Pesticide Usage in N
Need for a Baseline

Pesticides have been a mixed blessing for man. On the one hand, they increase yield and decrease labor requirements. On the other hand, they may kill non-target species, create environmental health hazards and encourage the evolution of poison-resistant pests. Pesticide use in a tropical developing country like Nigeria is necessary but may be indiscriminate or ill-advised. The author emphasizes that stricter controls are essential for the long-term well-being of developing countries.

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The role of pesticides in the control of insect pests of crops and forests as well as the insect vectors of human and animal diseases has engaged the attention of scientists since the beginning of this century.

In many developing countries, including Nigeria, pesticides are used as a quick and ready answer to pest problems that abound in arable and cash-crop farming and to control endemic and epidemic diseases like malaria, typhoid fever, filariasis, trypanosomiasis, onchocerciasis, etc.

Due to the persistence in nature of organochlorine pesticides such as DDT, aldrin, dieldrin, Lindane, chlordane and toxaphene, their use has been restricted or banned in many developed countries. Many tropical developing countries like Nigeria often base their pesticide registration on the practices of developed countries and recommendations of international agencies such as the World Health Organization (WHO) and the Food and Agricultural Organization (FAO).

The banning or restricted use of chemicals in such countries, without sufficient data about their impact on tropical environments, deserves some criticism. It is known that the volatilization and degradation of pesticides are more rapid in the tropics than in temperate zones. Studies also indicate that this is due to differences in temperature and soil microbiological activities (1–3). Nutritional and socio-economic factors can influence the accumulation of pesticides and their toxicological effects (4, 6). Therefore, in tropical developing countries such as Nigeria, where malnutrition and undernourishment are rampant, the initiation of research on pesticide residues is highly desirable.

An organized survey has therefore been embarked upon to determine the residue levels of different pesticides in organisms of different terrestrial and aquatic ecosystems in Nigeria.

APPLICATION OF PESTICIDES

Synthetic pesticides were introduced to the Nigerian market in the 1940s. By 1970, 21 various types of organochlorine, organophosphorus and carbamate pesticides were introduced (7) for use against household pests and pests of food crops, ornamental plants and stored products as well as insects of veterinary and medical importance. Today, over 200 different brands of pesticides are marketed, and this number is likely to increase with the high demand for good-quality agricultural products. Data on exact annual consumption levels are difficult to obtain.

The majority of the pesticides used belong to the organophosphorus and carbamate groups. As there is no regulation of the use of organochlorine pesticides in Nigeria, many of them, notably hexachlorocyclohexane (HCH), aldrin, dieldrin, chlordane, pentachlorophenol (PCP) and DDT are still very much in use in different formulations for the control of pests of cocoa, cotton, yams, cassava, groundnut, cowpea, vegetables and stored products. DDT/dieldrin, DDT/HCH, aldrin and Lindane are used in large-scale vector-control programs, especially in the northern part of the country. For instance, in the Kainji area, DDT and HCH are released into rivers for the control of black flies, a vector of onchocerciasis. The WHO malaria eradication program that was started in 1955 still continues in various parts of the country.

Spraying of homes and offices against mosquitoes, cockroaches, termites, rats and snakes has increased. Herbicides are relatively new in the Nigerian market. A National Herbicide Use Committee (NNHUC), established in 1980, has recommended the use of 46 different brands of herbicides (8). Guidelines for the third and fourth development plans stress the need for increased food production to feed the growing population, and recognize the use of pesticides as one of the improved practices for attaining this objective. Most Nigerian farmers are beginning to understand the need for pesticides as a result of the work of the Agricultural Extension Services.

The services are available in technology transfer stations set up by the Nigerian Federal Department of Agriculture to educate the local farmers about the use of pesticides, fertilizers and machinery for the improvement of agricultural production. Support is also given to research centers in the development and production of improved varieties of seeds for sale to local farmers at subsidized rates.

