



Pesticides: Their Effects, Disposal, and Alternatives Researched by Bethany Albert

Introduction:

Pesticides are substances utilized with the intent to deter or kill any kind of pest that poses a threat to crops. However, the pesticides that have this lethal quality towards insects, vermin, and plant diseases pose significant health risks towards humans as well. When disposed of improperly, they remain in the ecosystem, travelling through the food chain to humans.

As the health risks of pesticides have become more widely recognized, many countries have enacted strict regulations regarding pesticide use. However, in many developing countries quality control is irregular, disposal is unsafe, and hundreds of tons of obsolete pesticides lie in storage, posing a risk to the surrounding environment (Pesticide Action Network 2001).

Health risks associated with various pesticides include chemical burns, respiratory failure, pulmonary edema, bronchioconstriction, respiratory muscular paralysis, cardiac arrhythmias, epileptic seizures, headaches, nausea, skin rashes, fatigue, blindness, permanent psychological damage, and death (Clarke 1997; Marten 2004).



The problem is particularly serious because there are stockpiles of abandoned chemicals littering the nations. Marketers of these products sold far more than was necessary while donors oversaturated developing countries and the result is that they are now leaching into the environment (Marshall 2003; Jain 1992).

Pesticides are not viable because of the health and environmental damage they create, and because they slowly become ineffective as pests develop resistances (Marten 2004). This resistance creates a fatal cycle of debt called "the pesticide trap" as farmers must buy more and more insecticides to keep their farms productive (Marten 2004).

There are alternatives to using these harmful chemicals. In order to protect humans and the environment, farmers need to escape from this dependence on chemicals. Additionally, the pesticides that lie in storage need to be disposed of safely.

Pesticide Statistics:

- Despite a ten-fold increase in the use of chemical insecticides since WW2, the loss of food and fibre crops to insects has risen from 7% to 13% (Harris 1999)
- In 1985, the WHO estimated that there are 3 million acute, severe pesticide poisonings and 20,000 accidental deaths each year. In 1990, the WHO revised their estimates to 25 million cases of acute occupational pesticide poisoning in developing countries each year (Harris 1999)
- An International Labour Organisation report of 1996 draws attention to dangers in the agricultural sector, where 14% of all known occupational injuries and 10% of all fatal injuries are caused by pesticides (Harris 1999).
- 60 pesticide active ingredients have been classified by recognised authorities as being carcinogenic to some degree. 118 pesticides have been identified as disrupting hormonal balance (Harris 1999).
- The quantity of obsolete pesticides in Africa alone is more than 20,000 tonnes, which will cost up to US\$150 million to destroy (Harris 1999).
- 50% of all pesticide related illness and 72.5% of recorded fatal pesticide poisonings occur in developing countries, although these countries account for only 25% of the pesticides used world-wide (Harris 1999).

Amounts of Pesticides in Village

<http://www.wastesummit.com/Documents/Day-3-Presentations/Richard-Thompson>

Volunteers-Specific Nations:

Belize:

The Food and Agricultural Organization of the United Nations reports that in 2000 there were 14,958 kg of pesticide stocks in Belize.

13 tons of DDT alone are stored in various locations in Belize (Fernandez 2001).

Ghana:

The Food and Agricultural Organization of the United Nations reports that in 2000 there were 71,960 kg of pesticide stocks in Ghana



“The last survey was carried out in 1999 and showed that there was around 72 tonnes of obsolete pesticides held in government and parastatal stores. This survey was not comprehensive and did not include any review of farms...The Government of Ghana through the Ministry of Food and Agriculture has initiated the process of taking inventory of all obsolete and unwanted pesticides in Ghana in collaboration with CropLife Ghana with a view to disposing them safely and effectively” - (Cleanfarms 2010).

India:

The Food and Agricultural Organization of the United Nations reports that in 2007 there were 3,346,042 kg of pesticide stocks in India.

“A survey of pesticide residues in food samples collected in 12 states found residues in 85 % of samples with 43% above the recommended doses.” -Jeremy Harris 1999.

“A seven year study by the Indian Council of Medical Research released in 1993 analysed 2,205 cow and buffalo milk samples from 12 states. HCH (lindane) was detected in about 85% of the samples, with up to 41% of the samples exceeding tolerance limits. DDT residues were detected in 82% of the samples and 37% contained residues above the limit of 0.05mg/kg, in some cases 44 times higher at 2.2 mg/kg.” – Jeremy Harris 1999

Kenya:

The Food and Agricultural Organization of the United Nations reports that in 1997 there were 56,364 kg of pesticide stocks in Kenya.

