Pesticide Use and Health Costs

A Brief Bibliographical Survey
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Pesticides and Health Costs


   Abstract: Today the goal of designing highly productive, sustainable agricultural production systems is at the forefront of the agricultural research agenda around the world. The key to designing sustainable agricultural production technologies is in understanding their economic, environmental, and human health impacts. This volume presents a methodology designed to quantify such impacts and to represent them as tradeoffs. This tradeoff methodology is proposed as an approach to accomplish two essential elements in achieving agricultural sustainability. First, the tradeoffs method is a key to the design of successful interdisciplinary research projects to assess sustainability of production systems. Second, the tradeoffs method provides a successful means to communicate research findings to policy makers and the public.


Pesticides, Health and Environmental Issues


Abstract: Forty five randomly selected farmer-volunteers were divided into eight groups corresponding to eight pesticide-related activities; mixing and loading; spraying; cleaning and
disposal; days one and seven re-entry; and a group who did all activities. Methyl parathion 50EC was applied at approximately 327 to 467 grams ai/ha. Potential dermal penetration through the protective clothing material was highest for the group doing all activities (46.84%). Regional exposure was predominant in the hands (23 to 73 percent) for all field activities. Potential dermal contamination was highest during mixing and loading, with the left hand the most contaminated. Urinary metabolite (paranitrophenol) levels were lowered after exposure in seven of the eight tested activities. it should be noted that the farmer subjects have been chronically exposed to different pesticides types for an average of nine years, such that even the (high) baseline levels already showed presence of paranitrophenol.


Abstract: from 1976 to 1977, 51 30-ml biopsy human fat samples from patients undergoing surgery were examined. All samples contained DDT residues; highest level of DDT and related compounds (DDT-R) was 31.34 ppm, averaging at 9.14 ppm. HCH residues were also found with the highest level at 30.05 ppm, averaging 4.30 ppm. The major component of its residues was of beta-HCH (known for its accumulation behavior), with alpha and gamma-isomers. The high HCH incidence confirms its bioconcentration in fatty tissues, while those of the isomers indicate rather recent exposure.


Abstract: The use of pesticides in Ghanaian agriculture, though beneficial in reducing crop loss both before and after harvest, has been associated with threats to human health often due to the misapplication of the chemicals. This study was an initial attempt to explore the knowledge, attitudes and practices of 123 farm workers on three irrigation project areas in the Accra Plains, Ghana, regarding the safe handling and use of pesticides, to assess the prevalence of symptoms associated with organophosphorus pesticides (OPs) and carbamates and to determine the prevalence of pesticide-related symptoms, and blood cholinesterase. The study design was cross-sectional in type. Methods used were interviews and observation, and biological monitoring. The results revealed moderate levels of knowledge of the routes of absorption of pesticides and of potential symptoms following exposure. Knowledge of personal protective measures was poor to moderate. High risk practices included frequent handling of the chemicals, home storage of pesticides and short re-entry intervals. Despite knowledge of some health risks associated with pesticides, the use of personal protective equipment (PPE) was minimal due primarily to financial constraints. The prevalence of symptoms was higher and cholinesterase levels lower than in a control group of teachers. It is suggested that there is a need for more epidemiologic studies to investigate the problems associated with pesticide induced ill health as well as research into appropriate and affordable PPE. PPE needs to be subsidized. Training of agriculture and health workers in safety precautions, recognition, and management of pesticide-related ill health is a matter of urgency.


Abstract: Theoretical literature on the economics of technology has emphasized the effects on technological trajectories of positive feedbacks. In a competition among technologies that all perform a similar function, the presence of increasing returns to adoptions can force all but one technology from the market. Furthermore, the victor need not be the superior technology. This paper provides an empirical study of one technological competition which illuminates this theoretical work. It uses theoretical results to explain why chemical control of agricultural pests remains the dominant technology in spite of many claims that it is inferior to its main competitor, integrated pest management.