For Nigeria and all developing countries, pesticide use is indispensable to the struggle against hunger and disease. Emphasis should therefore be placed on judicious and safe use rather than the banning and/or restriction of pesticides. Nevertheless, in view of the adverse effects resulting from pollution of the environment by these chemicals, e.g., damage to, or mass killing of, non-target organisms (2, 9–11), there is a pressing need for the control and monitoring of pesticide usage in Nigeria.

Our survey revealed that the current handling of pesticide importation, storage, distribution and use in Nigeria requires considerable re-evaluation.

The type and amount of imported pesticides are partially based on information supplied by the manufacturers and partially on availability. The Nigerian Federal Department of Pest Control Services does not undertake any form of routine testing; neither does it conduct any research that would enable it to advise the government on the suitability of the pesticides. There is, therefore, no way to ascertain that the information supplied by the manufacturers is correct and sufficiently comprehensive or that the active ingredients have not undergone degradation at the time of use. Storage facilities at the depots and in the agricultural establishments are grossly in-

Nigeria—Study

BY SAMUEL S. ATUMA AND DORCAS I. OKOR

adequate. Some pesticides dissolved in volatile and flammable organic solvents are stored under uncontrolled temperature conditions. Other pesticides are delivered in large metal drums, which are left in open fields under the intense ultraviolet radiation of the sun and long periods of heavy rain. Some or all of the labels, including instructions for use, are washed off. Some containers get rusty and leak pesticides that may leach down to the groundwater table and eventually to streams, rivers and wells. Most rural dwellers who depend solely on stream and well water for domestic purposes, do not have their water tested before use. The consequences, therefore, of drinking from polluted rivers, streams and wells can be measured only in terms of mortality, morbidity and physiological changes preceding morbidity.

The effectiveness of pesticides is at present determined only by product yield. There is no monitoring of the effect on the applicators and the non-target flora and fauna, nor is there any analysis of the final product that goes to the markets. Applicators wear little or no protective clothing due to ignorance and discomfort in the hot and sometimes humid climate.

Information from the rural areas reveals a gross misuse and abuse of pesticides in the environment, in human food, and in health measures. Gammalin 20 (gamma HCH), for example, has been used to kill fish in streams and rivers, to treat dried fish against weevils, against pests of stored kola nuts, to kill human head lice, and, in a diluted suspension form, gammalin 20 is ingested as a worm expeller.

In this part of the world, dumping of empty pesticide containers into rivers, streams or open fields, or use of such containers to store potable water, is a common occurrence. This is probably the most significant contributing factor to pesticide pollution of the Nigerian environment.

Apart from cases of gammalin 20 poisoning reported in Ibadan (12) many cases of poisoning of humans are not reported, especially in the rural areas. Immediate mortality of birds, especially insectivorous ones, following DDT application was reported by Koeman et al. (13).

Pesticide residue analysis has been limited to isolated tests of fish, soil and human blood and urine. Freshwater fish from Bendel State have been found to be contaminated with DDT (0.08–4.3 mg/kg), HCH (0.08–4.36 mg/kg) and hexachlorobenzene (HCB) (0.06–0.60 mg/kg) (14). Samples of fish from Ibadan in Oyo State were found to contain organochlorides (mg/kg) in the following amounts: DDT, 0.05–2.2; gamma HCH, 0.01–3.52; dieldrin, 0.5–10.2 (15). The same workers found soil samples to contain the following amounts of organochlorides (mg/kg): DDT, 0.07–14.9; HCH, 0.01–0.1; dieldrin drin, 1.7–12.2; aldrin, 1.1–2.5. Human blood levels have shown the following amounts of organochlorides (mg/kg: DDT, 0.07–14.9; HCH, 0.01–0.1; dieldrin 0.15–0.28 (15). In adipose tissue, the amounts (mg/kg) recorded were as follows: DDT, 6.5; HCH, 0.19–0.36; dieldrin, 0.02–0.18; heptachlor epoxide, 0.004–0.02 (16). Pentachlorophenol has also been detected in blood (trace—21.33 μg/kg) and urine (0.025–0.23 mg/kg) (17). Though these levels may not be considered toxicologically significant, the possible effects of continued exposure, especially from indiscriminate use and abuse of pesticides, cannot be overemphasized.

