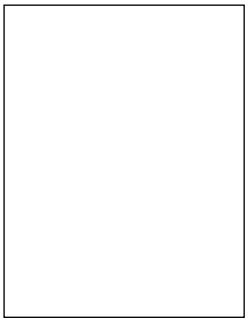

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PII: S1002-0160(17)60361-8
DOI: 10.1016/S1002-0160(17)60361-8
Reference: NA

To appear in:

Received date: NA
Revised date: NA
Accepted date: NA

Please cite this article as: LIU Borui, HUANG Qing, CAI Huajie, GUO Xiang, WANG Tingting, GUI Mingying, Distribution and Speciation of Chromium and Cadmium in Fertilized Chernozem, *Pedosphere* (2017), 10.1016/S1002-0160(17)60361-8.

PEDOSPHERE

Pedosphere ISSN 1002-0160/CN 32-1315/P doi:10.1016/S1002-0160(17)60361-8

Distribution and Speciation of Chromium and Cadmium in Fertilized Chernozem

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ABSTRACT

Fertilizers are widely applied in agricultural practice to improve crop yield and quality. However, they can also alter the behavior of soil pollutants. A field experiment was conducted on chernozem soil in Heilongjiang Province, China. Various proportions of inorganic nitrogen (N), phosphor (P) and organic fertilizers were applied in the plot. Soil samples were collected at four time points over two years, and the concentrations and speciation of chromium (Cr) and cadmium (Cd) were analyzed. Inorganic fertilizers addition had little effect on the concentrations of Cr or Cd, while organic fertilizer addition reduced the concentrations of both Cr and Cd. Inorganic fertilizers increased the concentration of Cr in the exchangeable form, while decreased the one of its residual form ($P < 0.05$). Addition of inorganic or organic fertilizer alone decreased concentrations of exchangeable Cd ($P < 0.05$), but the combination had the opposite effect. According to National Standard of the People's Republic of China (GB), high concentrations of Cd in plots could result in an environmental risk, and fertilizer application could lower that risk. Risk Assessment Code showed that risks resulting from the metals were lowered when organic fertilizer was applied alone (1350.0 g m^{-2}) or in combination with inorganic fertilizers (8.2 g m^{-2} for N fertilizer, 3.0 g m^{-2} for P fertilizer, 3.7 g m^{-2} for K fertilizer and 675.0 g m^{-2} for organic fertilizer). In conclusion, when practicing agriculture in chernozem soil, organic fertilizer should be applied alone or with inorganic fertilizers to lower the environmental risks of Cr and Cd pollution.

Key Words: chemical speciation; environmental risk; fertilizer; heavy metals; soil pollution;

INTRODUCTION

Soil, the most important types of environmental media, is very important to agriculture and food production. Therefore, soil quality has been widely concerned. Soil pollution has worsened enormously because of industrial activities, the intensive use of biocides and fertilizers in agriculture, urban waste and atmospheric deposition (Calisi *et al.*, 2013). These pollutants can not only damage the soil ecosystem, but also endanger human health.

Because of the toxicity, stability and recalcitrance to biodegradation, accumulation of heavy metals (such as lead