Chemosphere 178 (2017) 154–164

Contents lists available at ScienceDirect

Chemosphere

journal homepage: www.elsevier.com/locate/chemosphere

Review

Status of pesticides pollution in Tanzania – A review

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HIGHLIGHTS

- The reviewed studies exposed that, banned pesticides like DDT are still in use.
- Soil samples from former storage sites revealed high levels of pesticide residues.
- Knowledge of Tanzanian famers on pesticides handling is still very low.
- Rigorous legislation and regulations to control pesticides is missing in Tanzania.
- Training of pesticide users on proper pesticide handling is highly needed.

ARTICLE INFO

Article history:
Received 4 November 2016
Received in revised form
14 February 2017
Accepted 9 March 2017
Available online 9 March 2017

Handling Editor: Caroline Gaus

Keywords:
Vegetation
Soil
Water
Sediment
Organochlorine
Persistent Organic Pollutant

ABSTRACT

Various studies have been conducted in Tanzania to assess the magnitude of pesticides pollution associated with pesticides application, storage, disposal as well as knowledge of farmers on pesticides handling. The studies analysed samples from different matrices covering vegetation, biota, water, sediments and soil. The objective of this review was to summarise the results of pesticides residues reported in different components of the environment to give a clear picture of pesticides pollution status in the country for law enforcement as well as for taking precaution measures. Gaps which need to be filled in order to establish a comprehensive understanding on pesticides pollution in the country have also been highlighted. Reviewed studies revealed that, most of the samples contained pesticides below permissible limits (WHO, FAO, US-EPA) except for few samples such as water from Kikavu river, Kilimanjaro region and Kilolo district, Iringa region which were detected with some Organochlorine pesticides (OCPs) above WHO permissible limits. Some soil samples from the former storage sites also contained pesticides above FAO permissible limits. Pesticides and their metabolites were also detected both in vegetation, food and biota samples. The prevalent pesticides in the reviewed studies were the organochlorines such as Dichlorodiphenyltrichloroethane (DDT), endosulfan and Hexachlorocyclohexane (HCH). Surveys to assess farmer's knowledge on pesticides handling observed poor understanding of farmers on pesticides storage, application and disposal. Decontamination of former storage areas, continuous monitoring of pesticide applications and training of farmers on proper handling of pesticides are highly recommended.

Contents

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http://dx.doi.org/10.1016/j.chemosphere.2017.03.036
0045-6535/

1. Introduction

1.1. General introduction

A pesticide can be defined as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest such as insects, mites, nematodes, weeds, rats, etc. (Zhang et al., 2011).

Worldwide, the use of pesticides is increasing day by day as a result of growing population which influences the need for increasing food production. It has been established that, about one-third of the agricultural products worldwide are produced by using pesticides (Liu et al., 2002). An estimate loss of 78%, 54% and 32% for fruits, vegetables and cereals, respectively, can be reached as a consequence emanating from pest injury if pesticides are not used (Cai, 2008). Apart from being useful in agriculture, pesticides also play a vital role in the health sector. According to the World Health Organization, the most powerful and widely applied system of controlling malaria-carrying insects is through application of insecticides, mostly in the form of insecticide-treated nets and indoor residual spraying (Malaria Consortium, 2016).

Despite of the advantages of pesticides stated above, the risks of using pesticides are serious as well. Most of the pesticides are highly toxic both to humans and the environment especially when not properly used. The widespread use and disposal of pesticides by farmers, institutions and the public in general, provide many possible sources of pesticides and their metabolite into the atmosphere, soils and rivers thus threatening both human health and the ecosystem at large. The environmental pollution caused by pesticides in Asia, Africa, Latin America, the Middle East and Eastern Europe have been reported to be a serious problem (Sitaramaraju et al., 2014). This is notable, especially with the pollution caused by organochlorine types of pesticides such as DDTs, HCHs, aldrin, dieldrin, endrin, heptachlor and hexachlorobenzene. The uses of these types of pesticides have been continued although they have been banned in many countries including Tanzania some decades ago (UNEP, 2009). OCPs are characterized by low polarity, low aqueous solubility and high lipid solubility (lipophilicity), this property gives the propensity to bioaccumulate in the food chain posing a great threat to human health and the environment globally (Afful et al., 2010). OCPs have high chance of been found in water, sediments, soil and food even decades after application due to their long half-lives, stability in the environment and long-range transport (Abbassy et al., 1999).

Availability of banned organochlorine pesticides in different environmental compartments in Tanzania can be ascribed to their persistence in the environment, illegal uses, and emissions from certain point sources or improper disposal (Kishimba et al., 2004; Marco and Kishimba, 2007).

In order to ascertain the status of pesticides pollution levels in various regions of Tanzania and in different compartments of the environment, various studies carried out in Tanzania have been reviewed in this paper with the main objective/purpose of indicating the level of pollution in different regions of the country so as to provoke the government to enhance the enforcement of laws and regulations governing pesticides trade in the country and provide training to pesticides users so that they can take precautions to safeguard their health and the environment at large. The review also intended to highlight on the gaps which need to be covered in order to have a comprehensive understanding of pesticides pollution in the country as well as creating new research avenues. At a global scale the review can be replicated in other countries facing the same problem of pesticide pollution like Tanzania so that at the end of the day joint efforts can be made to tackle this problem worldwide through existing international conventions.

1.2. Literature search process

The articles reviewed in this paper were obtained through Agora, google scholar and PubMed databases. The key words used in searching included “Pesticides pollution in Tanzania”, “effects of organochlorines in the environment”, organochlorine pesticides in soil, sediment, biota and water in Tanzania”, “knowledge of farmers on pesticides handling in Tanzania”. References in the obtained articles were also scrutinized and those found to be relevant to the objective of his articles were searched.

2. Pesticides pollution in Tanzania

As with other countries in the world, pesticides uses in Tanzania have been increasing year by year. Since 1992, the use of pesticides has rapidly increased following agrochemicals trade liberalization in the country (Ngowi, 2002). It is estimated that 18% of pesticides in Tanzania is used in the public health sector while 81% is used in livestock and agricultural sectors and the remaining 1% is used for other purposes including protecting buildings from damage caused by insect pests (Agenda, 2006). From the year 2000–2003, the imports of pesticides increased from 500 to 2500 tonnes. In the year 2006, 682 different types of pesticides were registered in the country (Agenda, 2006). According to the Ministry Of Agriculture (2011), a total of 1023 different pesticides were registered in Tanzania by the year 2011.

Although pesticides has been used to improve and maintain high agriculture productivity and controlling various disease caused by pests in Tanzania, pollution in water, sediments, soil, vegetation and biota have been reported in various regions (Hellar, 2011; Mohamed et al., 2014; Henry and Kishimba, 2003; Mahugija, 2013; Marco and Kishimba, 2006). The main causes of the pollution being improper application, storage and disposal (Mahugija, 2013; Kishimba and Mihale, 2004). Knowledge of Tanzanian farmers on pesticides handling (application, storage and disposal) is very poor due to lack of training and illiteracy (Lekei et al., 2014; Ngowi, 2002). Various studies conducted in different regions in the country to assess the pesticides levels in different compartment of the environment are summarized below. Fig. 1 below shows the regions of Tanzania.

2.1. Pesticide pollution in water and sediments

Improper management of agrochemicals may cause pollution of water resources. Most of these pollutants may reach surface and ground water resources through runoff, discharge and percolations, where they can cause significant water pollution (Aktar et al.,