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# Effects of Heavy metals on Plants Life: An Overview

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***Abstract:*** The soil is a valuable source of nutrition for most of the plant species. But now days most of the agricultural soils around the world are contaminated with heavy metals like cadmium (Cd), arsenic (As), mercury (Hg), etc. The high concentration of the heavy metals creates toxicity to all life form micro-organism to human beings. Although the heavy metals are naturally occurring elements that have a high atomic weight. Geological and anthropogenic activities enhance the concentration of metals and affects the plants morphology and physiology. Some of the activities such as mining of metals, burning of fossil fuels. use of enormous fertilizers and several pesticides and other agrichemical in agriculture alter the productivity of crop. Growth reduction as a result of changes in physiological and biochemical process in plants growing on heavy metal-polluted soils has been recorded.

***Keywords:*** Heavy metals, dangerous, effects on plants, soil pollution, cadmium, arsenic, agrochemical.

## INTRODUCTION

The heavy metals natural sources include weathering of metal bearing volcanic rocks and volcanic discharges, while human activities such as from the industries (non-ferrous industries, power plants, iron, steel and chemical industries), agriculture (irrigated with polluted water, use of mineral fertilizers especially from contaminated manure, sewage sludge and pesticides containing heavy metals, waste incineration, burning of fossil fuels and road-traffic. Due to their heavy input create toxicity means excess of required concentration or it is unwanted which were found spontaneous on the earth, and become immersion as a result of anthropogenic activities, enter in to environment and affect the plant growth. Heavy metals create environmental pollution due to their toxicity, persistence and their bio accumulative nature. They are the group of metals and metalloids with atomic density higher than density of water such as Copper (Cu), Silver (Ag), Arsenic (As), Nickel (Ni), Zinc (Zn), Chromium (Cr), Cadmium (Cd) etc. Soil pollution with heavy metals has become an analytical environmental concern due to its potential adverse ecological effects on human beings and other living organisms in adjoining area. Heavy metals happen naturally at low concentrations in soils. However, they are examining as soil contaminants due to their common occurrence, critical and chronic toxicity. These metals are extremely insistent in the environment. They are non-biodegradable in nature and thus readily accumulate to toxic levels (Chopra et al., 2009). The irrigation of wastewater (industrial, municipal and house hold), sewage-sludge and dumped solid wastes on soils has been widespread in agricultural areas.

Researchers have made an important contribution to investigate the impact of effluent storage / irrigation / drainage on soil related with heavy metal contamination and their accumulation in the plant system and lastly in the product (Mishra and Tripathi, 2008). Hence their remediation from the environment is imperative.

### Toxicity effects of heavy metal

Contamination of agricultural soil by heavy metal's has become a critical environmental

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concern due to their potential adverse ecological effects. Such toxic elements are considered as soil pollutants due to their widespread occurrence, and their acute and chronic toxic effects on plants grown of such type of soils. It is reported that permissible limit of cadmium (Cd) in agricultural soil is 100 mg/kg soil (Dushenkov v. Ensley D. Raskin I 1995) . Plants physiological activities are monitored in soil containing high concentration of Cd show visible symptoms of injury in the form of chlorosis, growth inhibition, browning of root tips and finally death (Gabbrielli et al., 1999). The inhibition of root by Fe (III) reductase induced by Cd led to Fe (II) deficiency, and it seriously affected photosynthesis. Other activities of plant physiology such as nitrogen fixation and ammonia assimilation is decreased in nodules of soybean plants during Cd treatments (Gollego Sm, Tomaro ML 2003). Metal toxicity can also affect the plasma membrane permeability, causing a reduction in water content, reduce ATPase activity of the plasma membrane fraction of wheat and sunflower roots (Fodo A, Erdei L 1995). Cadmium produces alterations in the functionality of membranes by inducing lipid peroxidation and disturbances in chloroplast metabolism by inhibiting chlorophyll biosynthesis and reducing the activity of enzymes involved in $CO_2$ fixation. In wheat (*Triticum* sp.) excessive of cadmium reduces the seed germination, decrease in plant nutrient content reduced, shoot and root length. Another study reported that in garlic (*Allium sativum*) Cd accumulation reduced shoot growth and in maize (*Zea mays*) it reduces shoot growth as well as inhibition of root growth (D. Liv et al., 2007).

Mercury is not essential for plant growth. Contamination of soils occurs due to the addition of Hg as part of fertilizers, lime, sludges and manures. The dynamics between the amount of Hg that exist in the soil and its uptake by plants is not linear and depends on several variables (e.g., cation-exchange capacity, soil pH , soil aeration, and plant species (Han Fx, Suy, et al., 2006). Mercury is a unique metal due to its existence in different forms e.g., HgS, $Hg^{+2}$, Hg and methyl-Hg. However, in agricultural soil, ionic form ($Hg^{+2}$) is predominant. Hg released in the soil mainly remains in solid phase through adsorption onto sulfides, clay particles and organic matters (Issar M. Sahi S et al., 2006). Increasing evidence has shown that $Hg^{+2}$ can readily accumulate in higher and aquatic plants. High level of $Hg^{+2}$ is strongly phytotoxic to plants cells. Toxic level of $Hg^{+2}$ can induce visible injuries and physiological disorder in plants. High level of $Hg^{+2}$ interfere the mitochondrial activity and induce oxidative stress by triggering the generation of ROS (Lewis S J B, wataha Jc et. Al., 2005).

It is well known that zinc helps a plant to produce chlorophyll and causes discoloration when the soil is deficient in zinc and plant growth is stunted (Kumar Nikhil 1984). Leaf discoloration appears first on the lower leaves and then gradually moves up to the plant. The phytotoxicity of Zn and Cd is indicated by decrease in growth and development, metabolism and an induction of oxidative damage in various plant species such as *Phaseolus vulgaris* and *Brassica juncea*.(Pardha saradhi P et al., 1999) High levels of Zn generally in soil inhibit several plant metabolic activities such as retarded growth and cause senescence.

It is reported that other heavy metal chromium (Cr) causes serious environmental contamination in soil, sediments, and groundwater (Shanker et al.,2005). The tanning industry is one of the major consumers of water and most of it is discharged as wastewater, which contains high amount of Cr (1.07-7.80 mg/l) (Nriagu, 1990). Earlier researchers have reported that excess amount of Cr causes inhibition of plant growth, chlorosis in young leaves, nutrient imbalance etc., in the plants (Chatterjee and Chatterjee, 2000; Dixit et al., 2002; Sharma et al., 2003; Scoccianti et al; 2006). Inhibition of chlorophyll biosynthesis has also been reported in terrestrial plants (Vajpayee et al., 2000). For example, barley seedlings grown in 100 um Cr showed 40% inhibition of growth (Skeffington et al., 1976).

## CONCLUSIONS

The plants grow on heavy metal polluted soils result in reduction in growth due to changes in the physiological and biochemical activities. Thus, it is evident from the earlier research findings that use and presence of heavy metal

having toxic effects on plants and other living organism. Hence, it is essential to explore the research for better understanding of heavy metal toxicity on plants and allied areas to maintain the ecological harmony of our planet.

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