Kenya imports 7,000 tons of synthetic pesticides annually (Rhoda 2006).

Nepal:

The Food and Agricultural Organization of the United Nations reports that in 2001 there were 67,074 kg of pesticide stocks in Nepal.

75 tons of obsolete pesticides, stored in warehouses. 177 tons of pesticides are imported from India annually. (Palikhe 2005)

“German Technical Co-operation (GTZ) officials have told Nepali authorities, they are ready to take the pesticides and dispose it safely in their country, if Nepal can collect all the pesticides in one point. We are looking for funds to collect them at one point, said a high-level official at environment ministry.

About 74 tonnes of different pesticides like DDT are being stored in over a dozen different places including Amlekhgunj, Nepalgunj and Khumaltar.

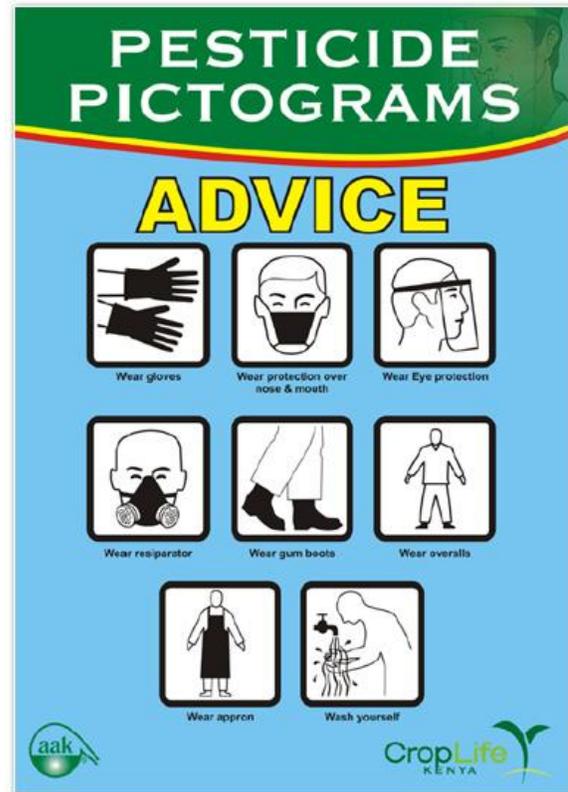
The pesticides are posing a threat to human lives as they are stored near human settlements. The ware house in Amlekhgunj, which also stores the largest amount of the pesticides, is just beside a school.

For safe disposal, the chemicals need to be incinerated at temperatures of 1,200-1,500 degrees Celsius equipped with special Air Pollution Control Devices (APCD). Such a set up is not available in Nepal.” – Nepalnews.com 2009

Pesticide Disposal:

Pesticides bioaccumulate, which means they do not dissolve into the ecosystem very easily and instead build up. They also travel through the ecosystem, spreading into drinking sources and through the ground. They also build up in fatty animals tissues, which means that human ingest these harmful chemicals when they eat meat from animals that have been exposed.

Because of this bioaccumulation, it is not safe to dispose of pesticides simply by burying them or dumping them into stream. Even buried pesticides are eventually unearthed by erosion or spread through the soil by water. Pesticides should never be disposed of in any place where they can get into drinking water. Even in places far from water, the pesticides can leach through the ground or be washed into streams, lakes, or other bodies of water by rain. It is likewise unsafe to pour pesticides down drains, as these often are re-circulated into drinking water resources. Plumbing systems are not equipped to remove pesticides from the water that they process.



Contaminated Containers:

Slice old pesticide containers so that they are unusable for other purposes. It is dangerous to use empty pesticide containers, even if well washed.

Incineration is the most common method of pesticide disposal. Incineration has the risk of releasing toxin emissions into the air, but there are currently no harmless ways to dispose of pesticides. It is far riskier to allow the pesticides to sit and further contaminate the environment. The Food and Agricultural Organization of the United Nations supports the proper incineration of pesticides in appropriate facilities. Developing countries seldom have the proper facilities for this, although cement kilns in Vietnam have been used to dispose of pesticides safely (Karstensen 2005). The common solution is that pesticides are transported to countries where such facilities exist. For example, Germany is currently helping Nepal dispose of its stockpiled pesticides. Only Europe, however, allows the importation of pesticides for disposal and facilities are in such demand that it is very expensive.

