

**ENVIRONMENTAL CONSEQUENCES OF AGRO-PESTICIDES
NECESSARY FOR RURAL DEVELOPMENT**

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ABSTRACT

The Malaysian government's strategy for economic development is sustaining rapid industrial growth and focussing its development programmes on the rural population in an all out effort to redress rural poverty. The rural poverty level, inspite of expected rapid development, is forcasted to be still around 50% by 1990. The rural scenario in Malaysia is no different. Agriculture is still dominated by the small farmers of the rural areas which remain as a dominant poverty trap. The idealized transition of agriculture into a modern sector, developed and reorganized into efficient industry supplying the food requirements of the country is yet to materialize. It is, thus, not suprising for agricultural development (synonymous to rural development) to have received top priority. The poor farmers of the rural sector are yet to benefit much from modern agriculture which certainly needs the essential modern inputs and technology. One of the modern tools of agricultural modernization is chemical pesticides (agro-pesticides). Agro-pesticides remains, inspite of their adverse publicity, our most powerful tool in the management of crop pests which are still causing heavy crop losses annually. Are agro-pesticides really necessary? This will be one of questions that will be answered in this paper. The paper will largely examine in some details the Malaysian version of the environmental consequences resulted from the long usage and overreliance upon toxic agro-pesticides relative to environmental pollution, ecological imbalances and disruptions, problems of pesticide-resistance pests added to the environment, recurrent pest and disease outbreaks, adverse effects on human health and future generations and finally the exclusion of traditional pest control technologies. Results of a recent survey on small farmers to understand their perception of the impact of agro-pesticides on the environment and their confidence on non-chemical method to control pests are presented. The paper finally discussed an appropriate immediate measures to be taken and our future strategies in protecting the rural environment.

INTRODUCTION

The technology of today and the past have made possible the human species to exert a greater impact on the global environment than perhaps any other species during the history of life on this planet (Farrner, 1972). One facet of this technology, modern medicine, has responded almost miraculously to the primitive drive to survive and to preserve life (ibid). However, modern medicine has not been able to respond well with respect to the development of over population.

As population grows, another aspect of our technology, modern agriculture, has responded miraculously in its attempts to meet the growing world's demand for food and fibre. The increased production of food and fibre is accomplished primarily through managed, simplified ecosystems and meaningful rural development. More food may be attained by reducing or eliminating or suppressing competition with other species. Thus, a critically important aspect of agricultural technology has been the development of chemical pesticides (agro-pesticides) needed for controlling pests.

Truly, we are faced with a dilemma. Side-effects of chemical pesticides are not sufficiently understood, and although there have been significant strides, we are still very far from a truly predictive ecology. Obviously, we can permit this lack of knowledge to serve neither as a basis for abandonment of chemical pesticides (the position of the extremists regarding environment) nor as the basis for the relaxing approach that ignores the remifying effects of subtle environmental insults.

In the largely rural and non-industrial countries like Malaysia, where farming technology is somewhat traditional and yields small, human populations are increasing, the numbers of people who depend for survival solely on agriculture seem likely to increase for at least 50 years to come (Bunting, 1972). Rural development in the context of Malaysia is agricultural development. In advancing agriculture through rapid development of the rural sectors, the desire of the farmer or plantation owner for maximum economic return may lead him to aim to control pests more completely than the interest of the community as a whole may require. In general as new technology is introduced, it continually alters both the microecology and the macroecology, so that pest problems and the means of regulating them will never be static. Hence, agro-pesticides are likely to continue to be necessary, but the pesticides themselves and the ways of using them will change and improve.

RURAL DEVELOPMENT AND POVERTY

Much efforts have been put by the Malaysian government into development especially in the rural areas. Such areas are agricultural sector comprising the majority (65%) of the population (Government of Malaysia, 1981). The agriculture-based industry of the rural areas encompasses rubber smallholders, oil palm smallholders, padi farmers, fishermen and others.

Development in Malaysia began changing its emphasis after the 80's to replace the old paradigm of development which focussed merely on economic growth (Ghazali, 1983). In place of capital intensive technology, the shift was towards an integration of traditional and modern systems which would reduce pollution and utilize more labour. Development ultimately is not a matter of technology or gross national product, but the attainment of new knowledge and skills, the growth of a new consciousness (such as environmental consciousness), the expansion of the human mind and the infusion of human confidence.

