The Pharma Innovation Journal 2019; 8(6): 1016-1018

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2019; 8(6): 1016-1018

www.thepharmajournal.com
Received: 15-04-2019
Accepted: 19-05-2019

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Assessment of heavy metals (Cr, Cu, Cd, Pb & Zn) in soil and potato crop amended with solid liquid Waste in Prayagraj India

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Abstract
An economically physeable and emerging technique for rejeunivate /refreshment of agro ecological system contaminated with heavy metals. The study was conducted to determine the accumulation of heavy metals in Potato (*Solanum tuberosum* L.) in research farm department of Soil Science and Agricultural Chemistry. Heterogeneous accumulation of heavy metals was found potato. However metal accumulation varied in the tuber, (Potato). The concentration of Chromium 4.08 µg g^{-1}, Copper 0.68 µg g^{-1}, Cadmium 2.44 µg g^{-1}, Lead 1.21 µg g^{-1}, and Zinc 4.08 µg g^{-1} was recorded, was found significant in the treatment T_5 50% RDF NPK + 50% RDF solid liquid waste. Plants were found to have an enrichment coefficient which reflects their heavy metal accumulation potential. Findings suggest that the 50% recommended dose of fertilizers with 50% solid liquid waste may be used for rejuvenation of land contaminated toxic metals and higher yielding of crops from economical point of view.

Keywords: Solid liquid-waste amendments, heavy metals and atomic absorption spectrometer etc.

Introduction

The term ‘heavy metal’ is often used to cover a diverse range of elements, which constitute an important class of pollutants. Such pollutants have received the attention of researchers all over the world, mainly due to their harmful effects on living beings. Heavy metals enter into the environment. Disposal of metal-enriched sewage sludge and sewage effluents. The sewer wastes in India and abroad are normally used as a potential source of irrigation particularly around cities for growing vegetables and fodder crops study of irrigation through rain, dairy wastes, and sewer waters showed the increased level of total Zn, Mn. Fe. Cu, Cd, Ni and Pb etc.

pH, Ec of soil receiving sewer waters and dairy wastes (Narwal *et al*. 1988) Municipal wastes usually have high contents of heavy metals and their continuous application to soil may result in enrichment of heavy metals in top soils. (Singh and Singh, 1994) Reported that heavy metal concentration of sewage irrigated soil showed Mn> Fe> Cu > Pb> Zn> Cr> Cd. Mamtani *et al.* (2011) reported that Metals are an important and essential part of our daily lives. Their ubiquitous presence and use has not been without significant consequences. Both industrial and non-industrial exposures to metals are characterized by a variety of acute and chronic ailments. Their knowledge and training in the evaluation of health problems related to such exposures is inadequate. This paper presents documented research findings from various studies that have examined the relationship between metal exposures and their adverse health effects both in developing and developed countries. Further, use of solid liquid waste, a biological residue from sewage treatment process in agriculture.

Materials and Methods

The experiment was conducted at Research Farm of Department of Soil Science at Sam Higginbottom Institute of Agriculture, Technology and Sciences, Prayagraj, the area is situated on the south of Prayagraj on the right side of the river Yamuna on the South of Rewa Road at a distance of about 6 km from Allahabad city. It is situated at 25.57^{0}24'08.71-N latitude, 81^{0}50' 16.95”E longitude and at the altitude of 98 meter above mean sea level.

The climatic condition of the investigation area is most suitable for the cultivation of tuber crops. The soil of experimental area falls in order Inceptisol and the experimental field is alluvial in nature, the experiment were conducted during Rabi season 2014 to study the

"Assessment of Heavy Metal Amended with Solid Liquid Waste in Potato Crop (*Solanum tuberosum* L.) cv. Kufri badshah". The treatments were allocated in 3×3 randomized block design with three replications and three levels of solid liquid -waste for the crop (T_1=Control, T_2=@ 0.00% RDF: N:P:K: + 50%Solid Liquid Waste, T_3=@ 0.0% RDF: N:P:K: + 100% Solid Liquid Waste, T_4=@ 50% RDF: N:P:K: + 0% RDF Solid Liquid Waste, T_5=@ 50% RDF: N:P:K: + 50% RDF Solid Liquid Waste, T_6=@ 50% RDF: N:P:K: + 100% RDF Solid Liquid Waste, T_7=@ 100% RDF: N:P:K: + 0% RDF Solid Liquid Waste, T_8=@ 100% RDF: N:P:K: + 50% RDF Solid Liquid Waste, T_9=[@ 100% RDF: N:P:K: + 100%RDF Solid Liquid Waste.

Soil sample were taken from 0-15 cm depth randomly, air dried and passed through 2 mm sieve and the size of sample was reduced by conning and quartering. Then the composite soil sample was taken for mechanical and chemical analysis. Bouyoucos–Hydrometer method (1957) was used for the mechanical analysis of soil to determine sand, silt and clay fraction in the sample. The composition of soil sample was found of the Sand 60.80%, Silt 24.10% and Clay 15.10%. Texture was sandy loam according to USDA system. After crop harvest soil sample were taken to the plough level, i.e. up to 0-15 cm depth each plot for determination of important physical and chemical properties of soil.

