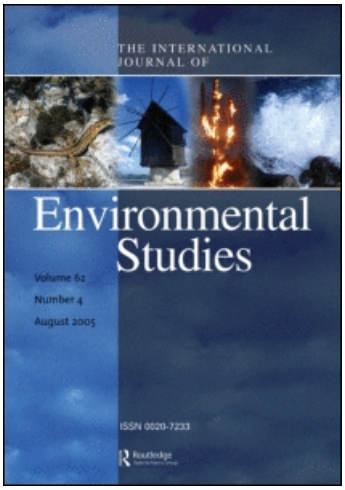

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AN OVERVIEW OF EXPOSURE AND MANAGEMENT OF PERSISTENT ORGANIC PESTICIDES IN SWAZILAND

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Available information in Swaziland indicates that there are stocks of persistent organic pesticides that have been discontinued elsewhere because of their carcinogenic, mutagenic and teratogenic properties. Some of these pesticides, such as DDT and endosulfan, are still used in agriculture to protect crops and livestock from pests and diseases, and in vector control especially mosquitoes. There has been an increase in the use of these pesticides over the years. It is estimated that about 30–40% of the population may have already been exposed to these pesticides. The cultural and lifestyle determinants of pesticide exposure are highlighted.

Keywords: POPs exposure sources; Management; Pest control; Swaziland

INTRODUCTION

The application of chemical control technologies (pesticides and fertilizers) that have proved effective in the developed countries have made a firm entry into agriculture and vector control in the developing countries. The widely spread use of pesticides is partly due to the advantages they offer. Pesticides are effective, and their use can prevent loss of yield and reduce risks for losses and diseases. They work quickly, which makes them suitable for use in emergency situations, and frequently they are the only remedy when crops and humans are under immediate threat of infestation and epidemics, respectively. Many of these substances that play important roles in modern society are persistent, organic and halogenated.

Persistent organic pesticides (POPs) have been defined as organic substances that are resistant to photolytic, biological and chemical degradation. Many POPs are characterized by low water solubility and high lipid solubility, leading to bioaccumulation in fatty tissues. According to reference [1], POPs with these characteristics are typically semi-volatile, enabling them to move long distances through the atmosphere before deposition occurs. The toxicity and bioaccumulation of these substances have indicated the need for management strategies. Examples of POPs include: dichlorodiphenyltrichloroethane (DDT), dieldrin, endosulfan, to mention but a few.

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Excessive use of pesticides causes anxiety about pesticide residues in the environment especially about bioaccumulation of the more persistent types. For example, residues of DDT have been shown to be persistent and pervasive in air [2] and in the lipids of most animals [3].

In Swaziland a substantial amount of resources is devoted towards the production of more food to meet the high population growth rate of about 3.42% per annum, and in order to combat malnutrition and prevent endemic communicable diseases such as malaria. Pesticides are therefore used in order to achieve these goals. The use of pesticides in both agriculture and vector-control areas has been on the increase. According to a report [4], POPs were among an estimated 320 tons of pesticides used between 1993–1994. Also the Department of Public Health of the Ministry of Health uses DDT to control malaria-carrying mosquitoes in the eastern parts of the country. Since 1989, there has been an increase by about 20% on the amount being used for this purpose. Consequently, it is highly probable that this may have led to a high level of exposure by the population.

Therefore, it is important to present an overview of the sources of exposure/as well as the current scenario, in pesticide management in the country. Cultural, lifestyle and common practices determinants of pesticide exposure are highlighted.

SOURCES OF PESTICIDES IN SWAZILAND

The bulk of pesticides used in Swaziland come from two main distributors: Farm Chemicals (FC) and Swaziland Agricultural Supplies (SAS). The supply from these distributors accounts for about 80% of the pesticides used in the country [5]. The remaining 20% comes from the Agricultural Development Advisory Services (ADAS). Most of these pesticides are imported from neighbouring countries who, in turn, import from the far east.