Abstract: The developing countries comprise more than 75% of the total world population covering most of Africa, Asia, Latin America, and South Europe. Their warm climate favors cultivation of many strategic crops including cotton, rubber, rice, corn, spices, tea, coffee, cocoa beans, sugarcane, tobacco, legumes, tropical and subtropical fruits, and vegetables. They are bound to the industrialized countries for exporting their cash crops and importing all production equipment and materials including pesticides and fertilizers. They suffer from illiteracy, overpopulation, and low standards of living. Their deficient economy and infrastructure hinder their ability to regulate efficiently registration of pesticides. Their inhabitants are at high risk due to the acute and chronic adverse health effects induced by pesticide exposure under both occupational and epidemiological conditions. Their legislations, regulations, technical capabilities, and medical care need to be upgraded to a reliable standard. This is essential for the global welfare because any hazardous pesticides dumped or released in the environment in these countries will not be dissipated but can reappear as residues in imported raw foods or by destroying terrestrial and aquatic life, through their transportation within the atmosphere, or in liquid discharges to soil and water bodies. International assistance and support are badly needed by United Nations Agencies, mainly WHO, UNEP, FAO, ILO, IPCS, IRPTC, and other relevant international organizations.


Abstract: Many developing countries are importing industrial processes that make use of toxic chemicals. By the same token, pesticides, which are toxic by design, are also used increasingly in agriculture and in public health programs to control pests and vector-borne diseases. Recent estimates suggest that pesticides account for more than 20,000 fatalities yearly, and that most of these will have occurred in developing countries. This may actually be a gross
underreporting. Although organophosphate and carbamate insecticides are still responsible for many of those poisoning cases, herbicides such as paraquat are also increasingly being implicated in fatal poisoning cases. Newer pesticides such as the synthetic derivatives of pyrethrin, which were believed to be relatively safe to humans, now appear to be implicated in some serious cases of intoxication. Community-based pest control using locally available botanical pesticides could have severe consequences unless the toxicity of these compounds is carefully assessed relative to nontarget organisms. A high proportion of pesticide intoxications appear to be due to lack of knowledge, unsafe attitudes, and dangerous practices. The technology available to small farmers for pesticide application is often inappropriate: faulty sprayers, lack of protective equipment adapted to tropical conditions, nonexistent first-aid provisions. Agricultural extension is often not oriented to the transfer of information relative to the dangers inherent in the use of pesticides. The lack of information at all levels may be one of the most important causative factors of chemical intoxication in developing countries. Research should at this time concentrate on behaviors leading to chemical intoxication. This should be done concurrently with proper prospective and retrospective surveys of poisonings in developing country communities. More information should be sought relative to the decision processes of import, legislation, and licensing. Research and development efforts in appropriate technology and safety devices are also critically needed.


Abstract: The Red River Valley in Minnesota, a major agricultural region, has been shown in earlier studies to have significantly higher rates of birth defects than other areas of the state. These studies found that rates of birth defects were even higher among families of pesticide applicators in the region, suggesting these effects may be due to paternal exposure to agricultural pesticides. A new follow-on study surveyed state-licensed pesticide applicators and examined the rate of birth defects in their children and the type of pesticides they applied (i.e. fungicides, herbicides, insecticides, fumigants, or combinations). Of the 536 pesticide applicators with children, a total of 54 children had confirmed birth defects – 10.1 percent compared with a national average of 3.7 percent. The highest rate of birth defects was found among children born to applicators using combinations of herbicides, insecticides, and fumigants. The study also found fewer male children born to pesticide applicators using fungicides and higher rates of birth defects among children conceived in the spring (a time when herbicides are typically applied). The authors suggest that environmental agents present in the spring are responsible for the increased birth defect rate, and that fungicides may be selectively affecting the survival of the male fetus.


Abstract: Acute pesticide poisoning is a major public health problem in Sri Lanka. In several agricultural districts, it precedes all other causes of death in government hospitals. Most of the acute poisoning cases are intentional (suicide) and occur among young adults, mainly males. Poisoning due to occupational exposure is also common, but less well documented. In an irrigation area in Sri Lanka a very high incidence of serious pesticide poisoning was observed, with 68% due to intentional ingestion of liquid pesticides. It is argued that the easy availability and widespread use of highly hazardous pesticides is the most important reason for this high number of poisoning cases. The frequent application of highly hazardous pesticides in high concentrations was often irrational and posed serious health and financial risks to the farmers. Sales promotion activities and credit facilities promoted this excessive pesticide use, which was not counteracted by an agricultural extension service. Hazardous practices when spraying pesticides were due to the impossibility of applying recommended protective measures under the local conditions, rather than to lack of knowledge. Current emphasis on programs that promote the safe use of pesticides through education and training of farmers will be ineffective in Sri Lanka because knowledge is already high and most poisoning cases are intentional. Instead, enforcement of legislation to restrict availability of the most hazardous pesticides would result in an immediate health benefit. Improved agricultural extension services to promote alternative non-chemical methods of pest control is the most important strategy, in the long term, to prevent acute pesticide poisoning.