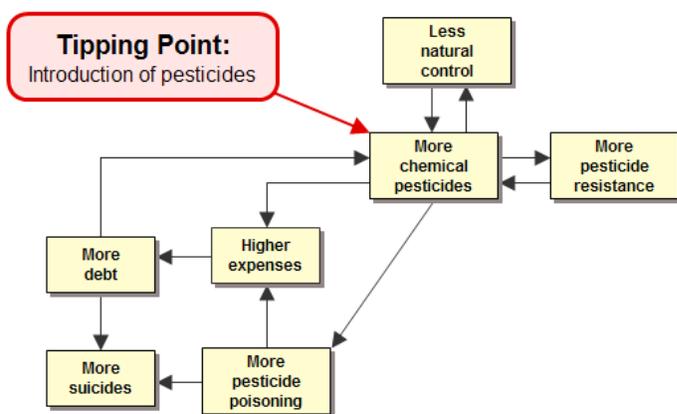
The Food and Agricultural Organization of the United Nations has a program where once countries desiring assistance to dispose of pesticides have completed a preliminary assessment of its obsolete pesticide stockpiles, the FAO assists in designing a project, formulating a proposal, and finding international financial assistance. Once the program is ready to be launched, the FAO provides technical and legal advice to ensure effectiveness. Throughout the process, the FAO serves as a resource for training, finding proper equipment, and selecting consultants and contractors. (Food and Agricultural Organization of the United Nations.)

For a list of country-specific resources on how to dispose of pesticides safely or contact an organization that will dispose of them for you, please go to the Country Specific Resources section of this document.

The Pesticide Cycle

In order for pesticides to be removed from the environment, farmers must stop depending on them. This does not mean that farmers are doomed to have low production crops – in fact, non-pesticide pest management can be even more effective than pesticide use.

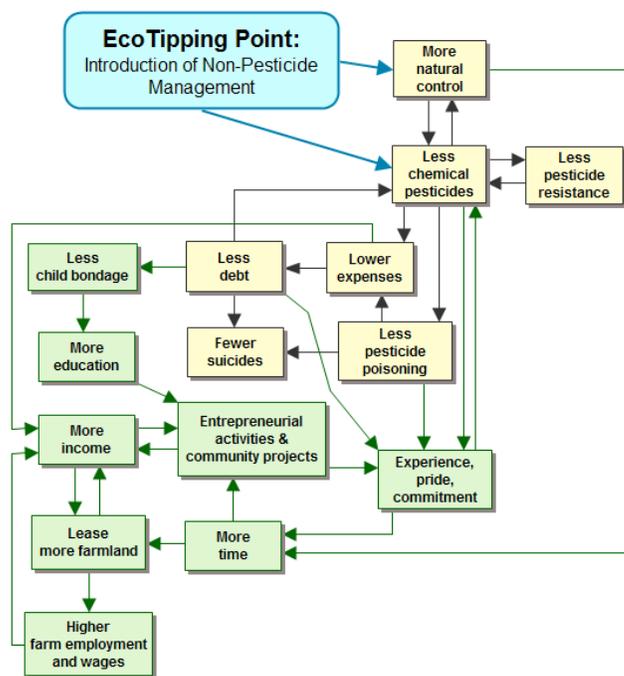
Andhra Pradesh Non-Pesticide Management: Negative Tip



The first of the two diagrams shown here from the Eco Tipping Points Project (<http://www.ecotippingpoints.org>) that conducted non-pest management tests in Andhra Pradesh, India, demonstrate the negative effects of pesticide use. Pesticide dependency creates an ascending spiral where more and more pesticides are necessary as pests become resistant to the chemicals. Thus, there are more cycles of debt and more harmful chemicals in the environment.

The second diagram demonstrates the positive effects of using non-chemical methods. It is healthier, more profitable, and helps strengthen communities by creating positive cycles. Yellow represent vicious cycles reversed by positive tip to form virtuous cycles. Green represents spin-offs and associated virtuous cycles.

