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SOIL POLLUTION AS OCCASIONED BY FARMING PRACTICES AND GLOBAL WARMING

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ABSTRACT
Environment pollution is a burning topic of the day. Air, water and soil are being polluted alike. Soil being a "universal sink" bears the greatest burden of environmental pollution. It is getting polluted in a number of ways. These ways are discussed in the paper and therefore, there is need for urgent control of soil pollution in order to preserve soil fertility and increase the productivity of crops. The paper focuses on the review of sources and causes of soil pollution as well as global warming and their effects on crop production. Finally, the paper explains various farming practices and recommendations towards increased in agricultural production.
Key Words: Soil pollution, Farming practice and Global warming.

INTRODUCTION
Pollution is defined as the introduction of any substance to the environment that adversely affects the usefulness of a resource (Van Der Perk, 2006). The substance that is introduced and that adversely affects the environment is the pollutant, pollution and contamination are two terms used synonymously to mean the introduction into the environment by humans of substances that are harmful or poisonous to people and ecosystems (Van Der Perk, 2006). According to many other authors, however, meanings of soil pollution and soil contamination are different. To them, soil contamination is the introduction to the soil of a chemical substance which was not originally present (de Haan and van Riemsdijk, 1986), and soil pollution is the presence of a chemical substance in soil in concentrations higher than natural as a result of human activity and that has a detrimental effect on the soil environment and its components (Kabata-Pendias and Pendias, 2001).

Climate is an important factor of agricultural productivity. The fundamental role of agriculture in human welfare, concern has been expressed by many organizations and others regarding the potential effects of global warming on agricultural productivity. Interest of this matter has motivated a substantial body of research on global warming and agriculture over the past decade. Global warming is expected to affect agricultural and livestock production, hydrologic balances, input supplies and other components of agricultural systems.

Global warming is one of today's most popular and controversial topics. It is the result of combined human activity and natural variability (Wang *et al.*, 2010). Prevailing farming practices break down soil carbon into carbon dioxide that is released into the atmosphere, greatly contributing to global warming. Also the use of agrochemicals and fertilizers contribute to the release of greenhouse gases. Global warming also has its effect on the agricultural production, hence the need to look at the relationship between soil pollution, farming practices and global warming.

SOIL POLLUTION
Soil pollution is defined as the build-up in soils of persistent toxic compounds, chemicals, salts, radioactive materials, or disease causing agents, which have adverse effects on plant growth and animal health (Okrent, 1999). There are many different ways that soil can become polluted, such as seepage from a landfill, discharge of industrial waste into the soil, percolation of contaminated water into the soil, rupture of underground storage tanks and excess application of pesticides, herbicides or fertilizer. The

most common chemicals involved in causing soil pollution are: petroleum hydrocarbons, heavy metals, pesticides and solvents.

INORGANIC TOXIC COMPOUNDS

Inorganic residues in industrial waste cause serious problems as regards their disposal. They contain metals which have high potential for toxicity. Industrial activity also emits large amounts of arsenic fluorides and sulphur dioxide (SO2) (Richardson *et al.*, 2006). Fluorides are found in the atmosphere from super phosphate, phosphoric acid, and aluminium, steel and ceramic industries. Sulphur dioxide emitted by factories and thermal plants may make soils very acidic. These metals cause leaf injury and destroy vegetation. Copper, mercury, cadmium, lead, nickel, arsenic are the elements which can accumulate in the soil, if they get entry either through sewage, industrial waste or mine washings. Some of the fungicides containing copper and mercury also add to soil pollution. Smokes from automobiles contain lead which gets adsorbed by soil particles and is toxic to plants. The toxicity can be minimized by building up soil organic matter, adding lime to soils and keeping the soil alkaline (Van Zorge, 1996).

