Heavy metal pollution in red haricot beans (Phaseolus vulgaris) and cowpeas (Vigna unguiculata) grown using untreated sewage water in Ruai, Nairobi-Kenya

Author: Sigoria, Everlyne Nasenya

Abstract:

Recurrent rainfall inconsistency experienced across Kenya brings about a reduction in crop production that relies on rain fed agriculture. Nairobi peri-urban farmers have turned to irrigate their residential plots using untreated sewage water. A study was done on P. vulgaris (red haricot beans) and Viunguiculata (cowpeas) between Nov. 2009 and Jan.20 lOin Ruai - Nairobi County. The general objective of the study was to investigate levels of heavy metals: (cadmium (Cd), copper(Cu),lead (Pb) and zinc(Zn) inF. vulgaris and V unguiculatagrown in sewage contaminated soil and irrigated using untreated sewage water. Randomized Experimental Block Design - Latin Square was adopted. Two adjacent sites, 20m apart, measuring 4.5m x 4.5m each were mapped out as Sites 1 and 2 being main treatments A and B (Control) respectively. The sites were each divided into 3 blocks; each block had 3 plots which were prepared. Three plots were planted with P. vulgaris, 3 with Vvunguiculata and 3were without crop. Sites 1 and 2 were irrigated with untreated sewage water and tap water respectively. Samples of certified seeds, soils, waters and plants parts were randomly taken before planting, at 15, 30, 60 and 90 days after planting and were processed,analyzed in the laboratory using the laboratory procedures for determining heavy metals by an Atomic Absorption Spectrophotometer (AAS) (Model 210 VGP).Data analysis was carried out by ANOV A, Genstat program. The study revealed significant differences (P< 0.05) in levels of Cd, Cu, Pb and Zn in different parts of beans and cowpeas grown in sites 1 and 2.In beans roots, the mean levels were 0.135 m gL-' in site 1 and 0.160 m gL-' in site 2 for Pb,0.629 m gL-' in site 1 and 0.782 m gL-' in site 2 for Zn, Cu was spectrophotometrically undetectable in site 1 and 0.003 m gL -, in site 2, Cd was spectrophotometrically undetectable in site 1 and O.OOlm gl," in site 2, whereas in cowpeas roots the mean levels of Cd and Cu were spectrophotometrically undetectable in sites 1 and 2, Pb was 0.484 m gL-' in site 1 and 0.423 m gL-' in site 2, Zn was 1.615 rn gL-' in site 1 and 1.462 m gL-' in site 2. There were significant differences (P<0.05) in Zn levels in cowpeas and beans roots in sites 1 and 2. In beans leaves, the mean levels for: Pb was 0.613 m gL-' in site 1 and 0.740 m gL-' in site 2, Zn was 1.336 m gL-' in site 1 and 1.430 m gL-' in site 2, Cd was 0.001 m gL-' in site 1 and 0.013 m gL-' in site 2. While in cowpeas leaves the mean levels of Cd and Cu were spectrophotometrically ndetectable in sites 1 and 2, Pb was 0.484 m gL-' in site 1 and 0.423 m gL-' in site 2, Zn was 1.615 m gL-' in site 1 and 1.462 m gL-'in site 2. There were significant differences (P<0.05) between Zn level in cowpeas leaves and Cd level in beans leaves in sites 1 and 2. In harvested beans seeds, the mean level of Pb was 0.061 m gL-' in site 1 and 0.035 m gL-' in site 2, Zn was 0.124m gL-' in site 1 and 0.346m gL-' in site 2, Cu was 0.120 m gL-' in site 1 and 0.594 m gL-' in site 2. There were significant differences (P<0.05) in Pb, Zn and Cu levels in beans seeds in both sites. The study concludes that heavy metals (Cd, Cu, Pb and Zn) from the soil accumulate in different concentrations in the different parts of the P. vulgaris and Vunguiculata,the variation could be attributed to the different uptake and transport of heavy metals (Cd, Cu, Pb and Zn)by different plants and therefore recommends that untreated sewage water and sewage contaminated soils are not suitable for irrigating and growing on respectively of P. vulgaris and V unguiculatacrops.