Andhra Pradesh Non-Pesticide Management: Positive Tip



Substitutes/Alternatives for Pesticides

DDT has not only been used as a pesticide, but in homes to kill mosquitoes to prevent the spread of malaria. There are alternatives to DDT however. Management of mosquito populations can involve removing stagnant water where they breed and utilizing mosquito nets while sleeping. Instead of using DDT, the Belizean approach is now emphasizing hygiene, sanitation, and the destruction of mosquito breeding grounds to control malaria. (Fernandez 2001)

In recent years a new field of bio-pesticides has

opened up. Some microbial and botanical pesticides are eco-friendly, such as the bio-pesticide *Bacillus thuringiensis* (Bt) (Palihke 2005). Biologically-based pesticides, such as pheromones and microbial pesticides, are becoming increasingly popular and often are safer than traditional chemical pesticides. (EPA 2009)

Pyrethrin-based Insecticides: According to the African Center for Environmental Advocacy and Governance (CEAG Africa), Pyrethrins “are currently rated as the safest alternatives to DDT because they are biological products.”

The Neem tree is an Indian tree that is untouched by pests because Neem oil is anti-feedant (Mahmood 2009). For more detailed information on how to utilize neem oil as a pesticide, see the neem tree document in the online library.

Approaches for Non-Pesticide Pest Management used by Socio-Economic and Cultural Upliftment in Rural Environment in Andhra Pradesh, India

ftp://ftp.fao.org/SD/SDA/SDAR/sard/GP%20updates/pest_management_India.pdf

- Using light traps and bonfires to attract moths.
- Placing yellow and white sticky boards in the field to attract and kill insects that suck out the plant's juices.
- Removing by hand leaves on which many insect eggs have been laid.
- Setting pheromone traps to check on the numbers of pests in the field.
- Using biological pesticides such as neem seed-kernel extracts and chilli-garlic extracts to control bollworms and sucking insects. There are also other locally available plants to make biological pesticides.
- Using an extract made from cow dung and urine to control aphids and leafhoppers which also acts as a fertilizer.
- Planting trap crops such as castor and marigold. Insects are likely to lay their eggs on these plants, where they can be picked off easily.

Solutions for India from The ecotipping Points Project:

“Spraying chili-garlic solution on crops. The solution is prepared by soaking chili and garlic powder in water for 24 hours. Chili-garlic solution kills pest insects directly when sprayed on a crop.

Applying a mixture of cow dung and urine to combat leaf hoppers and aphids. Cow dung/urine acts as a repellent and disrupts insect growth.

Manual removal of leaves that are heavily infested with pest insects.

Planting "trap crops" (e.g., sorghum, marigold, castor, and green gum) around the edge of the field to attract pest insects away from the crop. The trap crops are checked daily. Parts of the plants with insect eggs are removed and burned.

Putting yellow and white wooden disks in the fields. The yellow disks, which attract sucking insects (e.g., mites and thrips), and white disks which attracts white flies, are covered with

sticky grease to trap the insects. Lighting small bonfires on moonless nights to attract and kill moths before they can lay eggs in the field.

Placing perches for insectivorous birds in the fields.

Deep summer plowing to destroy the pupae of cotton bollworms, army worms and other pests whose pupae are in the soil.

Applying a 'Nuclear poly Hydral' virus extract. Pest larvae attacked by this virus are easily recognized because they are hanging upside down from leaf edges if the crop. Farmers collect 250 infected larvae, grind them into a solution, and spray the solution on the crop. The solution from 250 larvae ("250 LE") is sufficient to kill the larvae on one acre of cotton crop."
(Marten 2004)

Integrated Pest Management

Integrated Pest Management (IMP) is an environmentally sensitive approach to pest control that combines common sense with knowledge about the life cycles of pests. It does not condemn all pesticides entirely, but seeks to use them in healthy, environmentally friendly ways. The approach entails prevention, observation, and intervention to form an ecological technique that effectively manages pest populations. Methods include bug traps, mulching, solarization, releasing pest predators, and utilizing resistant-strain crops. (EPA 2009, IMBCRSP 2010).

"IPM is needed in all areas of the developing world. Pests—insects, diseases, weeds, vertebrates— respect no borders and spread through plant and animal migration, wind and water. Human activity, including trade in plant and animal products, also contributes to this expansion.