Physico-chemical parameters of the samples were determined by standard methods (APHA, 2000).Soil samples approx. depth of 0-15, Potato tuber collected and at 70 C for 24 h, grind and mixed thoroughly for metal analysis. The soil and potato samples weighing 1g each, were digested in a mixture of concentrated nitric and perchloric acid (5:1) until a clear solution was obtained. The solution was filtered with the help of whatman 42 filter paper, reconstituted to the desired volume and metal content determined in atomic absorption spectrophotometer (Perkin Elmer). Samples were analysed in triplicate.

Results and Discussion

As depicted in. fig. 1 the effect of solid liquid-waste on Fresh weight of tuber of potato**.** Effect of solid liquid waste on Fresh weight of tuber of potato was significantly influenced by sewage-sludge levels. However, at T_5 81.07 (g) maximum weight of potato tuber was recorded, with T_5=@ 50% RDF: N: P: K: + 50% RDF Solid Liquid Waste. The minimum Fresh weight of tuber 45.54 was recorded with T_0 respectively, similar readings was recorded (Pakhnenko *et al.* 2009).

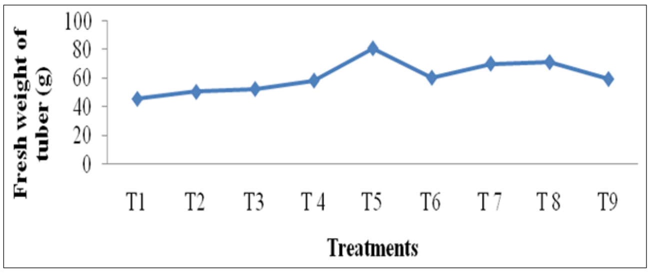

Fig 1: Effect of solid liquid waste on Fresh weight of tuber of potato

Table 2: Chemical analysis of Solid liquid waste

Parameters	Unit	Value
pH	w/v	07.4
EC	(dS/m)	1.62
Total Organic Carbon	%	2.85
Lead	µg g^{-1}	390
Copper	µg g^{-1}	13
Chromium	µg g^{-1}	249
Cadmium	µg g^{-1}	389
Zinc	µg g^{-1}	289

Table 3: Assessment of Soil Samples

Parameters	Unit	value
pH	w/v	7.64
EC	(dS/m)	0.45
Total Organic Carbon	%	0.51
Lead	µg g^{-1}	0.75
Copper	µg g^{-1}	7.05
Chromium	µg g^{-1}	2.33
Cadmium	µg g^{-1}	0.93
Zinc	µg g^{-1}	2.62

As depicted in. fig. 1 the effect of solid liquid-waste on Distribution of heavy metal in potato. Effect of solid liquid waste on Distribution of heavy metal in potato was significantly influenced by sewage-sludge levels. The minimum Chromium 4.08µg g^{-1}, Copper 0.68µg g^{-1}, Cadmium 2.44 µg g^{-1}, Lead 1.21µg g^{-1}, and Zinc 4.08µg g^{-1} was recorded, with T_5.

Table 4: Distribution of heavy metal and impact on potato tubers

Treatments	Chromium µg g^{-1}	Copper µg g^{-1}	Cadmium µg g^{-1}	Lead µg g^{-1}	Zinc µg g^{-1}
T_1	4.75	0.85	2.70	1.37	35.90
T_2	4.31	0.84	4.73	3.14	62.30
T_3	5.33	0.94	7.69	4.16	6.22
T_4	2.45	1.14	5.25	3.34	42.31
T_5	2.18	0.68	2.44	1.21	4.08
T_6	5.37	1.22	8.09	4.30	62.64
T_7	2.64	1.14	2.84	1.21	5.91
T_8	4.24	1.28	5.18	3.28	48.11
T_9	5.49	1.35	8.15	4.33	65.63
F-test	S	S	S	S	S