AGRICULTURAL LAND USE IN SWAZILAND

Swaziland is one of the small countries in Southern Africa, covering approximately 17,365 sq km. Swaziland has a population of about 900,000 people. Agricultural land use in Swaziland is normally divided between the Swazi Nation Land (SNL) and Individual Tenure Farms (ITF). The latter is also referred to as Title Deed Land (TDL). Table I shows the land area available for agricultural purposes in Swaziland for the year 1989/90 [6].

From Table I, Swazi Nation Land (SNL) and Title Deed Land Farm (TDL) constituted about 65% and 35%, respectively, in the 1989/90 cropping season. The modern commercial

TABLE I Agricultural Land Use in Swaziland for the Year 1989/90.

Crop land	*Whole country*	*SNL (ha)*	*TDL (ha)*
Total	194,873	123,274	71,599
Fallow	22,570	10,808	11,762
Crops	172,303	112,466	59,837

SNL = Swazi Nation Land, TDL = Title Deed Land, ha = Hectare.

TABLE II Land Area Used for Commercial Agriculture on TDL for 1989/90.

Commercial forest	*Whole country (ha)*	*SNL (ha)*	*TDL (ha)*
Total	112,169	–	–
Pines	80,468	–	80,468
Others	31,701	–	31,701

agriculture is operating on TDL and the land area available for this is shown in Table II. Title Deed Land accounts for about 60% of the total industrial output although it only constitutes 35% of the crop area. On the other hand, the productivity from Swazi Nation Land is very low because it is characterised by semi-subsistent agriculture, communal grazing and traditional tenure.

The agricultural sector is one of the leading sectors in the contribution to the GDP of Swaziland. In 1990/91, the agricultural sector accounted for about 13.5% of the country's GDP. Of this total maize and cotton contributed about 22%, while sugar, citrus and pineapple production contributed about 60%, and the rest by livestock [7]. The relative importance of the main agricultural crops is shown in Table III. Production from TDL is market-oriented, with sugarcane and citrus being the most important crops, and this is reflected in the high value of production per hectare, as shown in Table III. In comparison, crops produced on SNL are mostly for subsistence purposes with maize being the main crop, and cotton the primary source of income.

PESTICIDES USED IN SWAZILAND FOR AGRICULTURAL PURPOSES

Pesticides are widely used on SNL and TDL to protect crops and livestock from pests and diseases. It is extremely difficult to give exact quantities of pesticides being used in Swaziland. However, statistics are available only for pesticides used by TDL farmers and the Ministry of Health [8].

One way of estimating the amount of pesticides used for agricultural purposes is to sum the quantities of pesticides sold by the two main distributors (SAS and FC). The quantity of the most common pesticides used in Swaziland on TDL and large estate farms is shown in Tables IV and V. As shown in Tables IV and V, a number of persistent organic

TABLE III Production of Major Crops on SNL and TDL for 1991–92.

	Production (mt/ha)	*Yield (mt/ha)*
Title Deed Land		
Sugar-cane	3941	105.1
Cotton	2.8	0.3
Citrus	59.0	21.1
Swazi Nation Land		
Cotton	3.0	0.2
Maize	54.0	0.7

mt/ha = Metric tones per hectare.

TABLE IV Quantity of the Most Common Insecticides Used and Hectares to Which Applied on Title Deed Land and Large Estate Farms in Swaziland for 1992–93.

Trade name	*Unit*	*Quantity*	*Hectare*
Orchex	kg	125	5
Cintrex narrow	kg	400	12
Dimethoate	kg	3	13
Temik	kg	40	12
Kombat-bait	kg	50	12
DDT	kg	510	97
Endosulfan	kg	150	20
Dithane	kg	30	2.2
Malathion	kg	3140	73
Copper oxychloride	kg	13.6	20
Terramycin blue	kg	1.6	20
Benlate	kg	500	20
Tartar emetic	kg	12	20
Sevimol	kg	45	32
Carbaryl	kg	381	55
Kombate-stalkborer	kg	67	65
Azodrin	kg	1.2	226
Dipterex	kg	38	93

pesticides are still very much in use in Swaziland, although most of these pesticides have been discontinued in most countries, especially the developed countries. DDT is used against American bollworm, leafeaters, thrips and all bollworm [9]. Endosulfan is also used against American bollworm, aphids, moth and loopers on cotton [9].