Abstract: Growing evidence exists that chronic exposure to low levels of organophosphate pesticides (OPs), widely used both in agriculture and residential settings, can cause adverse health effects in children. Despite these concerns, few studies have evaluated children’s long-term exposure to OPs. A recent study examines year-long fluctuations in OP metabolite concentrations in a group of low-income family children living in an agricultural community. The study found that regardless of the families’ proximity to treated orchards or parental work exposure to pesticides, metabolite levels increased in children’s urine during the spring and summer spraying months. Because OPs have a relatively short half-life in the body, levels declined (but were still detectable) in fall and winter after agricultural spraying ended. Study findings support the theory that children are continuously exposed to low levels of OPs in the diet, with episodes of higher exposures as a result of residential and agricultural pesticide use.


Abstract: in 1969, it was reported that DDT, DDE, lindane, dieldrin and heptachloreephoxide were present in the cord blood (fetal) and tissues of 10stillborn infants, in levels equal to that of adults. This confirms the transplacental transfer of these compounds, which can also reach the
newborn via the breast milk. Measuring DDE levels in fetal whole blood, they found that premature infants had levels elevated three- to fourfold relative to control, term infants. Although these elevations could be explained by the absence of body fat to store the compound, which is common in pre-term infants, a causative role of chlorinated pesticides in inducing premature deliveries cannot be ruled out.


Abstract: The most serious childhood diseases in the U.S. and other developed countries are chronic conditions with multiple causative factors, including environmental pollution. Although environmental linkages are known or suspected for many diseases, their economic costs to society have not been estimated. A recent study estimates the incidence, prevalence, mortality, and annual costs of four environmentally induced childhood diseases – lead poisoning, asthma, cancer, and developmental disabilities. Using approximations of incidence and prevalence for each of these diseases in the U.S., the researchers estimated the average annual costs attributable to toxic environmental exposures to be $43.4 billion for lead poisoning; $9.2 billion for neurobehavioral disorders; $2.0 billion for asthma; and $300 million for cancer. For these diseases alone, the total annual cost (average) attributable to environmental factors is $54.9 billion, nearly 2.8 percent of the total annual costs for illness in America. By comparison, the cost of all child-related research was only $2 billion (1995 estimate) – a small fraction of federal research spending. Based on the results of the study, the authors recommend increased investment in disease tracking and surveillance, basic research on disease mechanisms, prevention-oriented epidemiologic research, and most importantly, pollution prevention.


Abstract: Several studies have suggested that household pesticide use is associated with increased risk of childhood leukemia; however, many of these studies are limited by small study size or weaknesses in exposure data. To address these concerns, a more comprehensive study in California recruited 162 children (ages 15 and under) with recent diagnoses of leukemia and 162 matched controls. For each study participant, the primary care giver was interviewed in detail regarding household pesticide use, including the type of product and frequency and timing of use. Pesticide use was examined for five discrete periods: the three months prior to pregnancy, pregnancy, and each of the three years after birth. The researchers found that children who lived in homes professionally treated for pests or where insecticides
had been applied indoors at any time during the five periods had a higher risk of leukemia. The highest risk was seen for indoor pesticide use during pregnancy. No association was found for outdoor pesticide use or for use of herbicides or flea control products. These results provide additional evidence that exposure to insecticides during development and the early years of life is associated with an increased risk of childhood leukemia.


Abstract: Twelve volunteer farmers were divided into two groups: protected and unprotected farmers tested before and after spraying methyl parathion 50EC at a final spray concentration of 0.05 to 0.18 kg ai/ha. While there was no significant difference in cholinesterase (ChE) levels before and after exposure in either farmer’s group, there was significant red cell ChE depression in 31percent of the sample. Farmers wearing protective clothing had significantly higher hemoglobin levels than those without. In terms of potential dermal exposure, total pesticide residue levels by anatomical locations are 37 to 200 times higher for the unprotected group. Mean levels of urinary metabolite (paranitrophenol) for both groups were higher after exposure. There was a statistically significant lowering in the after-exposure levels of paranitrophenol of the protected group, suggesting some from of protection not only from exposure but also from systemic absorption.