Nevertheless, in addition to achieving impressive growth, Malaysia has given special attention to rural development and the eradication of poverty. Since the 60's emphasis was increasingly placed on providing land to the rural poor and raising the productivity of small-scale farmers (Hasan, 1980). The government's target is to reduce the incidence of poverty from 49% of the households in 1970 to 17 percent by 1990. Given the rapid rate of population growth expected over this period (the rate of increase in the number of household is projected at 3.3 percent per year) attaining this target will be a formidable task (Young, 1980). The rural poverty level, inspite of expected rapid rural development is forecasted to be still around 50% by 1990.

MODERNIZATION OF TRADITIONAL AGRICULTURE

Over the developing world as a whole, farming systems vary from increasingly prosperous commercial farming such as in Malaysia to the poor slash and burn system of Latin American and African Savannahs (Bunting, 1972). With the exception of the modern estate sector or plantation system of growing crops in Malaysia, the agricultural systems of the majority (75%) of small farms in the rural areas are largely traditional (Hasan, 1980).

In traditional agriculture, the first objective is subsistence for the family and sales off the farm and market opportunities tend to be small unpredictable and unorganized. The use of pesticides is minimal or nil. In ecological term, translocation within the ecosystem is poorly developed. The technology is traditional, it was few or no purchased inputs and little mechanical equipments (Clark and Haswell, 1968). However, in the last decade, modernization of the traditional agricultural sector has been progressing reasonably well. During the 1961 - 1980, the growth rate of agricultural output was about 6 percent a year, among the highest rates anywhere (Hassan, 1980). Although the rate of growth of agricultural production as a result of modernizing traditional system was high, the growth of real agricultural incomes was not more than 1 - 2 percent a year. More recently, it was reported that agriculture in Malaysia is in a state of crisis (Todd, 1985). What is really need in this country and this had been fulfilled not long ago is a national agricultural policy (NAP). This need arises because of the existence of poverty in the rural areas in spite of the relatively rapid overall growth of the economy (Ayub, 1983).

One of the development strategy of the NAP in modernizing our traditional agriculture is to improve rural living standards by increasing the total area cultivated by small farmers, increasing the size of holdings & increasing productivity of land and labour through the use of modern technology such as agro-pesticides (ibid).

Effective and smooth transfer of appropriate modern technologies is essential in modernization of rural community and to speed up rural development, while maintaining much of the traditional practices (Hussein, 1984). Very often, with the advent of modern pesticides and with the help of governmental legislation, the traditional methods of pest control have been thrown out of the window and may be wiped out of existence (ibid). Agro-pesticides have become synonymous to modern pest control.

PESTICIDE USAGE IN MALAYSIA

Pesticide figures showing the level of domestic consumption are more difficult to obtain than fertilizers. A small quantity of agro-pesticides is manufactured locally, while the bulk being imported and repacked locally for sale. In 1979, Malaysian imported more than 4 million litres of liquid pesticides and 2½ million kg of non-liquid pesticides for a total value of \$73 million ringgit. The figures for 1980 were 5 million litres and 3 million kg of pesticides, respectively. It is estimated that about 2,000 tons of pesticides were imported in 1981 (SAHABAT ALAM MALAYSIA, 1984).

The sales of pesticides was valued at 175 million ringgit in 1982 (Chew, 1983) and 250 million ringgit in 1983 (SAM, 1984). The main groups of agro-pesticides now in use are the weedicides, insecticides, fungicides and rodenticides with 80% of the share goes to weedicides (ibid) (Table 1). While weedicides and rodenticides markets are in the plantations' and smallholders' rubber and oil palm, both fungicides and insecticides are confined in the smallholders' vegetable, rice, tobacco and other miscellaneous crops.

Farmers rely on the pesticides to protect their crops against the pests. Agro-pesticides are easily obtainable from shops and sundry stalls. Our farmers, being mostly (72%) ignorant, still depend on shopkeepers for recommendation on the use of pesticides (SAHABAT ALAM MALAYSIA, 1984). Very few of these farmers are briefed about the potential hazards to health and the long-term adverse effects of pesticides. Consequently, farmers generally use more pesticides than what is recommended. The disturbing fact is that the use of pesticides is increasing at a rapid rate, public awareness of the problem has not been widely noticeable. Publicity and information on the environmental consequences and problems associated with the use of pesticides have been minimal for the reason that adverse publicity might affects sales of pesticides or the trading of pesticides.

ENVIRONMENTAL CONSEQUENCES OF AGRO-PESTICIDES

Agro-pesticides (insecticides, fungicides, weedicides, nematocides etc.) are of such fundamental importance to the human race, both for agriculture and for the preservation of health of rural people. However, the virtual indispensability does not justify the use of pesticides on an infinitely increasing scope or irresponsibly without regard to the quality of the environment.

