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Organophosphate Pesticide Residues Analysis Sampled From Containerised Beans Repatriated from European Union

V. Isegbe[1], M. Habib[1], J. Obaje[1], S. Ekoro[1], S. Solomon[1]

[1]Nigeria Agricultural Quarantine Service, Abuja. Nigeria
Solomonpqs@yahoo.com

For correspondence: Dr. Solomon Sunday, Nigeria Agricultural Quarantine Service, P. M. B. 285, Garki, Abuja. Nigeria

ABSTRACT

Pesticide residue is a major contaminant on dried beans originating from Nigeria in recent time. Five containers of dried brown beans repartriated from an EU country to Nigeria owing to this contaminant were randomly sampled. One hundred and twenty-five kilogram 125 kg of beans was taken from each container at Apapa sea port. Beans from each bag were poured on polythene bag spread on the ground, mixed thoroughly by hands. Four samples were taken from each bag; each weighed two (2) kg from the mixed bulk sample. Each sample (Total 22 samples) was stored in a polythene bag, carefully labeled and taken to BATO chemical laboratories limited, Oshodi, Lagos for pesticide residues analysis. The results revealed high level of cypemethrine mg/kg, Dichlorvos mg/kg, Dimethoate mg/kg, Chlorpyrifo mg/kg and Diazinon mg/kg in many samples. Based on EU standard, Cypemethrine contained between 0.003 mg/kg to 0.146 mg/kg, as against the acceptable maximum residue limit of 0.05 mg/kg, Dimethoate mg/kg contained between 0.073 mg per kilogramme to 0.083mg/kg, as against the acceptable maximum residue limit of 0.02 mg/kg, Chlorpyrifo contained between 0.003 mg per kilogramme to 0.06 mg/kg, as against the acceptable maximum residue limit of 0.05 mg/kg**,** Diazinon contained between 0.029 mg per kilogramme to 0.08 1mg/kg, as against the acceptable maximum residue limit of 0.01mg/kg and Dichlorvos contained between 0.024 mg per kilogramme to 0.381mg/kg, as against the acceptable maximum residue limit of 0.01mg/kg. This study therefore, provided baseline information on contamination level of pesticides residues in dried beans originating from Nigeria with a view to controlling them from farm to the table.

Keywords: pesticide residues, dried beans, Nigeria

INTRODUCTION

Pesticides are poisons; they are produced because they are toxic to one pest or the other (Banjo *et al.*, 2010**)**. Pesticides are an important management tool in agricultural enterprise; they increase yields and increase protection against insects at post-harvest and storage, and it has continued to be the bedrock of agriculture in modern times because of its unquantifiable benefits one of which include enhancement of shelf life of stored agricultural products (Olabode *et al*., 2011). Cooper and Dobson (2007) maintained that for every dollar spent on pesticide for crop yield and storage four dollars in crops is saved; since 10 billion dollars worth of agro-chemicals is used for crops globally annually then 40 billion worth of crops is saved annually.

The use of synthetic insecticides has adverse effects on human health (Otitodun *et al*., 2012). The undesirable consequences of pesticides use on human health have become more evident from the 1950s

onward (Morner *et al*., 2002). According to Ogunjimi and Farinde (2012) pesticides use in Nigeria has been on the increase after it was introduced in the early 1950s and particularly in 1957 when Lindane was introduced and recommended for use in Nigeria. In the face of a growing human population, and increased urbanization in Nigeria, the demand for pesticide increased in the early 1960s after her Independence and the risk of pesticide whether real or perceived forced changes in the ways these chemicals are used. The estimated annual application of pesticides is more than 4 million tons, but only 1% of this reaches the target pests (Gaurilescu, 2005). While their use improves the quantity of agricultural products it potentially affects their quality, as pesticides may enter human diet (Grlic, 1988).

Organic phosphate is the most widely used pesticide worldwide and their metabolites are wide spread across different populations (Aprea, 2000). The adverse short-term effects of exposure to these chemicals have been studied mostly in the nervous system, which is their primary target (Gupter *et al*., 20001). In other word, they are neurotoxic to non-target animals, including humans and other mammals (Bjorling-Poulsen *et al*., 2008).

