



Review on Toxicity assessment for carcinogenic soil contaminants

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Abstract The production of our food and the quality of our environment are so importantly related to the wide use of the soil, it is very important that all of us know some basic facts and ideas about the soil. We also see that there is much information available on physico-chemical properties of soil but very limited data is available on carcinogens which are present in the soil. Much attention in recent years towards the Environmental pollution has been increased due to heavy metals pollution from agriculture.

Today, use of fertilizers and pesticides are necessary in agriculture to obtain high crop yield. But the most of the farmers using the fertilizers and pesticides in excess amount and unnecessarily due to which adverse effect are seen in the environment. Therefore it is important to aware the farmers about the effect of pesticides and fertilizers because these contains the toxic elements which are harmful to the human beings, animals and plants. That's why farmers should be identified the structure and chemical content of the soil and then the most appropriate type of fertilizers and pesticides should get selected.

Keywords Soil, pollutant sources, soil carcinogen, effects

Introduction

Soil is our most important resource, which provides a fundamental need. It is formed by weathering of rocks on land surface and is most important life support elements among land [1]. It includes earthworms, nematodes, arthropods, fungi, protozoa and bacteria with each having own task. They take part in an important task in plant healthiness; a way nutrients are managed which has a major impact on plant growth, soil fertility, and agriculture sustainability? Soil is not only important for agriculture but also have more useful for living organism. Soil type is a major factor in determining what types of plants will grow in certain area. Plants use inorganic elements from the soil [2]. Soil plays a major role in determining the sustainable productivity of an agro- ecosystem. The sustainable productivity of a soil mainly depends upon its ability to supply essential nutrients to the growing plants. The deficiency of micronutrients has become major constraint to productivity, stability and sustainability [3]. Human race is totally depending on the fertility off the soil. Contamination of the soil leads to the total downfall of the human being so it is needed to take care of it and needed to nurture with the minimum use of the pro carcinogens ingredients.

Soil is one of the major life support system on Earth. Heavy metals are considered as one of the most serious pollutants in the environment due to their toxicity persistence and bio – accumulation [4]. The yield of crop depends on fertility and presence of micronutrients and heavy metals in the soil. The soil condition is of great importance, because it is an universal medium for plant growth, which supplies essential nutrients to the plants [5]. Heavy metals (Fe, Mn, Ni, Co, Zn, Cu, Cr, V, Ti, Cd, Hg, Mo and other trace metals) as well as As, Se and F occur naturally in soils, which are formed by geological process, such as alteration and erosion of the geological underground materials. Besides the parent material, the sources of contamination in soils are multifarious, and include agricultural



and industrial pollution [6]. The majority of the heavy metals are toxic to living organisms and even those considered essential can be toxic if present in excess. The heavy metals can impair important biochemical processes posing a threat to human health, plant growth and animal life [7]. Heavy metal contamination is also increasing because of mining, burning of fossil fuels and industrial as well as agricultural activities. Some heavy metals are necessary as plant micronutrients and other heavy metals which can bioaccumulate in plants and animals and may enter into human beings through the food chain. Most problems of soil pollution are associated with large amounts of heavy metals [8].

Impact of Fertilizers and Pesticides on Agriculture soil –

Modern agricultural practices lead to the saturation of soil and water with chemicals such as fertilizers and pesticides. In India, the production of fertilizers and pesticides has increased day by day. The industrialization and development in agriculture are necessary to meet the basic requirements of people, at the same time it is necessary to preserve the environment [9]. In recent years, the quality of soil is rapidly decreasing because of intensive agricultural practices. The quality and quantity of crop depends upon the presence of micronutrients including fertilizers and pesticides. These are supplied to the soil by giving the different fertilizers such as urea, sulphate, phosphate, etc by the external addition to the crop [10]. Intensive agriculture also leads to depletion of micronutrients and also decreasing the food quality. Critical pollution problems arise mainly from their excessive application rates. Although the fertilizers are used to increase the fertility of soil, yet they also contaminate the soil with their impurities. The main factor is the use of raw materials containing toxic metals such as Cd, Pb and Cr in the manufacture of fertilizer [11]. When the fertilizers are contaminated with other synthetic organic pollutants, the water present in the soil may also get polluted. For the high crop yield the farmers used the pesticides and fertilizers in excess amount. Overuse of fertilizers can also provide soil contamination; it increases the concentration of a particular element or substance of environmental interest above its naturally occurring level in the soil [12]. According to Savonen overuse of chemical fertilizers and pesticides have effects on the soil organisms that are similar to human overuse of antibiotics. Indiscriminate use of chemicals might work for a few years, but after while; there are not enough beneficial soil organisms to hold on to the nutrients [13].

