Soil Challenges by Pesticide: An Illustrated Concept for Environmental Awareness

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Abstract

Majority of pesticides applied to the soils are not specifically targeting the pest only but also taking another dimension of environmental concern. Typically, when pesticides are sprayed to the plants, they dissolve speedily and enter various components of soil medium. This situation brings into existence a relationship between soil and chemicals contained in the pesticides. This relationship creates abnormal condition in soil and makes it to behave contrary to its natural stage of formation. This paper has taken into account an illustrated concept of pesticides behaviour under this condition as a challenge to four major soil components namely: soil quality, water quality, air quality and human quality. However, complex activities of soil challenges by pesticides as affecting these soil components include the agricultural activities, waste disposal, industrial environmental issues such as mining, chemical disposals, and accidental oil spills and occurrence of acid rain. These combined issues are discussed in this paper primarily to contribute with some basic ideas regarding the environmental aspect of pesticides consequences in agriculture.

Keywords: Soil; Air; Water; Soil challenges; Pesticides

Introduction

In the US 1957 Yearbook of Agriculture entitled “Soil”, three deẐnitions are presented, and each being a little more involved than the preceding and 21st Century one. HXese deẐnitions are as follows: (a) the natural medium for the growth of land plants; (b) a dynamic natural body on the surface of the earth, in which plants grow, composed of mineral and organic materials and living forms; and (c) the collections of natural bodies occupying parts of the earth’s m]N ая

adverse ewect on soil properties, human, animal health, plants and soil biota [10]. The term has been also regarded as a situation whereby harmful objects and chemicals are applied to soils directly or indirectly in a way that cause harm to other living things or even destroys soil mineral particles or water ecosystem [19].

Tools such as herbicides, insecticides, and fungicides protect crops both before and after harvest by increasing crop productivity, reducing yield losses, controlling pest and diseases, and improving crop quality [15]. Unfortunately, pesticides are poisons and can be hazardous when misused in the farm or garden. Many problems are attributed to this misuse of pesticides. These include the following: Fish kills, reproductive failure in birds, and acute illnesses in people and animals [20]. Besides, they are non-biodegradable, persistent and get accumulated in the environmental soil component as well as into the human food chain [14]. Therefore, this short communication was initiated to take into consideration the aspect of some challenges created by pesticides in soil, and also to build an awareness regarding pesticides behaviour in soil. This information is important because of the need to further understand the negative relationship between pesticides, soil, plant, microorganism and environment.

Soil Challenges by Pesticides

The theoretical and practical concept of soil challenges by pesticides can be described as 'pesticides transmission in soil'. This concept can be explained as a situation whereby the pesticide chemicals enter the soil via spray drift during foliage treatment, wash-oww from treated foliage, release from granulates or from treated seeds in soil [21]. The same problem may exist when pesticides such as soil fumigants and nematocides are applied directly into soil to control pests and plant diseases [22]. However, the transport, persistence or degradation of pesticides in this circumstance, depend on the chemical, physical and biological properties of the soils involved [7,23,24]. This is particularly true because of the relation between soil factors and sorption/ desorption, volatilisation, degradation, uptake by plants, run-oww, and leaching of pesticides in soil medium [10,23].

Sorption is the most important interaction between soil and pesticides and limits degradation as well as transport in soil [25]. Pesticides bound to soil organic matter or clay particles are less mobile, bio available but also less accessible to microbial degradation and thus more persistent [7]. Soil organic matter is the most important factor inzuencing sorption and leaching of pesticides in soil [26]. Practically, addition of amount and composition of organic matter had large impact on pesticides sorption. For example soil rich on humus content are more chemically reactive with pesticides than non-humiZed soil [27]. Fast sorption usually occurs in short time after pesticide application, and with time it becomes much slower [25]; although repeated application may also increase the sorption and formation of bound, non-extractable residues. This transformation and degradation system of pesticides has created many entrances for the occurrence of contamination and pollution in soil [7]. The results of these caused tremendous ewects on soil and water quality, biological system in soil and human diseases [9].

Generally, the ecosystem aspects of these implications include the soil quality, the air quality, the water quality, and the human health issues. The following explanation is generalized as it must be noted that pesticides awects almost all the major components of soil interaction systems [3]: the biosphere (organisms), lithosphere (rocks), hydrosphere (water), atmosphere and pedosphere (soil). These Zve components of ecosystem are fully describing the soil, air, water and human qualities in detailed concept of soil science as a scientiZc discipline.

1. Soil quality

Soil quality has been deZned by Karlen and co-workers as: 'the capacity of a speciZc kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation' [28]. This potential meaning of soil in this context may be awected when soil becomes contaminated or polluted. The surface and subsurface soil coibd n d æ]ɹя

4. Human quality

Human quality can be related to the concept of health and wellbeing of human population from childhood to adulthood. HXis dynamic system of human growth requires protection and management for its success in all aspects of agronomic practices. When soil, air and water polluted and contaminated, the human quality is also aẉected. Human population used soil for food security, water for drinking and related purposes, and air for breath. HXese three components of human ecosystem are aẉected by pesticides through contamination and pollution. HXe problems have also led to multiple and complicated human diseases including cancers, inability to speak ẑuently, hormonal imbalances leading to infertility, breast pain, menstrual disturbances, adrenal gland exhaustions, early menopause, immune

Most of the global soil's environment has been mapped for various needs, but in many areas soil contamination by pesticides is not yet covered. HXis study of soil mapping needs to be conducted in all aspects of agronomic soils to help outline the major areas of soil contamination by pesticide.

Surface soil formation is made up of millions of very small drops of pesticide chemicals, which are combined formulations of active and inactive ingredients. HXerefore, the need for regular soil analysis that could involve the use of both ex situ and in situ equipments will be an added advantage to help understand the impact of soil contamination by pesticides.

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