Significant contamination of dried beans has been reported in Nigeria. For example, in the Nation newspaper on Sunday, April 5 2015, it was reported that 42 food items produced in the country were rejected by United Kindom (UK) for quality defects. Again, in the Editorial newspaper Thursday, July 30 2015, European Union (EU) suspended the importation of dried beans originating from Nigeria as a result of pesticide residues in them.

In a bid for NAQS to carry out one of her functional objectives which is to facilitate international trade in agricultural products by enforcing compliance with World Trade Organization (WTO) and Sanitary and Phyto-sanitary (SPS) standards, there is need to determine level of pesticide residues in dried beans from the country. Similarly, concern about the health effects of pesticides have increased over the past years considering the rates at which scholars have put into the study of the phenomenon. However, there is no quantitative information on the levels of pesticide residues in dried beans from the country. The aim of this study therefore, was to provide baseline information on contamination level of pesticides residues in dried beans originating from Nigeria with a view to controlling them.

MATERIALS AND METHODS

Sampling Procedure

Five containers of dried brown beans (*Vigna unguiculata*) repartriated from an EU country to Nigeria owing to the suspension placed on beans originating from Nigeria were randomly sampled. One hundred and twenty-five kilogram (125 kg= 5bags) of beans was taken from each container at Apapa sea port. Beans from each bag were poured on polythene bag spread on the ground, mixed thoroughly by hands. Four samples were taken from each bag; each weighed two (2) kg from the mixed bulk sample. Each sample (Total 22 samples) was stored in a polythene bag, carefully labeled and taken to BATO chemical laboratories limited, Oshodi, Lagos for pesticide residues analysis. Results of Analysis of Pesticide Residues in Beans Sample (EPA Method 8081B) are shown in the table overleaf:

RESULTS

The results revealed high level of cypemethrine mg/kg, Dichlorvos mg/kg, Dimethoate mg/kg, Chlorpyrifo mg/kg and Diazinon mg/kg in many samples (table 1). cypemethrine contained between 0.003 mg/kg to 0.146 mg/kg, as against the acceptable maximum residue limit of 0.05 mg/kg, Dimethoate mg/kg contained between 0.073 mg per kilogramme to 0.083mg/kg, as against the acceptable maximum residue limit of 0.02 mg/kg, Chlorpyrifo contained between 0.003 mg per kilogramme to 0.06 mg/kg, as against the acceptable maximum residue limit of 0.05 mg/kg**,** Diazinon contained between 0.029 mg per kilogramme to 0.08 1mg/kg, as against the acceptable maximum residue limit of 0.01mg/kg and Dichlorvos contained between 0.024 mg per kilogramme to 0.381mg/kg, as against the acceptable maximum residue limit of 0.01mg/kg (Table 1).

DISCUSSION

Organophoshate pesticides are extensively used in agriculture. They are specifically designed to target the nervous systems of pests. For this reason, they are neurotoxic to non-target animals, including humans and other mammals (Bjorling-Poulsen et al., 2008). The results revealed high level of cypemethrine mg/kg, Dichlorvos mg/kg, dimethoate mg/kg, chlorpyrifos mg/kg and diazinon mg/kg in many samples (Table 1). This is in agreement with the findings of Claeys et al. (2011); Yuan et al. (2014) who reported that among many other pesticides cypemethrine, chlorpyrifos, boscalid, iprodione, dithiocarbamate and acephate are regularly detected in food. Various literature published between 2007 and 2014 suggests that legumes, leafy greens and fruits frequently contain the highest level of pesticides (Bempah et al., 2012). There is consistent evidence that these substances are regularly present as mixtures of multiple residues and in many cases, at levels above Maximum Residue Limit (MRL) limits in certain countries (Latifah et al., 2011).