TABLE V Quantity of Herbicides Used and Hectares to Which Applied on Title Deed Land and Large Estate Farms in Swaziland for 1992–93.

Trade name	*Unit*	*Quantity*	*Hectare*
Paraquat	L	2.967	53
2,4,5-T	L	2.200	45
Atrazine	L	35.895	225
Alachlor	L	11.017	132
M.C.P.A.	L	8.274	74
2,4-D	L	3.127	24
Metalochlor	L	4.057	11
Bromacil	L	600	22
Diuron	L	11.689	75
Gromoxon	L	1.357	155
Harness	L	12.357	57
Sencor	L	1.800	39
Fortrol	L	80	72
Velper	L	2.784	22
Lasso	L	480	11
Garlon	L	1.0	13
Sting	L	4.503	43
Ametryn	L	47.705	101
Round-up	L	17.577	398
Traflan	L	3.250	95
Gardomil	L	3.0	39
Eptam super	L	376	11
Gespax	L	500	20

PESTICIDES IN VECTOR-CONTROL IN SWAZILAND

The use of insecticides for the control of malaria and other vector-borne diseases worldwide has proved very effective since the 1950s. The failure of eradication programmes and the increase in world population have resulted in an increase in vector-transmitted diseases. There is no question that DDT and its analogs, occupy a unique position in vector-control. In Swaziland, the Department of Public Health of the Ministry of Health uses DDT to control malaria-carrying mosquitoes in the eastern parts of the country. In 1989/90 seasons, 9 tons 75% wettable concentrate of DDT was applied on the inner walls of homes throughout the endemic parts of the eastern parts of the country. In 1993/94, about 12 tons 75% wettable concentrate of DDT was used for the same purpose [10]. Other strong pesticides such as dichlorvos are used in formulation of sprays used against household pests, such as cockroaches and fly species.

FARMERS IN SWAZILAND

Generally, agricultural operations in Swazliand are characterised by a relatively few large-scale operators concentrating on a single major activity, such as the production of cotton, sugarcane, citrus fruits, pineapples and timber production. Other important crops such as cereals and legumes are also cultivated by a few farmers.

There are many small-scale farmers in Swaziland. The largest and the most organised group of farmers are the Vuvulane Irrigation Farmers [5]. The area consists of about 260 farms that are individually owned by farmers. The farmers practice mixed farming. They use about two thirds of their farms for sugarcane, and the rest for maize and vegetables. They sell two thirds of their produce and live on the remaining one third.

Obstacles in managing workplace exposure are in part due to poor or non-existent training, lack of safety equipment, and substandard working conditions. This is especially the case with SNL farmers and also for some farm workers on some of the larger estates. It is common knowledge that most farmers do little to observe simple hygiene and dispose of wastewater without due care to surface and ground water. Consequently, cases of river pollution have been reported in some of the farm areas. For example, in 1986, fish kill in one of the rivers was attributed to dieldrin used against cane beetle and stalk-borer in the sugarcane field [11]. Another river around the sugarcane area has also been reported polluted from time to time by pesticides used in agriculture in the area [5]. It is also common practice by a good number of small-scale farmers to use discarded pesticide containers for storing water for human consumption. Re-packing of these chemicals into containers labeled otherwise, *e.g.* beer bottles, is also rife.

ENVIRONMENTAL AND PUBLIC HEALTH HAZARDS

The exposure of Swazis to the increasing use of pesticides, especially the POPs on both SNL and TDL, represents a growing health hazard that has yet to receive due attention. Consequently, concerns resulting from occupational, bystander and near-field exposure are difficult to identify. Exposure to pesticides generally may be influenced by safety, lifestyle

and living conditions. Poor nutrition and health and poor hygienic practices can combine to increase the level of exposure and susceptibility to pesticide poisoning. These factors can be found among the rural dwellers in Swaziland.

