Lead

Title	**Accumulation and distribution of lead (Pb) in plant tissues of guar (*Cyamopsis tetragonoloba L.)* and sesame (*Sesamum indicum L.*): profitable phytoremediation with biofuel crops**
Author Name	Hira Amin, Basir Ahmed Arain, Taj Muhammad Jahangir, Muhammad Sadiq Abbasi & Farah Amin
Journal Name	Geology, Ecology, and Landscapes
Year	2018
Volume and Issue	Volume 02, January 2018
Pages	51–60
Abstracts	Contamination of lead indicates one of the major threats to soil system. Phytoremediation technique utilized plants which are able to tolerate and accumulate metals within in their tissues. It has recently been suggested that biofuel plants are more suitable for both utilization and remediation of metal contaminated soil. This study reported Pb phytoremediation potential of *Cyamopsis tetragonoloba* L. in comparison with *Sesamum indicum L*. in the framework of a pot-experiment. Plants were subjected to seven Pb concentrations (0, 100, 200, 400, 600, 800 and 1000 mg kg-1 soil) for 12 weeks. Our results demonstrated that both *C. tetragonoloba* and *S. indicum* were able to tolerate Pb concentrations up to 1000 mg kg-1 which confirms the plant ability to grow well in higher Pb levels. Significant metal accumulation was observed in root along with reduced biomass for both plants species. Furthermore, both plant species could possibly be used for phytostabilization, with success in marginally polluted soils where their growth would not be impaired and decontamination of Pb could be maintained at satisfying levels. However, bioconcentration factor (BCF), bioaccumulation coefficient (BAC) and translocation factor (TF) values proposed that C. tetragonoloba was more efficient for phytoremediation than S. indicum at higher Pb levels.
Keywords	Soil pollution; lead; accumulation; phytoextraction; phytostablization

Title	**Lead (Pb) Toxicity; Physio-Biochemical Mechanisms, Grain Yield, Quality, and Pb Distribution Proportions in Scented Rice**
Author Name	Umair Ashraf, Adam S. Kanu, Quanquan Deng, Zhaowen Mo, Shenggang Pan, Hua Tian and Xiangru Tang
Journal Name	Frontiers in Plant Science
Year	2017
Volume and Issue	Volume 08, February 2017
Pages	01-17
Abstracts	Lead (Pb) caused interruptions with normal plant metabolism, crop yield losses and quality issues are of great concern. This study assessed the physio-biochemical responses, yield and grain quality traits and Pb distribution proportions in three different fragrant rice cultivars i.e., Meixiangzhan-2, *Xinagyaxiangzhan* and Basmati-385. Plants were exposed to 400, 800, and 1,200 ppm of Pb while pots without Pb were taken as control (0 ppm). Our results showed that Pb toxicity significantly ($P < 0.05$) reduced photosynthetic pigments (chlorophyll contents and carotenoids) and inducted oxidative stress with increased production of hydrogen peroxide (H2O2), malanodialdehyde (MDA) and leaves leachates; while such effects were more apparent in *Xinagyaxiangzhan* than other two rice cultivars. Pb stress differentially affected the production protein, proline and soluble sugars; however the production rates were higher at heading stage (HS) than maturity stage (MS). Furthermore, Pb stress altered superoxide dismutase (SOD), peroxidases (POD), catalases (CAT) and ascorbate peroxidases (APX) activities and glutathione (GSH) and oxidized glutathione (GSSG) production in all rice cultivars at both HS and MS. All Pb levels reduced the yield and yield components of all rice cultivars; nonetheless such reductions were observed highest in *Xinagyaxiangzhan* (69.12%) than Meixiangzhan-2 (58.05%) and Basmati-385 (46.27%) and resulted in grain quality deterioration. Significant and positive correlations among rice yields with productive tillers/pot and grains per panicle while negative with sterility percentage were also observed. In addition, all rice cultivars readily taken up the Pb contents from soil to roots and transported upward in different proportions with maximum in roots followed by stemss, leaves, ears and grains. Higher proportions of Pb contents in above ground plant parts in *Xinagyaxiangzhan* possibly lead to maximum losses in this cultivar than other two cultivars; while less damage in Basmati-385 might be related to strong anti-oxidative defense system and lower proportions of Pb contents in its aerial parts.
Keywords	antioxidant defense, grain yield, lead, oxidative stress, scented rice, quality characters

Title	**Efficiency of green waste compost and biochar soil amendments for reducing lead and copper mobility and uptake to ryegrass**
Author Name	Nadia Karami, Rafael Clemente, Eduardo Moreno-Jiménez, Nicholas W. Lepp, Luke Beesley
Journal Name	Journal of Hazardous material
Year	2011
Volume and Issue	191, 1-3
Pages	41-48
Abstracts	Green waste compost and biochar amendments were assessed for their assistance in regulating the mobility of copper (Cu) and lead (Pb) and the resultant uptake of these metals into vegetation. The amendments were mixed with a heavily Cu and Pb contaminated soil (600 and 21,000 mg kg−1, respectively) from a former copper mine in Cheshire (UK), on a volume basis both singly and in combination in greenhouse pot trials. Ryegrass (*Lolium perenne L. var. Cadix*) was grown for the following 4 months during which biomass, metals in soil pore water and plant uptake were measured in three consecutive harvests. Very high Pb concentrations in pore water from untreated soil (>80 mg l−1) were reduced furthest by compost amendment (<5 mg l−1) whereas biochar was the more effective treatment at reducing pore water Cu concentrations. Duly, ryegrass shoot Cu levels were reduced and large, significant reductions in shoot Pb levels were observed after biochar and compost amendments, respectively during successive harvests. However, because green waste compost singly and in combination with biochar vividly enhanced biomass yields, harvestable amounts of Pb were only significantly reduced by the compost amendment which had reduced shoot Pb levels furthest. The low biomass of ryegrass with biochar amendment meant that this was the only amendment which did not significantly increase harvestable amounts of Cu. Therefore the two amendments have opposing metal specific suitability for treating this contaminated soil regarding whether it is a maximum reduction in plant tissue metal concentration or a maximum reduction in harvestable amount of metal that is required.
Keywords	Heavy metals, Compost, Biochar, Ryegrass, Pore water, Remediation

