ENVIRONMENTAL PESTICIDE POLLUTION IN TANZANIA

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INTRODUCTION

- Tanzania: over 940,000 km^2
- Population: over 37 million
- GDP per capita $ 690
- Agriculture the main employer, over 70%, > 50% of GDP
- Pesticides: mainly in agriculture and public health
- Pesticides subsidized up to 1992
- Removal of subsidies led to decrease in use and agricultural production: peasants could not afford to purchase them at market prices


North Atlantic Ocean
Mediterranean Sea
Morocco
Tunisia
Suez Canal
Algeria
Libya
Egypt
Cape Verde
Mauritania
Mali
Niger
Red Sea
Senegal
Gambia
Guinea Bissau
Guinea
Burkina Faso
Chad
Sudan
Eritrea
Gulf of Aden
Djibouti
Sierra Leone
Liberia
Ivory Coast
Ghana
Togo
Benin
Nigeria
Ethiopia
Central African Republic
Cameroon
Somalia
Uganda
Kenya
Equitorial Guinea
Gabon
Congo
Rwanda
Burundi
Sao Tome & Principe
Dem. Rep. Congo
Tanzania
Indian Ocean
Seychelles
South Atlantic Ocean
Angola
Comoros
Mayotte
Malawi
Zambia
Zimbabwe
Namibia
Botswana
Mozambique
Madagascar
Mauritius
Reunion
Swaziland
Lesotho
South Africa

MAJOR CLASSES OF PESTICIDES USED IN TANZANIA

1. Organochlorine - *hydrophobic*
   -Persistent and bioaccumulating
2. Organophosphorus - *easily hydrolysed*
   - less persistent, no bioaccumulation
3. Carbamates- hydrolyse in water
   - less persistent, no bioaccumulation
4. Pyrethrins(oids) - hydrolyse in water
   - less persistent, no bioaccumulation
5. Herbicides: various chemical groups

Management of Pesticides in Tanzania

TPRI: regulation and control of formulation, Importation & distribution according to needs Problems:

Low purchasing power

- Buying cheap (environmentally doubtful) pesticides
- Accept donations of pesticides
  - In excess compared to needs
  - Sometimes expired

e.g consignment of partly expired pesticide from Greece

2. Consequently:
   - ☞TZ has more than 1400 tons of obsolete pesticides (20% organochlorines)
   - ☞Most of them now in proper stores
3. Mishandling of pesticides
   - ☞Improper applications
   - ☞Use of containers for domestic purposes
   - ☞Pesticides sometimes used in suicides and homicides
   - ☞Pesticides stored in households

Pesticide Residues Analyses in Tanzania

Most of them were done by the Tropidcal Pesticide Research Institute (TPRI) in the late 70's to early 80's

Mainly for: - registration
- updating of registration

Despite the rather indiscriminate use of pesticides, there was lack of proper assessment of the residues and their impacts on the environment and foodstuffs

From 1998: A Pesticide residue laboratory
- Chemistry Department at UDSM
Substantial number of studies have been done and some are ongoing

Pesticides in Lake Victoria

STUDY AREAS

1. Dar es Salaam coastal area
2. Lake Victoria basin: L. Victoria and rivers (Mwanza and Mara regions)
3. TPC Sugarcane plantations – Kilimanjaro & Kilombero
4. Unguja island - Zanzibar
5. Coast region: Vikuge Farm and Kibaha & Bagamoyo
6. Rufiji Delta

Samples

1. Water – All sites
2. Sediment – Dar es Salaam, L. Victoria, TPC & Rufiji
3. Soil – L. Victoria, TPC and Vikuge
4. Biota – Dar es Salaam, Vikuge and L. Victoria
5. Vegetables: Arusha, Iringa, Tanga, Morogoro
6. Birds, Fish: L. Victoria, Rufiji


UGANDA
DEM. REP. OF THE CONGO
Lake Victoria
0 100 200 km
0 100 200 mi
Bukoba
Musoma
KENYA
RWANDA
Mwanza
Arusha
Kilimanjaro
BURUNDI
Kigoma
Tabora
Tanga
Wete
Pemba
Mkoani
Zanzibar
Lake Tanganyika
Dodoma
Zanzibar
DAR ES SALAAM
Mafia Island
Sumbawanga
Iringa
Mbeya
Indian Ocean
DEM. REP. OF THE CONGO
Lake Nyasa
Lindi
Songea
Mtwara
ZAMBIA
MALAWI
DEM. REP. OF THE CONGO
MOZAMBIQUE