The amount of public outcry about the side-effects of pesticides on non-target organisms and upon environmental quality provides substantial proof that changes must be made in pest control practices and, in some cases, in the nature of the pesticides themselves. It must be remembered that pesticides are applied to the environment as purposeful contaminant; consequently, the benefit from their use must greatly exceed any damage to environmental quality.

The consequences of environmental contamination on the biospheres' organism takes three forms:

- 1) direct kill;
- 2) indirect toxic effects resulting from biomagnification and
- 3) selective kill of certain species whereby some non-target organisms are killed immediately or directly (Flint and Bosch, 1981)

Pesticides Endanger The Health Of Rural People

All chemical pesticides are potentially dangerous. There is no such thing as a completely safe chemical pesticide. They can kill by contact (Dermal) and ingestion (oral). Persistent pesticides such as the organochlorine groups will persist in the environment for a very long period, and they are metabolized into more toxic residues which are of great danger to humans and animals. These groups of pesticides such as DDT, alieldrin, aldrin, accumulate in the body and can reach dangerous concentration. How pesticides can be accumulated at the different trophic levels is shown in Figure 1 (Flint and Bosch, 1981).

It is indeed difficult to assign a value to the impaired health or loss of human life resulting from pesticide poisoning, either accidental or suicidal. It is often said that most cases of pesticide poisoning could have been avoided if label instructions were carefully followed. However, this contention too easily dismisses the fact that pesticide poisoning is so common

In Malaysia, more than 1,200 people have died of pesticide poisoning since 1980 (New Straits Times, 1985). Health Ministry figures revealed that of the 2,160 people admitted for paraquat (a weedicide) poisoning between 1980 - 1984, more than 50 percent died. It was estimated that for the first half of 1985, about 150 people had succumbed to the pesticide. Of the fatalities, 70 percent are suicides and the remaining 30 percent are either accidental or exposure to the agro-pesticide during handling (ibid).

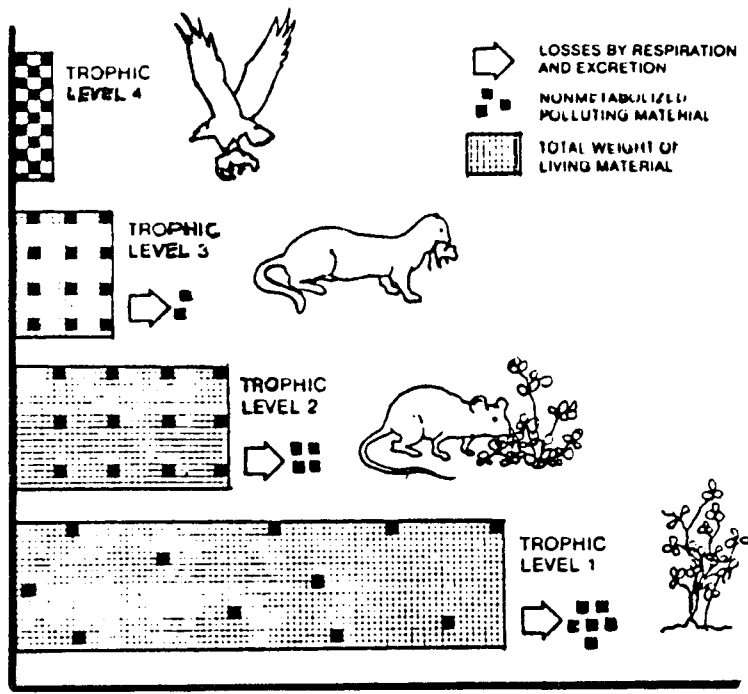


Figure 1. Diagram showing how toxic chemical pesticides are most likely to accumulate in animals at the highest trophic level on the food chain. (After Flint and Bosch, 1982)

Although the organochlorine insecticides mentioned above stay in the environment for long period of time, they are much less hazardous to humans than are the organophosphates (parathion, monocrotophos, dichloruos). Typically, organophosphates produce a quick, heavy kill immediately following application, because they generally break down rapidly in the environment, they must often be applied repeatedly.