Organic phosphate insecticides inhibit the enzyme cholinesterase, which results in disruption to the nervous and muscular system (WHO, 1989). Farmed animals can accumulate pesticides from contaminated feed. These substances are generally stored in the fat and muscles of the animals, some can also be found in the brain, liver, lungs and other offal (LeDoux, 2011). There is evidence that fertility of both men and women may be reduced with increased pesticide exposure (Abell et al., 2000; Oliva et al., 2001). Dichlorvos, a component of organophosphate, has a high acute toxicity: the oral LD50 in rats is between 56 and 108mg/kg. It is classified by the WHO as a Class IB, 'highly hazardous'(WHO, 1993). The dermal toxicity is similar to oral toxicity, and dermal exposure is a cause for concern. There is evidence that dichlorvos can induce delayed neuropathy in hens at very high doses; and neurophysiological and behavioural changes in rats (WHO, 1989).

Pesticide residues commonly present in food that is grown through intensive industrial farming. Food often contains multiple residues and therefore pesticides are presented to us as mixtures or cock tails (Fenik et al., 2011). The toxic effect of these mixtures is poorly understood, though it is recognised that some substances can interact synergistically in that their combined effect is greater than that of the individual components (Reffstrup et al., 2010).

According to the report of Wikowska and Biziuk (2011), residues of pesticide applied can persist within the tissues or on the surface of crops when they are brought to market. Continuous monitoring is necessary to ensure as far as possible that limit values set for pesticide residues are not exceeded in produce reaching the market place (Li et al, 2014). Extensive research suggests that washing and cooking does reduce some of these residues that are on the surface of the plant, in some cases food preparation can actually concentrate levels (Keikothaile et al., 2010).

It is desirable and hereby recommended that awareness programmes should therefore be created to sensitize farmers on the need to embark on crop protection through multi-level approach that increases heterogeneity of the landscape so as to provide habitat for pollinators and natural pest control species. It is also imperative that farmers plant cowpea resistant varieties to prevent the use of synthetic pesticides on the field.

Awareness should also be provided among the stakeholders such as exporters, warehouse owners and farmers on the dangers associated with the indiscriminate use of synthetic pesticides and the use of good cultural practices (air-tight containers, organic pesticides) to reduce the pesticide residues in storage beans be encauraged.

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Table 1. Pesticide Residues In Beans

S/N	Sample	Cypermethrin mg/kg	Dichlorvos mg/kg	Dimethoate mg/kg	Chlorpyrifos mg/kg	Diazinon mg/kg
1	CAIU SAMPLE 0A	N.D	N.D	N.D	N.D	0.029
2	CAIU SAMPLE 0B	0.025	0.052	0.073	N.D	0.035
3	CAIU SAMPLE 0C	0.004	0.046	N.D	N.D	N.D
4	CAIU SAMPLE 0D	N.D	0.026	N.D	N.D	N.D
5	CAIU SAMPLE 0E	N.D	N.D	N.D	0.059	0.029
6	CAIU SAMPLE 1A	N.D	0.031	N.D	N.D	0.039
7	CAIU SAMPLE 1B	0.135	N.D	N.D	N.D	0.069
8	CAIU SAMPLE 1C	0.043	N.D	N.D	N.D	0.081
9	CAIU SAMPLE 1D	0.024	0.142	N.D	N.D	0.049
10	CAIU SAMPLE 1E	N.D	0.024	N.D	N.D	0.043
11	CAIU SAMPLE 2A	0.146	0.23	0.083	0.027	0.032
12	CAIU SAMPLE 3A	0.19	0.381	N.D	0.06	0.034
13	CAIU SAMPLE 3B	0.021	0.138	N.D	0.027	0.031
14	CAIU SAMPLE 3C	0.028	0.286	N.D	0.021	0.042
15	CAIU SAMPLE 3D	0.014	0.146	0.076	0.056	0.044
16	CAIU SAMPLE 3E	0.019	0.081	N.D	0.003	0.026
17	CAIU SAMPLE 4A	N.D	0.028	N.D	0.063	0.061
18	CAIU SAMPLE 5A	0.03	0.044	N.D	N.D	N.D
19	CAIU SAMPLE 5B	0.003	0.035	N.D	N.D	0.031
20	CAIU SAMPLE 5C	0.012	0.05	N.D	N.D	0.029
21	CAIU SAMPLE 5D	0.06	0.027	N.D	N.D	0.033
22	CAIU SAMPLE 5E	0.019	0.024	N.D	N.D	0.049
	MAXIMUM RESIDUE LEVEL(UK/EC)	0.05	0.01	0.02	0.05	0.01