RESULTS

- Water Samples

Dry season: Either V. Low levels/No residues detected

- Residues detected in wet season

- DDT and its metabolite, HCH and dieldrin. (up to to 2 μg/L)

- Others residues detected at Vikuge (average concentration)

- thiabendazole (0.17 and 0.6 μg/l in pond and well respectively)
- Carbosulfan (3.1 μg/l)
- chlorprofam (1.5 μg/l)

➢ **Detection of residues in wet season due to run-off and suspended particles**

Table 1 Pesticide res. levels in wet season water samples, (μg/l)

Location	Type of water	N	ΣDDT	%f	ΣHCH	%f	dieldrin	%f
Dar es Salaam Coast	River & marine	13	0.05 – 0.8 (0.4)	100	n.d	-	0.2 – 2.5 (0.6)	100
L. Victoria & Basin	River & lake	11	n.d. -1.5 (0.2)	27	n.d. – 0.2 (0.04)	27	(0.6)	-
TPC - Moshi	River	13	n.d. - 0.08 (0.02)	46	n.d. - 0.03 (0.01)	38	n.d.	-
Unguja Island	River & marine	11	n.d. -1.4 (0.3)	45	n.d. -1.1 (0.3)	91	n.d.	-
Vikuge	Pond	4	0.2 – 0.4 (0.2)	100	n.d. – 0.4 (0.2)	75	n.d.	-
Storage Site	well	7	0.2 – 33 (9)	100	1 – 5.7 (1.7)	100	n.d.	-

Pesticide Residues in Sediments

Table 2: Residue levels (μg/kg dry weight)in dry season sediments

Location	Sediment	N	ΣDDT	%f	ΣHCH	%f	dieldrin	%f
Dar es Salaam Coast	River & marine	12	7.9 – 57 (28)	100	n.d.	-	n.d.– 45 (8.4)	66.7
L. Victoria & Basin	River & lake	9	n.d.– 12 (2.0)	20	n.d.	-	n.d.	-
TPC - Moshi	River	12	n.d.– 720 (204)	67	n.d.– 61 (14)	42	n.d.	-

- No significant variation in detection frequencies in dry and wet season.in sediments from DSM but there is notable variation in Mwanza and TPC sediments (Table 2 &3)

Table 3: **Status of pesticide levels (μg/kg dry weight) in sediments during wet season**

Location	Sediment	N	ΣDDT	%f	ΣHCH	%f	dieldrin	%f
Dar es Salaam Coast	River & marine	12	6.4 – 51 (18.2)	100	n.d. – 2.7 (0.6)	25	2.3 – 48.4 (9.4)	100
L.Victoria & Basin	River & lake	9	n.d. – 710 (142)	78	n.d. – 130 (58)	78	n.d.	-
TPC -Moshi	River	12	n.d. – 440 (115)	67	n.d. – 57 (14.3)	67	n.d. – 7.2 (0.9)	17
Vikuge storage site	Drainage ditch	8	$1x10^4$ – $2x10^5$ ($5.4x10^4$)	100	$2.8x10^5$ – $74x10^6$ ($2.4x10^6$)	100	n.d.	-

- **Higher levels of residues in sediments than water were attributed to their hydrophobicity**

Table 4: **Pesticide levels (μg/kg dry weight) in soil**

Dry season

Location	Soil	N	ΣDDT	%f	ΣHCH	%f	dieldrin	%f
L.Victoria & Basin	Agricultural fields	40	n.d. – 20 (1.4)	65	n.d. – 3.4 (0.74)	59	n.d.	-
TPC - Moshi	Sugarcane Plantation	13	n.d. – 880 (110)	92	n.d. – 16 (5)	83	n.d.	-

Wet eason

L.Victoria & Basin	Agricultural fields	13	n.d. – 97 (42)	100	n.d. – 59 (27)	63	n.d.	-
TPC - Moshi	Sugarcane Plantation	13	n.d. – 1150 (184)	92	n.d. – 37.3 (9)	69	nd – 14 (1.0)	8
Vikuge storage site	Old store	7	$9.4x10^5$ – $2.8x10^8$ ($7.3x10^7$)		n.d.– $6.3x10^7$ ($2.1x10^7$)	87	n.d.	-

The Vikuge Case Study

Welcome to Vikuge Farm!