Abstract: The article mainly dealt with trialkyl phosphorothioates(TP). Human relevance of TP-induced lung injury indicate that lungs are an important site for binding or metabolism of organophosphorus pesticides; exposure by inhalation may occur occupational activites, and respiratory distress is commonly found in acute human poisoning with organophosphate insecticides, the latter being generally attributed to the effects of cholinesterase inhibition leading to bronchospasm and excessive tracheobronchial secretions, respiratory muscle paralysis and cause of pulmonary oedema encountered in India; delayed pulmonary oedema or pneumonitis may also be observed in organophosphate poisoning.

Abstract: Employees from a total of six sections from the two institutes (Agricultural Entomology, Physics, Botany and Administration) were examined, these employees handled a variety of chemicals including chlorpyrifos, dimethoate, fenthion, trichlorphon, methomyl, dichlorvos, carbofuran, DNOC, 2,4 –D, atrazine, oxadiazon, carbendazim and endosulfan. There was statistically significant reduction of plasma cholinesterase enzyme at the 0.025 probability level, while there was none in the whole-blood cholinesterase in all persons examined.


Abstract: Although a number of health hazards associated with pesticide exposure have been well documented, relatively little is known about the knowledge and health beliefs that may influence pesticide handling. This study measured knowledge levels concerning pesticide safety and precautionary handling among applicators and examined relationships between knowledge scores and intentions to use handling precautions, perceptions of pesticide safety peer norms, and perceived self-efficacy to prevent personal exposure. Telephone interviews were conducted with a randomly selected sample of 164 dairy farmers who were pesticide applicators residing in Wisconsin (response rate = 77.4%). The percentage of correct responses to 18 knowledge items ranged from 100% to 45.7%. Knowledge levels were positively related to intentions, beliefs, and self-efficacy regarding use of personal protective gear but were not significantly related to risk perceptions and peer norms concerning pesticide safety.


Venezuela – a Developing Country,” Archives of Environmental Health, Vol. 54, No.6, Pg.
430-435.
UPLB – Agricultural Policy Research Program Monograph No.89-01, Los Banos, Philippines: University of the Philippines at Los Banos.
economic assessment”, IRRI and World Resources Institute, Philippines.
symptoms among agropesticide applicators in Sri Lanka”, Social Science and Medicine,

Abstract: Sri Lankan farmers use large amounts of pesticides to control the pests affecting their
vegetable crops. Improper use of pesticides by farmers has resulted in poisoning of
occupational origin. This paper examines the use of protective measures by pesticide
applicators and its relationship to their illness symptoms. The data were collected by
interviewing a stratified random sample of 150 farmers from predominantly vegetable growing
areas of the Matale district during 1990/91 using structured questionnaires. These data were
supplemented with secondary data and observation of all stages of pesticide application. Scales
were constructed to measure the domains of material style of life, awareness and use of
protective measures, and illness symptoms experienced by pesticide applicators. It was found
that most of the farmers were aware of the protective measures to be used when applying
pesticides. There was, however, no significant positive relationship between awareness and use
of protective measures. The main reason for not using protective measures was discomfort. The
most common symptoms reported by pesticide applicators were faintish feeling, headache and
dizziness. A significant negative relationship was observed between use of protective measures
and symptoms exhibited within four hours of application. It is recommended that protective
materials adapted to the climate and socio-economic conditions of farmers be developed, and
that farmers be encouraged to use these protective materials through appropriate educational
efforts and incentives.
environmental extension and public awareness program for Palestinian community in Gaza
Strip”, Journal of Pest Control and Environmental Science, Vol. 8, Pg. 75–98.
pesticides used in agricultural environment of Gaza Strip”, Science of the Total Environment,
Vol. 132, Pg. 371–80.[Medline]
147. Safi, J. M. (2002): “Association between chronic exposure to pesticides and recorded cases of
284,Pg. 75–84.[Medline]
knowledge, attitude and practice study”, Environmental Research, Vol. 94, Pg. 1-6.
Abstract: Pesticide toxic action is manifested almost entirely through the nervous system. Prominent signs include muscle tremor, incoordination, and convulsions. Levels below that required to produce toxic effects cause vague and nonspecific symptoms like headache, blurred vision, dizziness, and nausea. A study feeding rats with radioactive dieldrin observed that it was absorbed from the GI tract and distributed throughout the body within few hours. After oral administration, maximum concentrations were reached in body organs in one or two days, the highest concentrations appearing in the fat. Some redistribution took place in favor of fat within the next four days. These results indicate that blood levels of dieldrin might reflect both the initial absorption and the redistribution phenomenon. In animals, insecticides such as DDT, deildrin and lindane and/or their metabolites were observed. With a single injection, insecticide level apparently reached a maximum in the blood and then decreased. In fish, studies reported that observed that there were larger concentrations of endrin in the blood of the fist killed by endrin poisoning than in the fist that were exposed but not killed. In human beings, clinical symptoms of intoxication from aldrin and dieldrin include neurophysiological disturbances, such as tremors, with epileptiform convulsions in the more severe cases. Dieldrin has been found in fat biopsies at levels in excess of 100ppm in individuals showing symptoms of intoxication.