CONCLUSIONS AND RECOMMENDATIONS

The present level of pesticide use in Nigeria, if judiciously managed, should normally not cause any serious contamination of the environment. However, much of the contamination already encountered or reported can be derived from the present unrestricted and uncontrolled use due to ignorance on the part of the majority of the people regarding the possible adverse effects of pesticides.

In order to become more effective, the present piecemeal involvement of government agencies, research institutes and individual scientists should be replaced by a more coordinated action. Therefore, there is need to initiate an inter-agency committee on pesticides, including the Nigerian federal and state ministries of health and agriculture, research centers, universities, and importers and distributors of pesticides. Cooperative approaches to public education, applicator training and research on all aspects of pesticide pollution should be encouraged. Baseline data on the volume of pesticides imported, distributed and consumed and the residue levels in various aquatic ecosystems, land, air, foodstuffs and humans are necessary for the development of control strategies and for the assessment of potential problems. These efforts should be supported by the systematic monitoring of information on pesticide usage, pesticide-related mortality and morbidity, ecological impacts as well as safe use of pesticides.

References and Notes

1. G. W. Harris, *Dissertation Abstract*, **22**, 327 (1961).
2. J. Perfect, *Ambio*, **9**, 16 (1980).
3. P. O. Park and C. E. McKone, *Tropical Agriculture*, **44**, 133 (1966).
4. R. F. Bernard, *Studies of Effects of DDT on Birds*, publication of the Museum of Michigan State University, **2**, 156 (1963).
5. United States Department of Health, Education and Welfare, *Report of the Secretary's Commission on Pesticides and Their Relationship to Environmental Health*. (USHEW, Washington, D.C., 1969).
6. R. A. Shakman, *Archives of Environmental Health*, **28**, 105 (1974).
7. J. Donnelly and S. A. O. Adeyemi, *Handbook of Agricultural Insecticides Available in Nigeria*. (The Ministry of Agriculture and Natural Resources, Western State of Nigeria and the Entomological Society of Nigeria, 1970).
8. Nigerian National Herbicide Use Committee, *Report 1*, (Federal Ministry of Agriculture, Lagos, Nigeria, 1983).
9. E. G. Hunt and A. T. Bishoff, *California Fish and Game*, **461**, 91 (1960).
10. E. E. Turtle, A. Taylor, E. N. Wright, R. J. P. Thearle, H. Egan, W. H. Evans and N. M. Souter, *Journal of Science, Food and Agriculture*, **14**, 456 (1963).
11. S. Whitaker, S. Mazumdar, F. Gidney and E. Behr, *Newsweek* December 17, 1984.
12. A. O. B. Olugbile, *Bulletin of the Science Association of Nigeria*, **3**, 214 (1977).
13. J. H. Koeman, H. D. Rijksen, M. Smiles, B. K. Na'ISA, and K. J. R. Maclennan, *Journal of Zoology*, **21**, 443 (1971).
14. S. S. Atuma and C. O. Eigbe, *International Journal of Environmental Studies*, **24**, 251 (1985).
15. O. Osibanjo and S. Jensen, *Ecological and Environmental Perspectives of Pesticides Pollution* (Proceedings of the First National Conference on Water Pollution and Pesticide Residue in Foods, Ibadan, Nigeria, 1980).
16. M. Wassermann, G. O. Sofoluwe, L. Tomatis, N. E. Day, D. Wassermann and S. Lazarovici, *Environmental Physiology and Biochemistry*, **2**, 59 (1971).
17. S. S. Atuma and D. I. Okor, *Bulletin of Environmental Contamination and Toxicology*, **35**, 406 (1985).

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