- State farm app. 60 km west Dar es Salaam.
- Lowland coastal plain with hot climate and seasonal rains.
- Roads accessible by 4-wheel drive seasonally.
- Formerly pasture seed production, today hay that is sold to cattle owners in Dar es Salaam.

Case History

- Chemical company in Greece offers a consignment of pesticides to the government as foreign aid.
- The pesticides, 170 m^3, arrived in Tanzania 1986. Most were placed, with little prior arrangements, at Vikuge State Farm to be further distributed to other farms.
- The consignment was badly documented.
- Much of the consignment was clearly already expired.
- Many containers were empty or half empty.
- The donation contained pesticides that had been discontinued by the producers 20 years before the donation because of high mammalian toxicity.


Telodrin
SHELL
10
ΘΑΝΤΙΑΙ ΧΡΗΣΕΙΣ


The soil contains up to
30% DDT
6% HCH
40% totalt identifieable pesticides

- Obvious effects on vegetation and arthropods!
- Local healers use the soil as ‘medicine’ for humans and livestock!

At Vikuge

- Very high concentration of pesticides in surface soil, up to 30% DDT
  - ☞the recommended formulation for public use is 6%

Pesticide Residues in Biota

- Residues detected in biota

Table 5: **Status of pesticide levels (μg/kg fresh weight) in biota**

Location	Biota	N	ΣDDT	%f	ΣHCH	%f	Σendosulfan	%f
Dar es Salaam coast	Marine fish, crab and fresh water fish	16	5.5 – 76 (22)	100	n.d. – 3.6 (0.5)	20	n.d.	-
Lake Victoria	Fresh water Tilapia & Nile Perch	30	n.d. – 24 (3.5)	57	n.d.	-	n.d. – 80 (9.6)	57

Rufiji Biota Results

- Fish, Crabs and Prawns were analysed
- A total of 16 pesticides occurred at concentrations greater than the average detection limits. The residues p,p'-DDE, β-HCH and dieldrin were predominant in tDDT, tHCH and tcyclodiene groups, respectively
- The mean levels of OC contaminants in biota tDDT (1 – 54 ng/g fw), tHCH (0.6 – 3 ng/g fw) and tcyclodienes (0.7 – 6 ng/g fw) were general lower than the levels reported in similar studies from elsewhere and were also far below respective MRLs for human consumption

Vegetables

- **The vegetables analysed were cabbage, tomato, cabbage, African nightshades, amaranths, Chinese cabbage, carrots, cucumber *and* water melon**
- **Frequently found pesticide residues were HCHs, endosulfan and fenitrothion, These were found in almost all regions' samples**
- **Nearly all samples had levels below the respective MRLs.**

HIGHLIGHTS OF FINDINGS

- Contribution of agriculture to environmental contamination is insignificant, as compared to obsolete pesticides
- The banned organochlorine pesticides are still in use in most of the study areas
- Mishandling of pesticides in Tanzania is still a problem: at a fish market in Mwanza, evidence of washing of pesticide containers was clear
- Organochlorine contamination of biota is attributed by both bioaccumulation and direct spillage
- Biota safe for human consumption, unlike Vikuge well water during the rainy season

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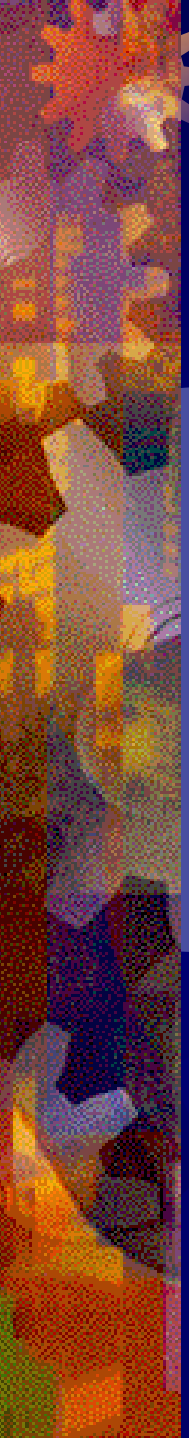

THANK YOU FOR YOUR ATTENTION!