The long-range effects of pesticides on humans may include an increased birth defects and in the occurrence of cancer. The herbicide 2, 4, 5-T is known to be tetratogenic and fetocidal to at least some mammals. Arsenic compounds used as insecticides have been reported to be carcinogens as well as direct poisons. Fungicides from the chemical pthalimide (captan, difolatan, folpet) have been shown to produce birth deformities in certain laboratory animals. Dichloruos, the common insecticide, is also a suspected mutagen. Insecticides such as DDT, dieldrin, aldrin have been implicated as probable carcinogens. The namaticide, DBCP has been associated with a number of cases of sterility among men. Knowledge of chemical induction of cancer and birth defects is still very scant.

A study conducted by Universiti Pertanian Malaysia in 1980 (Wong, 1980), on pesticide residues in the blood serum. The level of organochlorine compounds in Malaysian rice farmers, rubber estate workers and the general public were much higher than those in similar categories in USA (Table 2). Another study conducted by Juza (1982) at Universiti Pertanian Malaysia also detected organochlorine compounds in chicken eggs (Table 3).

Agro-Pesticides Affects Socio-Economic Status Of Farmers

The indiscriminate use of agro-pesticides by rice farmers have had their consequence on rice field fish. In Malaysia, scabies epidemic emerged in 1980 in padi fields, irrigation canals and ponds to plague fresh water fish. Since fish serves as food and income to the rice farmers and their families, their livelihoods are being threatened because too much pesticides have been applied to the rice fields. Undoubtedly, the widespread used of poisonous agro-pesticides has serious consequences on the health and socio-economic status of the farmers (SAHABAT ALAM MALAYSIA, 1984).

Pesticides Cause Ecological Backlashes

As some have predicted, inevitable upsets and backlashes quickly occurred literally everywhere agro-pesticides were used. The agriculturists have placed themselves on a pesticidal treadmill because three ecological based phenomena:

- 1) target pest resurgence,
- 2) secondary pest outbreaks, and
- 3) pesticide resistance - All of these are directly related to the disruption of biological control and lead

Table 1. Percentage market share of agro-pesticides in Malaysia.
(Chew, 1983)

Pesticide	% Share	Value (Million Rgt.)
Weedicides	80	140
Insecticides	12	21
Fungicides	5	9
Rodenticides	3	5

Table 2. Concentrations of total organochlorine insecticide residues (ppb) in blood serum of rubber tappers, padi farmers and the general public in Malaysia. (Wong, 1980)

Occupational Group	Insecticides			Total
	DDT-R	BHC-Iso.	Cyflodiene	
Estate Rubber Tappers	90	13	35	138
Padi Farmers	110	13	61	184
General Public (M'sia)	66	8	22	96
General Public (USA)	-	-	-	27

Table 3. Concentrations of organochlorine insecticide residues (ug/g) in chicken eggs. (Juzu, 1984)

Insecticide	egg yolk	whole egg	Tolerance level
			whole egg
Total BHC	0.037	0.013	0.500
Heptachlor	0.041	0.018	0.050
pp-DDT	0.087	0.031	0.500
pp-DDE	0.190	0.067	0.500

increasingly to a "pesticide addiction" from which it is difficult to withdraw (Stern, et al., 1959; Smith and Bosch, 1987).

The complex interplay of pest and natural enemies, of crops, farm animals and man is called 'agroecosystem'. The addition of pesticides help to reduce pest population and it can also cause upsets and backlashes in the following manner. First it may kill many of the natural enemies of the target pest or else the population of natural enemies may take longer to recover from pesticide application than do the pests. Thus freed from some of the natural controls which previously acted upon it, the population of the original pest may explode or resurge to unprecedented numbers (Hussein, 1981 and 1982).

The second backlash occurs when the pesticide kills large numbers of the natural enemies of a species other than the target pest, but having pest potential. This species, perhaps previously unnoticed, may then be able to reproduce relatively unhindered to the detriment of the farmer and his crops. The arrival of a new pest in this way is known as a 'secondary' pest outbreak.

In ignoring the ecological nature of pest control and in attempting to dominate pests with a simplistic chemical control strategy, we played directly into the strength of those formidable pests. Pests, especially insects, with their rapid breeding cycles and genetic diversity, are well placed to evolve the ability to resist attempts at chemical control. The problem of pest resistance and those of toxicity to non-target organisms commonly interact to speed the spin of the pesticide treadmill. How pesticide spraying increases the proportion of resistant pests, making subsequent application of pesticides less effective is shown in Figure 3.

ARE AGRO-PESTICIDES REALLY NECESSARY FOR RURAL DEVELOPMENT

The above question is a very challenging and is often asked by students, reporters, environmentalist and even farmers. These people who asked the question have good knowledge about genetic, biological and other non-chemical method of pest control and had been showered with reports of chemical hazards to health and environment, some real and some highly imaginative.