Title	**Utilization of laser-assisted analytical methods for monitoring of lead and nutrition elements distribution in fresh and dried Capsicum annuum l. leaves**
Author Name	Michaela Galiová, Jozef Kaiser, Karel Novotný, Martin Hartl, Rene Kizek and Petr Babula
Journal Name	Microscopy Research and Technique
Year	2011
Volume and Issue	74, 9
Pages	845-852
Abstracts	Laser induced breakdown spectroscopy (LIBS) and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) have been applied for high-resolution mapping of accumulation and distribution of heavy metal (lead) and nutrition elements (potassium, manganese) in leaves of *Capsicum annuum L*. samples. Lead was added in a form of Pb(NO3)2 at concentration up to 10 mmol L−1 into the vessels that contained tap water and where the 2-months old *Capsicum annuum L*. plants were grown another seven days. Two dimensional maps of the elements are presented for both laser-assisted analytical methods. Elemental mapping performed on fresh (frozen) and dried Capsicum annuum L. leaves are compared.
Keywords	LIBS, LA-ICP-MS,elemental mapping

Title	**Isolation of phosphate solubilizing bacteria and their potential for lead immobilization in soil**
Author Name	Jin Hee Park, Nanthi Bolan, Mallavarapu Megharaj, Ravi Naidu
Journal Name	Journal of Hazardous material
Year	2011
Volume and Issue	185, 2-3
Pages	829-836
Abstracts	Lead (Pb), a highly toxic heavy metal forms stable compounds with phosphate (P). The potential of phosphate solubilizing bacteria (PSB) to immobilize Pb by enhancing solubilization of insoluble P compounds was tested in this research. Eighteen different PSB strains isolated from P amended and Pb contaminated soils were screened for their efficiency in P solubilization. The PSB isolated from P amended soils solubilized 217–479 mg/L of P while the PSB from Pb contaminated soil solubilized 31–293 mg/L of P. Stepwise multiple regression analysis and P solubility kinetics indicated that the major mechanism of P solubilization by PSB is the pH reduction through the release of organic acids. From the isolated bacteria, two PSB were chosen for Pb immobilization and these bacteria were identified as Pantoea sp. and Enterobacter sp., respectively. The PSB significantly increased P solubilization by 25.0% and 49.9% in the case of Pantoea sp., and 63.3% and 88.6% in the case of Enterobacter sp. for 200 and 800 mg/kg of rock phosphate (RP) addition, respectively, thereby enhancing the immobilization of Pb by 8.25–13.7% in the case of Pantoea sp. and 14.7–26.4% in the case of Enterobacter sp. The ability of PSB to solubilize P, promote plant growth, and immobilize Pb can be used for phytostabilization of Pb contaminated soils.
Keywords	Pb contamination, Pb immobilization, Phosphate solubilizing bacteria (PSB), Rock phosphate, P solubilization

Title	**The detoxification of lead in Sedum alfredii H. is not related to phytochelatins but the glutathione**
Author Name	D.K. Gupta , H.G. Huang, X.E. Yang, B.H.N. Razafindrabe, M. Inouhe
Journal Name	Journal of Hazardous material
Year	2010
Volume and Issue	177, 1-3
Pages	437–444
Abstracts	Two ecotypes of *S. alfredii* [Pb accumulating (AE) and Pb non-accumulating (NAE)] differing in their ability in accumulating Pb were exposed to different Pb levels to evaluate the effects on plant length, photosynthetic pigments, antioxidant enzymes (SOD and APX), cysteine, non-protein thiols (NP-SH), phytochelatins (PCs) and glutathione (GSH) vis-à-vis Pb accumulation. Both ecotypes showed significant Pb accumulation in roots, however only the AE showed significant Pb accumulation in shoots. We found that both AE and NAE of S. alfredii-induced biosynthesis of GSH rather than phytochelatins in their tissue upon addition of even high Pb levels (200 μM). Root and shoot length were mostly affected in both ecotypes after addition of higher Pb concentrations and on longer durations, however photosynthetic pigments did not alter upon addition of any Pb treatment. Both superoxide dismutase (SOD) and ascorbate peroxidase (APX) activities of AE were higher than NAE. The levels of cysteine and NP-SH were also higher in AE than in NAE. Hence, the characteristic Pb accumulation of ecotypes differed presumably in relation to their capacity for detoxification of Pb. These results suggest that enzymatic and non-enzymatic antioxidants play a key role in the detoxification of Pb-induced toxic effects in Sedum alfredii. This plant can be used as an indicator species for Pb contamination.
Keywords	Ascorbate peroxidase, Glutathione, Lead, Phytochelatins, Superoxide dismutase, Sedum alfredii