ORGANIC WASTES

Organic wastes of various types cause pollution hazards. Domestic garbage, municipal sewage and industrial wastes when left in heaps or improperly disposed seriously affect health of human beings, plants and animals (Nathanail *et al.*, 2005). Organic wastes contain borates, phosphates, detergents in large amounts. If untreated they will affect the vegetative growth of plants. The main organic contaminants are phenols and coal. Asbestos, combustible materials, gases like methane, carbon dioxide, hydrogen sulphide, carbon monoxide, sulphur dioxide, petrol are also contaminants. The radioactive materials like uranium, thorium, strontium etc. also cause dangerous soil pollution. Fallout of strontium mostly remains on the soil and is concentrated in the sediments (Nathanail *et al.*, 2005). Decontamination procedures may include continuous cropping and use of chelate amendments. Other liquids wastes like sewage, sewage sludge, etc. are also important sources of soil problems.

A. SEWAGE AND SEWAGE SLUDGE

Soil pollution is often caused by the uncontrolled disposal of sewage and other liquid wastes resulting from domestic uses of water, industrial wastes containing a variety of pollutants, agricultural effluents from animal husbandry and drainage of irrigation water and urban runoff (Tarazona *et al.*, 2005). Irrigation with sewage water causes profound changes in the irrigated soils. Amongst various changes that are brought about in the soil as an outlet of sewage irrigation include physical changes like leaching, changes in humus content, and porosity etc., chemical changes like soil reaction, base exchange status, salinity, quantity and availability of nutrients like nitrogen, potash, phosphorus, etc. Sewage sludges pollute the soil by accumulating the metals like lead, nickel, zinc, cadmium, etc. This may lead to the phytoxicity of plants.

B. HEAVY METAL POLLUTANTS

Heavy metals are elements having a density greater than five in their elemental form. They mostly find specific absorption sites in the soil where they are retained very strongly either on the inorganic or organic colloids. They are widely distributed in the environment, soils, plants, animals and in their tissues. These are essential for plants and animals in trace amounts. Mainly urban and industrial aerosols, combustion of fuels, liquid and solid from animals and human beings, mining wastes, industrial and agricultural chemicals etc. are contributing heavy metal pollution. Heavy metals are present in all uncontaminated soils as the result of weathering from their parent materials. In agricultural soils, however, the concentration of one or more of these elements may be significantly increased in several ways, like through applications of chemicals, sewage sludge, farm slurries, etc.

Increased doses of fertilizers, pesticides or agricultural chemicals, over a period, add heavy metals to soils which may contaminate them. Certain phosphatic fertilizers frequently contain trace amounts of cadmium which may accumulate in these soils. Likewise, some fertilizers when applied to soils, they add

certain heavy metals. The fate of heavy metals in soil will be controlled by physical and biological processes acting within the soil. (Huinink, 1998; Urzelai, 2000).

ORGANIC PESTICIDES

Pesticides are quite frequently used to -control several types of pests now-a-days. Pesticides may exert harmful effects to micro-organisms, as a result of which plant growth may be affected. Pesticides which are not rapidly decomposed may create such problems. Accumulation is residues of pesticides in higher concentrations are toxic. Pesticides persistence in soil and movement into water streams may also lead to their entry into foods and create health hazards. Pesticides particularly aromatic organic compounds are not degraded rapidly and therefore, have a long persistence time Mercury, cadmium and arsenic are common constituents of pesticides and all these heavy metals are toxic (Provoost, 2006; Apitz, 2008).

SOURCES OF SOIL POLLUTION

The sources which pollute the soil are of two folds: Agricultural sources and non-agricultural sources.

a. AGRICULTURAL SOURCES

Soil pollution comes from different sources including agriculture and animal husbandry. Some of the agricultural practices lead to soil pollution. They are animal wastes, use of long lived pesticides, herbicides, fungicides, nematocides, etc. fertilizers and some agricultural practices.

b. NON-AGRICULTURAL SOURCES

Soil pollution by non-agricultural sources is usually the direct result of urban sprawl caused by rapidly increasing population and a rapidly per capita output of waste related to our modem way of life. Its materials that find their entry into the soil system have long persistence and accumulate in toxic concentration and thus become sources of pollution. Some of those most important soil pollutants are inorganic toxic compounds.
(USEPA, 2010).