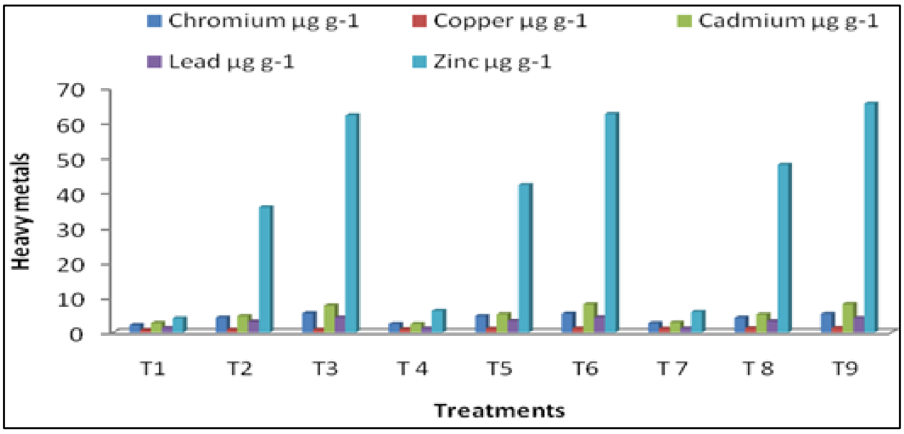

Fig 4: Distribution of metal and impact on potato tubers

It may be concluded that inspite of high concentration of metal in potato tuber, the potato tuber do not show any phenotypic symptoms. Competition among metals at the binding site in potato tuber may reduce the effectiveness of individual metals. Khan and Frankland (1983) showed that the mobility of Zn was higher than that of Zn and there was very little movement of Cu through the sub-soil. Ramos *et al*. (1994) showed that organic complexes of Cd bind loosely to soil particles and are easily taken up by plants growing in the soil. Further, Cd and Pb is not easily translocated into plants. In this study plant, water and soil have studied and the values are shown within standard limits. It can be concluded that there may be apparently synergistic effects of wide variety of metals and some other unknown modified chemicals/ pollutants play an important role in increasing metal accumulation in plants.

Visible phototoxic symptoms of plants

Visible symptoms of toxicity in potato, but the most common and non-specific symptoms are chlorosis, interveinal chlorosis, necrosis, stunted growth, shorter root length, and narrow leaves. The fertilization and fruiting phenomena of potato plant was drastically affected. Potato tubers were smaller in size and lesser in number and showed morphological symptoms of marked abnormal growth. Many laboratory studies have demonstrated that some heavy metals, particularly Cu, Ni, and Cd can create a series of disorders when supplied at concentrations higher than those normally encountered in natural conditions. More often than not, these effects are parallel to a reduction in the growth rate of the affected plants with concomitant effects on average concentrations. PTE of Kalipur area are far above their reference values and are within the critical plant concentration range described by Pendias *et al.* (1992) [6], and Mc Nichol and Brackett (1985) [7] which certainly affects plant metabolism and may or may not produce visible phytotoxicity. Plants don not always show visible symptoms morphologically but may have hidden injury due to pollutants or change in metabolic pathways. Though Fe, Mn, Zn concentration in plant tissues are well below the critical concentration, Cu, Pb, Ni, Cr and Cd are within the prescribed plant critical concentration range. These toxic heavy metals are obviously affecting plant life and also reduce the yield capacity likely to 10%.

Czaja (1962) [5] and Rao (1971) reported the partial failure of pollen grain germination on dust-laden stigmas and eventually lack of fertilization in the ovary. Also, a case of failure in fertilization was observed by Anderson (1914) [1] in cherry trees subjected to cement dust. Presumably, hampered fruiting phenomenon of brinjal plant may be attributed to complex industrial dust consisting of steel plant, thermal power plant, chemical plant, cement factory, fertilizer plant, etc. Which have altered the normal fertilization process. Heavy metals generally cause a decrease in total chlorophyll content (Clijisters and Van Assche, 1985) [9] thereby, alter metabolic pathways of the plant. Weeds in exception to this hypothesis, growth luxuriously in spite of heavy metal contamination.

Conclusion

The information generated is highly significant for potato that would be appropriate for cultivating in land/field amended with T_5=@ 50% RDF: N: P: K: + 50% RDF solid liquid waste. The mobilization ratio revealed that some plants species can efficiently restrict the passage of PTE from the contaminated soil. This restriction could be due to the cumulative effect of genetically controlled features, morphological and anatomical differences, or due to the physiology of the ion transport mechanism (Cataldo and Wildung 1978) [4].

References

1. Anderson PJ. The effect of dust from cement mills in the setting of fruit, plant world. 1914; 17:57.
2. Barman SC, Lal MM. Accumulation of heavy metals (Zn, Cu, Cd, and Pb) in soil and cultivated vegetables and weeds grown in industrially polluted fields. Indian J Environ. Biol. 1994; 15(2):107.
3. Buchaure MJ. Contamination of soil and vegetation near a Zinc smelter by Zn, Cd, Cu and Pb, Environ. Sci. and Technol. 1973; 7(2):131.
4. Cataldo DA, Widung RE. Soil and plant factors influencing the accumulation of heavy metals by plants, Environ. Hlth. Perspectives. 1978; 27:149.
5. Czaja AT. Uber Das Problem Der Zementstaubwirk-Ungen and Pflanzen, Staub. 1962; 22:228.
6. Kabata-Pendias A, Pendias H. Trace Elements in soil and Plants, 2nd edn., CRC Press, Boca Raton, Fla, 1992.
7. Mc Nichol RD, Beckett PHT. Critical tissue concentrations of potentially toxic elements, Plant Soil. 1985; 85:107.
8. Mitchell RL, Reith JWS, Johnston IM. Trace element uptake inrelation to soil content. J Sci. Food Agri. 1957; 8:51.
9. Clisjsters H, Van Assche F. Inhibition of photosynthesis by heavy metals', Photosyn. Res. Qual. 1985; 11(409)7-31.