Despite large-scale use of pesticides and fertilizers which are basically toxic and do not increase the yield. According to Wyszowska and Kucharski excessive amount of pesticides in the environment may result from a variety of breakdown that can happen while pesticides are being transported, stored or applied [14]. A variety of substances either created by or used in agricultural practices may increase cancer risk, including – pesticides, nitrates in fertilizers, dust, solvents, fuels, engine exhaust, paints and welding fumes [15]. Chemical fertilizers consumption increased exponentially throughout the world, causes serious environmental problems because some fertilizers consist of heavy metals which are carcinogenic in nature [16]. Twenty years ago, the US Department of Agriculture estimated that 50 million people in the US obtain their drinking water from groundwater that is contaminated with pesticides and other agricultural chemicals such as nitrates from fertilizers [17].

One of the most critical problems associated with intensive agricultural activities has been degradation of the natural environment due to the overuse of chemical fertilizer. In spite of environmental pressure against the use of chemical fertilizers, the deadly substance continues to be used unabated across the world. At the end of 20th century, an average of 91kgs of fertilizers was used for every hectare of cropland an increase of more than a third since the mid 1970s. The developing world accounted for the maximum increase both agricultural production and fertilizers used increased by about 4% between the mid 1980s and mid 1990s [18]. Fertilization may affect the accumulation of heavy metals in soil and plant system. Plants absorb the fertilizers through the soil, they can enter the food chain. Thus, fertilization leads to water, soil and air pollution [16].

The most of the pesticides and the fertilizers contains different chemicals and heavy metals; this heavy metal concentration in the soil is a major effect cause's threat to human life and the environment due to their toxicity. Heavy metals found in Fertilizers and Pesticides are prone to cancer and mutation of DNA. They also affect on Central Nervous system of Human Being. Some leads on damage the function of Human Organs. Insecticides too responsible for degeneration of Liver and Kidney.



Many pesticides have an immune suppressive effect. They trigger disease like cancer and asthma. There are pesticides that are persistent. e.g.-lindane, a persistent organochlorine pesticides, is a potent carcinogens. Studies examining the links between pesticides and risk of prostate cancer have shown that genetics and pesticide exposure together influence risk. For more likely to develop breast cancer when they reach middle age [19]. DDT is an extremely effective pesticide most widely used in agriculture purposes during World War 2nd, over the world, but it become great problems for human beings. Many experts believe that DDT stays in the environment, especially in the soil for such a long time and does not dissolve in water; it accumulates and create some problems in all biota. It is very cheap to manufacture, so most of the countries chose as a relatively inexpensive insecticide for spraying on a crops. The main disadvantage of DDT in agriculture, crops sprayed with DDT cannot be harvested up to one to two weeks. It leaves a lot of residual toxicity in vegetables, grains and plants and hence has a chance of causing cancer. DDT is carcinogenic to human beings, if its accumulation in human body exceeds a certain limit. It causes some negative health impact. Women have many pregnancy problems, early miscarriage, and difficulty in breastfeeding. DDT is actually harmful to the environment, although this was the reason given as DDT was banned from general use and one of the insecticides that is Endosulphan, has also been banned in many countries, but it is still use in some countries, including India. Both newly registered and re-registered pesticides can show evidence of cancer and still be used. For ex- the fungicide, vinclozolin is widely used on vineyards and was registered for use in 2000, despite laboratory test indicating that it causes testicular cancer and disrupts normal androgen activity in laboratory animals [20].

Enormous doses of pesticides residues have also been found in milk, fruits, vegetables, food articles and in blood. According to Byeno the contamination by toxic metals in animals can occur due to inhalation, skin preparation or ingestion of contaminated waters and foods, this last caused mainly by the capacity of plants in bioaccumulation these elements in high proportion and later offer them to animals and human beings [21]. In India the first report on poisoning due to pesticides from Kerala in 1958, where over 100 people died after consuming wheat flour contaminated with parathion [22]. Synthetic chemicals and fertilizers are a source of trace metals which are added to the soil either intentionally or as an impurity. Now Punjab Agriculture University, Ludhiyana, has reported the presence of heavy metals like Hg,Pb,As,Cr and Ni in vegetables like methi, mustard, mint, potatoes, tomatoes, cauliflower and peas [18]. Cancer causing agents are not listed on the label of pesticides and fertilizers. That's why people are unknown about the carcinogenic agents. The researchers have evaluated the most of the pesticides and fertilizers to determine whether the farmers who use them have increased risk of developing cancer. Among all the carcinogens elements Chromium is the most ubiquitous .