By addressing IPM, researchers have found that they touch a whole spectrum of development issues. IPM is, in fact, such a powerful tool that it allows for:

- reducing pesticide use
- reducing crop losses
- reducing damage to natural ecosystems
- reducing the loss of biodiversity
- increasing farmer income
- increasing the involvement of women in decision-making
- making export crops more attractive
- improving research & education capabilities"

- Integrated Pest Management Collaborative Research Support Program
http://www.oired.vt.edu/ipmcrsp/WhatWeDo/What_is_IPM.html

"IPM is not a single pest control method but, rather, a series of pest management evaluations, decisions and controls. In practicing IPM, growers who are aware of the potential for pest infestation follow a four-tiered approach. The four steps include:

Set Action Thresholds

Before taking any pest control action, IPM first sets an action threshold, a point at which pest populations or environmental conditions indicate that pest control action must be taken. Sighting a single pest does not always mean control is needed. The level at which pests will either become an economic threat is critical to guide future pest control decisions.

Monitor and Identify Pests

Not all insects, weeds, and other living organisms require control. Many organisms are innocuous, and some are even beneficial. IPM programs work to monitor for pests and identify them accurately, so that appropriate control decisions can be made in conjunction with action thresholds. This monitoring and identification removes the possibility that pesticides will be used when they are not really needed or that the wrong kind of pesticide will be used.

Prevention

As a first line of pest control, IPM programs work to manage the crop, lawn, or indoor space to prevent pests from becoming a threat. In an agricultural crop, this may mean using cultural methods, such as rotating between different crops, selecting pest-resistant varieties, and planting pest-free rootstock. These control methods can be very effective and cost-efficient and present little to no risk to people or the environment.

Control

Once monitoring, identification, and action thresholds indicate that pest control is required, and preventive methods are no longer effective or available, IPM programs then evaluate the proper control method both for effectiveness and risk. Effective, less *risky* pest controls are chosen first, including highly targeted chemicals, such as pheromones to disrupt pest mating, or mechanical control, such as trapping or weeding. If further monitoring, identifications and action thresholds indicate that less risky controls are not working, then additional pest control methods would be employed, such as targeted spraying of pesticides. Broadcast spraying of non-specific pesticides is a last resort.”

- Integrated Pest Management Collaborative Research Support Program
<http://www.epa.gov/pesticides/factsheets/ipm.htm#how>

Country Specific Resources:



Belize:

Belize Pesticides Control Board

Web: <http://www.pcbbelize.com>

Phone: (501)824-2640

Fax: (501)824-3486

Email: pcbinfo@btl.net

- Source for information on restricted pesticides and pesticide legislation in Belize.
- Posters and brochures
- On-site incineration guidelines and unit designs

- Training in the safe use of pesticides

Ghana:



Pesticide Action Network - African
PHONE : +221 33 825 49 14
FAX : +221 33 825 14 43
Email: panafrica@pan-afrique.org
Po.Box : 15938 Dakar-Fann

Ghana Organic Agriculture Network (GOAN)
Address: PO Box 6342, Kumasi, Ghana
Phone/Fax: 233 51 20 954
Email: info@goan-network.net
adimadosam@yahoo.com
ivysampa@yahoo.com

Cleanfarms: Obsolete Pesticide Collection Campaign
Office phone: 021939031
Mobiles: 029708890 or 0289553592
Fax: 021787052
Website: http://ghana.cleanfarms.net/website_english_home/
Email: info@cleanfarmsghana.net

- Cleanfarms will collect and dispose of unused pesticides

West African Consortium of IPM Excellence
Program Leader: Don Mullins
Title, Affiliation: Professor of Entomology, Virginia Tech
Email: mullinsd@vt.edu
Phone: (540) 231-5978
Website: <http://web.ento.vt.edu/ento/personalPage.jsp?uuid=809737>
Creating a regionally-integrated IPM research program in Mali, Senegal and Ghana.

India:



Pesticide Action Network Asia and the Pacific
P.O. Box 1170, Penang
10850 Malaysia
Tel: +604-657 0271 or +604-656 0381
E-mail: panap@panap.net
Resource materials

- Community-based Pesticide Action Monitoring (CPAM) Resource Centre

Hazardous Waste Management – Karnataka, India
Website: <http://www.hawa-project.org>

Address: The HAWA Project Karnataka
#17, Ground Floor
TNT Towers, Infantry Road
Bangalore - 560 001.
Phone: +91 80 2286774/41517910
Fax: +91 80 22864773
E-Mail: info@hawagtz.net

- Pesticide Disposal Facility

Integrated Pest Management: Science for Agricultural Growth in South Asia
Program Leader: Ed Rajotte
Title, Affiliation: Professor of Entomology and IPM Coordinator, Penn State University
E-mail: egrajotte@psu.edu
Phone: (814) 863-4641
Website: <http://www.ento.psu.edu/Personnel/Faculty/rajotte.htm>

- This project builds on previous investment by expanding efforts in Bangladesh and India, extending and replicating the participatory IPM approach in Nepal, strengthening the network of linkages in IPM knowledge and expertise across all of South Asia, and undertaking significant and innovative graduate education.