Africans are known to live in communities, especially in the rural areas. Such communal lifestyle is very evident in Swaziland. Homesteads are generally built close to one another and most of the dwellings are open types. So the spraying of POPs, such as DDT, in few homes can easily spread to a whole community. It is roughly estimated that with the present amount of DDT being used to spray homesteads in Swaziland, a large portion of the population of Swaziland lives in the DDT-treated area, giving an exposure of 40 g of pure DDT per person per year [12]. Apart from studies [13–14] on organochlorine compounds in human breast milk there has not been other research work conducted on POPs within the country.

In addition to lifestyle and living conditions, tradition can also influence exposure. For example, in Swaziland, communal grazing on SNL is very common. If the lands are contaminated with pesticides, which is often the case in rural farm areas, residues of the pesticides can easily be picked up by the grazing livestock. This livestock normally provide, milk as well as meat that are consumed on a daily basis and during celebrations and funerals. Thus pesticides such as DDT can be passed on to humans.

Also in Swaziland, people use wild vegetation in their daily diets, especially during the summer period. Any contamination of the vegetables by pesticides poses a health problem. As in most African countries, rivers and streams are used for domestic purposes without adequate treatment. During the summer period, run-offs from farmlands are very common and are discharged into streams and rivers.

The greatest concern is due to the use of persistent organic pesticides (POPs), such as DDT. Since DDT is fat soluble, during lactation fat mobilization could take place from adipose tissue and therefore DDT can be mobilized and excreted together with milk. This poses a danger to the newborn whose indispensable and the most important food is human milk.

The weight of scientific evidence strongly suggests that many POPs cause significant adverse effects to human health, at local, regional and global levels through long range transport. Short-term exposure to high concentrations of certain POPs has been shown to result in illness and death. For example, studies have shown that DDT may cause a number of adverse effects in humans, ranging from acute toxicity to cancer [15].

PESTICIDE MANAGEMENT IN SWAZILAND

In most African countries, including Swaziland, pesticide management is still in its infancy. A remarkable percentage of these hazards in developing countries, including Swaziland, are due to ignorance and indifference. These are aggravated by methods of applying the chemicals. Since most pests often hide in obscure corners of animal, water or plant bodies or cracks and sewers of buildings, most pesticide applicators aim at saturating the whole infested area with a pesticide. In this way, the applicators increase the risks of the applied pesticides reaching non-target areas or organisms.

Also reasons such as legislation, education, inadequate financial and human resources contribute to the problems of poor pesticides management.

At present in Swaziland, the author is not aware of any specific pesticide legislation to control the importation, distribution, handling and use of pesticides. A draft legislation was pre-

pared by an FAO legal consultant on pesticide management for Swaziland in 1992. However, the draft has not been followed up.

Most small-scale farmers *i.e.* the SNL farmers, are not well educated. Consequently, information on the use, handling, disposal and storage of pesticides are not grasped well. This has led to many reports on pesticides poisoning, particularly children, who play around with used pesticide containers that are not properly disposed.

As a developing nation, Swaziland is faced with economic problems such as increasing food production, unemployment, housing and health. These problems are considered high in the government's scale of preference, and consequently, the already limited financial resources are allocated to solving these problems instead of tackling the problems posed by POPs. Funds are not readily available to train more extension workers who can be used extensively in educating the small-scale farmers on the use and disposal of pesticides.

CONCLUSION

As reviewed above, there are several reasons for anxiety concerning the use and management of pesticides and, in particular, the persistent organic pesticides in Swaziland. For a start there is a need to introduce a workable legislation in line with the FAO guidelines on pesticide management. There should be a re-education of farmers to reduce dependence on chemical control as the main input on crop protection. Furthermore, applying IPM generally reduces the farmers production costs since fewer pesticides are used. This can be achieved by use of government extension workers. There is also a need for a monitoring programme to be put in place in order to quantify the problems associated with POPs. The recent establishment of the Swaziland Environmental Agency and the introduction of pyrethroids in the fight against mosquitoes by the Swaziland government are moves in the right direction.

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