Chromium

Chromium compounds are low soluble that's why it is easily available to plants, so it plays an important role in the soil processes. The growth in civilization and industrial activities has caused a number of environmental problems. The heavy metals at low doses are essential micronutrients for plants and animals, but they can detrimentally affect the health of most living organisms is higher doses [23]. Chromium generally exists in two stable oxidation states – hexavalent and trivalent. Chromium hexavalent are known to be toxic and carcinogenic, causing health problems such as liver damage, pulmonary congestion, vomiting and severe diarrhea [24]. The source of chromium in environment are both natural and anthropogenic, natural source include burning of oil and coal, petroleum from ferro chromate refractory material, chromium steel, pigment oxidents, catalyst and fertilizers [25]. In humans, the Cr affects the immune, renal and respiratory tract, and is known as a powerful carcinogens [26]. According to Schaumlöffel , a lethal dose of Cr⁶⁺ is between 50 and 100 mg kg⁻¹, a value much lower when compared to Cr⁺³, the values are between 1900 and 3300 mg kg⁻¹ [27]. Since the Cr⁺⁶ occupies the 17th position in the Priority List of Hazardous Substances [28].

Chromium is a heavy metal which shows adverse effect on human health. Its presence in agricultural soils can be endorsed to the use of fertilizers, pesticides and the use of waste water for irrigation. Chromium enters the food chain through consumption of plant material. A high concentration of chromium has been found to be harmful to vegetation. As the chromium concentration in plants increases, it adversely affects several biological parameters.



Ultimately there is a loss of vegetation, and land sometimes becomes barren [29]. Food contains Cr at concentration ranging from <10 to 1300 g/kg [30]. Highest concentration has been found in meat, fish, fruit, and vegetables [31]. Utensils used in the preparation of food may contribute to chromium levels [32]. In recent years, contamination of the environment by the chromium has become a major concern because it leads to nasopharyngeal and lung cancer. According to Paul epidemiological evidence strongly points to chromium hexavalent as the agent in carcinogenesis. Solubility and other characteristics of chromium, such as size, crystal modification, surface charge, and the ability to be phagocytized might be important in determining cancer risk [33].

Symptoms of Cr phytotoxicity include inhibition of seed germination or of early seedlings development, reduction of root growth, leaf chlorosis and depressed biomass [34]. Several workers have reported symptoms like reduced growth, necrosis, leaf epinasty, red brownish discoloration due to metal phytotoxicity [35]. These all lead to the create carcinogens.

Effect of Carcinogens

A carcinogen leads to cancer which is the rapid growth of abnormal malignant cells in the body. A lump or mass called a tumor is formed, caused by uncontrolled cell division. Cells from the tumor spread to other areas of the body via the bloodstream [36]. In 2010, cancer alone accounted for 8 per cent of the 2.5 million total male deaths and 12 per cent of the 1.6 million total female deaths in this age group (30 to 69 years). At nearly 23 per cent, oral cancer caused the most number of deaths among men. It was followed by stomach cancer (12.6 per cent) and lung cancer (11.4 per cent). In the case of women, cervical cancer was the leading cause (about 17 per cent), followed by breast cancer (10.2 per cent) [37]. We usually think our mind of the environment, the outdoors is the beauty of Mother Nature but in cancer research, environment is defined as everything outside the body that enters and interacts with it. This interaction is called an exposure [36].

When we look at a deadly disease like cancer, data show it matters where we live. One out of every 10 to 15 living in Delhi, Chennai, Mumbai and Bangalore will get cancer. This means every second or third family in these cities will face this trauma. In Bhopal, the incidence goes down to one out of 20-36 persons about half of that in metros [18]. Recent studies have also confirmed the carcinogenic effects of pesticides and fertilizers. DDT was banned in US and UK and Endosulphan, an insecticide that has been also banned in many countries, but it is still used in some countries, including India.

Conclusion

There is a risk of contamination of soils due to excess use of metals which enters from atmospheric deposition or the use of pesticides or fertilizers that contain considerable amounts of metals. There is a growing concern about the possibility of contamination resulting in uptake by plants and the introduction of the elements in food chain [5]. For proper functioning of biological system some elements, metal and chemicals are important, imbalance could lead to disorders. Food chain contamination has become a burning issue in recent year because of some elements accumulate in bio systems through contaminated water, soil and air.

From decades, the farmers are using the conventional type of chemical pesticides and fertilizers. According to Atreya, low education level of rural population, lack of information and training on pesticide safety, poor spraying technology, and inadequate personal protection during pesticides use have been reported to play a major role in the intoxication scenario [38]. The alternative is use of organic fertilizers. Generally, organic fertilizers are more environmentally friendly, while still providing very good nutritional support for plants [39]. The present work will make them aware about the health and hygiene by using the pesticides and fertilizers but for taking the high crop yield they are using the conventional type of technology. In Punjab state due to adverse impact of the chemicals and fertilizers farmers initiated the concept of Kitchen Garden. Instead of commercial farming people are taking necessary vegetable product in the courtyard which is free from all type of chemicals and fertilizers. This found very suitable way for health.

The present work will insist people to use the organic manures and pesticides to promote the healthy population of beneficial organisms in the soil but due to lack of information about the organic technology farmers using the chemical fertilizers and pesticides to yield high crop. It will also provide the information which can be used to create



safe work style with carcinogens free environment which will provide healthy life style for agricultural owners and labours which paves the way to cancer free India.

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