Our discussions convinced me that, for the most part, these people were still quite unaware of the proven benefits of pesticides. Yes, agro-pesticides are really necessary for agricultural modernization and development. This is my answer to those with environmental concerns who have been encouraged to believe that we can depend ourselves against pests by solely non-chemical methods. Much progress has been made in encouraging non-chemical controls, but integrated systems involving only non-chemical methods alone seldom provide adequate protection. Chemical pesticides are still a part of most successful integrated pest management system and for many pests, where only modest progress has been made in perfecting cultural, physical or biological control, pesticides still form the core of the control programs.

It is important to recognize that farmers must defend their crops and livestock by one means or another against a wide range of pests if they are to provide you and I with constant and adequate food supply. My main concern is that our country wants to have an efficient agriculture with high yields and through application of the best available technology in methods of pest control. We are all in favor of abundant food, year in and year out and we hope no one will go hungry.

FARMERS' PERCEPTION OF AGRO-PESTICIDES IN THE ENVIRONMENT

Many have agreed that in the development and use of an appropriate technology for the farmers, the farmers' perception should be thoroughly understood first if the technology has not been transferred yet. In the case where the technology has already been around for sometime, the farmers' perception of the situation needs to be understood also. Unless this is done, implementation of certain development programmes will be met with major obstacle.

In a recent survey conducted by Universiti Pertanian Malaysia, 100 traditional small farmers from selected villages were asked for their opinions on the use of agro-pesticides in farming (Hussein, 1985) (Table 4). Majority of them (85%) expressed concern, over the health hazards posed by agro-pesticides present in the environment. Half of the farmers (57%) found that the job of controlling the pests on their crops are facing the problem of pest resistance. They also understand that pesticides kill the natural enemies of the pests. To this question, 50% of the farmers showed positive response. Most (73%) of them, again, knew that chemical pesticides caused phytotoxicity problems. Nearly half (43%) agreed that most of the pesticides which were sprayed routinely are wasted. As a result 43% of the farmers interviewed wanted the use of pesticides to be stopped while 57% believed that pesticides are still necessary.

RECOMMENDATIONS

Taking into account the existing situation prevailing in Malaysia, I recommend the followings to be considered by this meeting as immediate measures to be taken by the government and as future strategies in protecting the rural environment.

- 1) Develop adequate registration schemes.
- 2) Develop national pest control strategies which use a combination of the safest possible control tools.
- 3) Monitor pesticide residues in human, food and drinking water.
- 4) Monitor pesticide residues in the physical environment, plants and animals.
- 5) Provide adequate extension services to advise pesticide users.
- 6) Adequate protection during transport of pesticide products.

Table 4. Average estimates (%) of farmer's positive response to issues on environmental problems of agro-pesticides. (Hussein, 1985)

Environmental Problems	Kuala Langat	Beranang	Labu- Nilai	Average
Phytotoxicity	79	78	61	73
Kill beneficial species	55	41	53	50
Pesticide resistance	50	56	44	51
Human health hazards	63	100	93	85

- 7) Develop method of residues analysis to allow individual organization to investigate pesticide problems.
- 8) Maintain long-term medical surveillance to determine effects of agro-pesticides on occupationally-exposed workers.
- 9) Document all agrochemical effects on humans.

CONCLUSIONS

Environmental pollution by agro-pesticides is a threat to the production of adequate supplies of high-quality food, feed and fiber and to human health and welfare. In reaching our goals for rural development, the quality of our environment has deteriorated. Ecological effects of agro-pesticides were not always accurately assessed.

Too often man has acted as the master and has exploited nature as his subject. In this often strange relationship, life appears to have become a struggle of man against his environment, and not a joint venture for mutual benefits. Future progress including rural development must always include improvements in the quality of our environment and will require greater emphasis on the ecological consequences of technological development. We who enjoy the fruits of this productive land and country must make a new commitment to the principles of ecology - a word read and heard frequently, but not well understood. Our most important goal is to achieve and maintain a fine ecological balance. On the one hand, health and comfort with the production of ample food and fibre is everyone's right to have in this planet. On the other hand, a better grasp of the environmental significance of agricultural practices, particularly the use of poisonous chemical pesticides, and their relation to pollution and control. The Malaysian government is strongly urged to intensify the activities in creating public awareness of the state of the rural environment and monitoring the impact of the environment as long as modern technologies are being continually introduced.

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