

Heavy Metals Accumulation in Post Harvest Soil and Grains of Rice and Wheat with Application of Sewage Sludge

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Application of sewage sludge (SS) for crop production is increasing as it is relatively inexpensive in comparison to chemical fertilizers. In addition to nutrients, it provides organic matter to soil however, it also contains pollutant elements. Field studies were conducted for two consecutive years (2011-12 and 2012-13) at Agricultural Research Farm, Banaras Hindu University, Varanasi, India to assess the effect of SS application on heavy metals accumulation in soil and grains of rice and wheat grown in sequence. Three levels of SS (15, 30 and 45 t ha⁻¹) and its combination along with 50 and 100% recommended dose of fertilizers (RDF) were applied. The experiment was laid out in Randomized Block Design with 10 treatments taking three replications. Sewage sludge was applied only in first crop (Istrice) and its residual effect was monitored in three successive crops (Istwheat - IInd rice - IInd wheat). Rice variety PRH 10 and wheat variety HUW 234 were taken as test crops. The initial soil had pH 8.49 (1:2.5), EC 0.149 dS m⁻¹ and organic carbon 0.47%. The SS had pH 6.57, EC 2.57 dS m⁻¹, organic C 9.65%, total N, P, K and S content as 1.4, 1.2, 0.87 and 0.96%, respectively. The contents of DTPA extractable Cd, Cr, Ni and Pb in SS were 4.62, 9.67, 13.6 and 8.87 mg kg⁻¹ and the total were 24.4, 51.3, 65.9 and 44.6 mg kg⁻¹, respectively. Sewage sludge significantly increased the DTPA-extractable Cd, Cr, Ni and Pb content over control in post harvest soil (PHS) of both rice and wheat. The highest content of Cd, Cr and Ni were recorded in PHS of Ist rice and decreased in PHS of subsequent crops. However, the highest content of Pb in soil was recorded in 4th crop of study (IInd wheat) followed by third crop (IInd rice). The highest total content of Cd, Cr, Ni and Pb in PHS collected at the termination of experiment were 2.43, 8.95, 18.9 and 17.0 mg kg⁻¹, respectively which showed accumulation of 4.1 times, 3.2 times, 59% and 93% over their respective controls. The maximum content of DTPA and total Cd, Cr, Ni and Pb in soils was recorded in treatments where 45 t ha⁻¹ SS was applied. Although the SS used in the present study was suitable for agricultural use, but if it is applied in high amount to soil over long periods, the heavy metals content may reach to a toxic level for public health. During the experiment, application of SS in soil significantly increased content of Cd, Cr, Ni and Pb in grain of rice and wheat.

Keywords: Sewage sludge; Rice; Wheat; Post harvest soil; Grain; Heavy metals