Abstract: Large worker populations in the Third World are exposed to increasing amounts of pesticides, including pesticides severely restricted and banned in industrialized countries. Studies on knowledge, attitudes, and practices indicate that unsafe use of pesticides is the rule in Third World countries. Surveys of acute poisonings show high rates in these countries, despite underregistration. The scarce studies on chronic health outcomes demonstrate neurotoxic, reproductive, and dermatologic effects. Exposure assessment consists mainly of cholinesterase testing, and few studies have quantified dermal and respiratory exposure. The few intervention studies demonstrate the need for evaluation of the impact of preventive measures and policies. There is no evidence that widespread “safe-use” programs have greatly affected exposure and morbidity. It was concluded that research should focus on simple methods for surveillance of exposure and on surveillance of acute illness and its causes in order to develop and evaluate rapid local interventions. Studies on chronic effects should be carried out in selected countries, aiming at long-term and broader interventions. Policies that promote the use of pesticides should be critically evaluated. North-South and South-South research collaborations must be encouraged to address this global health problem.
Abstract: In this paper the contingent valuation method (CVM) is used to elicit bids/values to avoid direct exposure to pesticides and the resulting illnesses among subsistence farmers in a developing country, namely Sri Lanka. Farmers using pesticides on their farms suffer from short-term as well as long-term illnesses. Deaths from direct exposure to pesticides are not uncommon. The CVM is used to determine the yearly value to an average farmer of avoiding the costs of direct exposure to pesticides and to calculate the pesticide cost scenarios for the entire country. The last section of the paper examines the factors that influence the willingness to pay (WTP) to avoid direct exposure to pesticides and the resulting illnesses and discuss the health and environmental policy implications stemming from the regression analysis.


**Websites**

177. **Pesticide Action Network UK, PAN UK**

Pesticide Action Network *UK* (PAN *UK*) promotes healthy food, agriculture and an environment which will provide food and meet public health needs without dependence on toxic chemicals, and without harm to food producers and agricultural workers. PAN *UK* is an independent, non-profit organization that works nationally and internationally with like-minded groups and individuals concerned with health, environment and development to eliminate the hazards of pesticides, reduce dependence on pesticides and prevent unnecessary expansion of use and increase the sustainable and ecological alternatives to chemical pest control.

[http://www.pan-uk.org](http://www.pan-uk.org)

178. **Environmental Health Action**

EnviroHealthAction is an education and action center that provides an online community for health professionals and others interested in environmental health. It is designed to provide busy professionals with the opportunity to access important resources and deliver valuable input to policymakers.

[http://www.envirohealthaction.org](http://www.envirohealthaction.org)

179. **People and the planet**

This site provides a global gateway to the greatest issue of our time: the future health and wellbeing of the human family as it presses ever more heavily on the natural resources of our planet. All 16 sections of our website are now fully on-line in our new format, and we will be building our new Picture Gallery over the coming months. Happy browsing - and please send us your feedback.

[http://www.peopleandplanet.net](http://www.peopleandplanet.net)

180. **U. S. Environmental Protection Agency (EPA)**

EPA’s Pesticides Program

[http://www.epa.gov/pesticides](http://www.epa.gov/pesticides)