AGRO-CHEMICALS AND SOIL POLLUTION

Agrochemicals include various chemical substances used for production and protection in agriculture. In most cases, it refers to the broad range of pesticides, including insecticides, herbicides, and fungicides. It may also include synthetic fertilizers, hormones and other chemical growth agents, and concentrated stores of raw animal manure. Most agrochemicals are toxic, and their bulk storage may pose signify cant environmental and/or health risks, particularly in the event of accidental spills. In many countries, use of agrichemicals is highly regulated. Fertilizers and manures cause soil pollution by introducing heavy metals and their compounds into the soil. The heavy metals associated with some phosphate fertilizers are arsenic, cadmium, manganese, uranium, vanadium, and zinc. Common phosphate fertilizers are manufactured from rock phosphates, and the heavy metal contents of the raw material depend on their source ores (Helal and Sauerbeck, 1984). Poultry manure and pig manure may pollute the soil with zinc, copper, and arsenic.

FARMING PRACTICES AND SOIL POLLUTION

Agricultural facilities contribute approximately 20 % of the annual increase in anthropogenic greenhouse gas emissions (Belluck *et al.,* 2003). This sector contributes to global warming through carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) gases emission. Given the intensive productive nature of these activities, the main risks for the soil are associated with the use of agrochemicals (fertilizers and pesticides) to improve production and as well as the quality of products. Among the pesticides, special emphasis has been made on the organochlorines, included in the Stockholm Convention (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex, hexachlorobenzene, toxaphene, chlordecone, lindane, endosulfan), known as Persistent Organic Pollutants (POPs) because of their irreversible toxic effects on health (mutagenicity and carcinogenicity), as well as soil contamination.

CAUSES OF SOIL POLLUTION

Soil pollution is caused by the presence of man-made chemicals or other alteration in the natural soil environment. This type of contamination typically arises from the rupture of underground storage links, application of pesticides, and percolation of contaminated surface water to subsurface strata, oil and fuel dumping, leaching of wastes from landfills or direct discharge of industrial wastes to the soil. The most common chemicals involved are petroleum hydrocarbons, solvents, pesticides, lead and other heavy metals. This occurrence of this phenomenon is correlated with the degree of industrialization and intensities of chemical usage. A soil pollutant is any factor which deteriorates the quality, texture and mineral content of the soil or which disturbs the biological balance of the organisms in the soil. Pollution in soil is associated with indiscriminate use of fertilizers, indiscriminate use of pesticides, insecticides and herbicides, dumping of large quantities of solid waste and deforestation and soil erosion (Gevao *et al.*, 2000; Nawrot *et al.*, 2006).

POLLUTION DUE TO URBANIZATION

Pollution of surface soils materials (like vegetables, animal wastes, papers, wooden pieces, carcasses, plant twigs, leaves, cloth wastes as well as sweepings) and many non-biodegradable materials (such as plastic bags, plastic bottles, plastic wastes, glass bottles, glass pieces, stone / cement pieces) (Simcox *et al.*, 1995; Nawrot *et al.*, 2006). On a rough estimate Indian cities are producing solid city wastes to the tune of 50,000 - 80,000 metric tons every day. If left uncollected and decomposed, they are a cause of several problems such as:

i. Clogging of drains: Causing serious drainage problems including the burst / leakage of drainage lines leading to health problems. Barrier to movement of water: Solid wastes have seriously damaged the normal movement of water thus creating problem of inundation, damage to foundation of buildings as well as public health hazards.
ii. Foul smell: Generated by dumping the wastes at a place.
iii. Increased microbial activities: Microbial decomposition of organic wastes generate large quantities of methane besides many chemicals to pollute the soil and water flowing on its surface.
iv. When such solid wastes are hospital wastes they create many health problems: As they may have dangerous pathogen within them besides dangerous medicines, injections.