Kenya:



Pesticide Action Network - African
PHONE : +221 33 825 49 14
FAX : +221 33 825 14 43
Email: panafrica@pan-afrique.org
Po.Box : 15938 Dakar-Fann

Kenya Association for Physicians & Medical Workers for Social Responsibility
Address: PO Box 21253, 00505 Ngong Road Nairobi, Kenya
Phone: 254 2 714 757

Regional IPM Program in East Africa: Kenya, Tanzania and Uganda
Program Leader: Mark Erbaugh
Title, Affiliation: Interim Director, International Programs in Agriculture, The Ohio State University
Email: erbaugh.1@osu.edu
Phone: (614) 292-7252
Website: <http://www.aaec.vt.edu/ipmcrcspuganda/IPMCRSPEA/>

- Improving productivity of high-value horticultural crops by adopting IPM in Kenya, Tanzania and Uganda.

Nepal:



Nepal Drug and Poison Information Center
75, Abhiyan Marg, Shamakhushi

PO Box No. 8975, EPC 1313
Kathmandu
Clinical Director: Professor Dr Shyam P. Lohani
Emergency telephone: +977 1435 3877 (24 hours)
Fax: +977 1435 3877
Cell phone: +977 985 1038490
E-mail: mediinvent@yahoo.com; lohanis@gmail.com
Web site: <http://www.south-asia.com/uhn>

International Development Enterprises
Website: www.ide-international.org
Phone: 9771-533953
Fax: 9771-533953
Regional Office: P.O. Box 2674, Kathmandu, Nepal

- IDE has worked for decades helping rural families to increase their agricultural productivity, providing them with a basis for food security, income generation, integration with markets, and the beginnings of an upward spiral out of poverty.

Global Contact:

Obsolete Pesticide Programme
Plant Production and Protection Division
Food and Agriculture Organization of the United Nations
Address: Viale delle Terme di Caracalla
00153 Rome, Italy
Website: <http://www.fao.org/ag/AGP/AGPP/Pesticid/Disposal/en/index.html>
Tel.: + 39 06 5705 3372
Fax : + 39 06 5705 6347

- The FAO has a program where once countries desiring assistance to dispose of pesticides have completed a preliminary assessment of its obsolete pesticide stockpiles, the FAO assists in designing a project, formulating a proposal, and finding international financial assistance. Once the program is ready to be launched, the FAO provides technical and legal advice to ensure effectiveness. Throughout the process, the FAO serves as a resource for training, finding proper equipment, and selecting consultants and contractors

Resources for All:

Environmental Protection Agency. "Integrated Pest Management (IPM) Principles."
2009. <http://www.epa.gov/pesticides/factsheets/ipm.htm>

"Alphabetical List of Pesticide Fact Sheets"
http://www.epa.gov/pesticides/factsheets/alpha_fs.htm

- Information on various pesticides
- Guidelines on reading pesticide labels
- Guidelines on chemical safety
- Tips on pesticides

Hospitals for a Healthy Environment. "Implementing Integrated Pest Management."

<http://www.h2e-online.org/docs/h2e10stepipm.pdf>

- Very general guidelines for preparing to

Integrated Pest Management Collaborative Research Support Program. 2010.

http://www.oired.vt.edu/ipmcrsp/?src=draft_home

- The IPMCRSP is one of 9 collaborative research support programs set up to leverage the expertise found at American land grant universities in developing countries.

Pesticide Action Network. <http://pesticidelibrary.org>

- Links to over 5000 articles on pesticides

World Health Organization. "Guidelines for Testing." 2010.

<http://www.who.int/whopes/guidelines/en/>

- Guidelines for testing efficacy of insecticides etc
- Guidelines for generic risk assessments

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<http://www.chem.unep.ch/ddt/DDTProfiles/India.html>

Kenya

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