POLLUTION OF UNDERGROUND SOIL

Underground soil in cities is likely to be polluted by chemicals released by industrial wastes and industrial wastes, decomposed and partially decomposed materials of sanitary wastes. Many dangerous chemicals like cadmium, chromium, lead, arsenic, selenium products are likely to be deposited in underground soil. Similarly underground soils polluted by sanitary wastes generate many harmful chemicals. These can damage the normal activities and ecological balance in the underground soil (Simcox *et al.*, 1995).

EFFECTS OF SOIL POLLUTION

Agricultural effects include reduced soil fertility**,** reduced nitrogen fixation**,** and increased erodibility. Others are reduced crop yield and imbalance in soil fauna and flora. Industrial effects are dangerous chemicals entering underground water**,** ecological imbalance**,** and release of pollutant gases while others include release of radioactive rays causing health problems**,** increased salinity and reduced vegetation.

CONSEQUENCES

Public health problems, pollution of drinking water sources and waste management problems.
Soil becomes unavailable to grow food. If contaminated soil is used to grow food, the land will usually produce lower yields, can cause even more harm because a lack of plants on the soil will cause more erosion, the pollutants will change the makeup of the soil and the types of micro organisms that will live in it. Thus it's possible for soil pollution to change whole ecosystems (Urzelai, 2000; Apitz, 2008).

CONTROL OF SOIL POLLUTION

The following steps have been suggested to control soil pollution. To help prevent soil erosion, we can limit construction in sensitive area. In general we would need less fertilizer and fewer pesticides if we could all adopt the three Rs: Reduce, Reuse, and Recycle. This would give us less solid waste. Control of land loss and soil erosion can be attempted through restoring forest and grass cover to check wastelands, soil erosion and floods. Crop rotation or mixed cropping can improve the fertility of the land (Simcox *et al.*, 1995).

FARMING PRACTICES CONTRIBUTION TO GREENHOUSE EMISSION

Agriculture activities serve as both sources and sinks for greenhouse gases. Agriculture sinks of greenhouse gases are reservoirs of carbon that have been removed from the atmosphere through the process of biological carbon sequestration. The primary sources of greenhouse gases in agriculture are the production of nitrogen based fertilizers; the combustion of fossil fuels such as coal, gasoline, diesel fuel and natural gas; and waste management.

EFFECTS OF GLOBAL WARMING ON AGRICULTURE

Global warming can affect agriculture in a variety of ways. Beyond a certain range of temperatures, warming tends to reduce yields because crops speed through their development, producing less grain in the process. And higher temperatures also interfere with the ability of plants to get and use moisture. Evaporation from the soil accelerates when temperatures rise and plants increase transpiration - that is; lose more moisture from their leaves. The combined effect is called “evapotranspiration.” Because global warming is likely to increase rainfall, the net impact of higher temperatures on water availability is a race between higher evapotranspiration and higher precipitation (Belluck *et al.*, 2003).

CONCLUSION AND RECOMMENDATIONS

Agriculture activities serve as both sources and sinks for greenhouse gases. Agriculture sinks of greenhouse gases are reservoirs of carbon that have been removed from the atmosphere through the process of biological carbon sequestration.

a) Global warming poses a serious threat to our environment, shifting to a more resilient, sustainable agricultural system will mitigate global warming while building an agricultural food system that is better for our planet and its people. Failing to do so will result in devastating consequences for agriculture and the environment.
b) Rapid global warming is expected to impact agriculture by causing shifts in temperature, precipitation, soil quality, pest regimes, and seasonal growth patterns. Current agricultural activities are a significant source of greenhouse gases that aggravate climate disruption. And this is worsened by the fact that population in on the increase at a geometric rate forcing farmers to open up marginal lands which could have served as a sink for greenhouse gases hence exposing them to degradation.
c) The amount of GHGs emitted from an agricultural operation depends on its system and management. Sustainable and organic agricultural systems can help reduce agricultural GHG emissions through energy conservation, lower levels of carbon-based inputs, lower use of synthetic fertilizer and other features that minimize GHG emissions and sequester carbon in the soil.

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