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REPORTS TO THE UNITED STATES CONGRESS

by

THE AGENCY FOR INTERNATIONAL DEVELOPMENT

I.
INTEGRATED PEST MANAGEMENT: A.I.D. POLICY AND IMPLEMENTATION

II.
PESTICIDE USE AND POISONING: A GLOBAL VIEW

September 1990
Washington, D.C. USA

INTEGRATED PEST MANAGEMENT:

A.I.D. POLICY AND IMPLEMENTATION

JUNE 1990

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I. *INTEGRATED PEST MANAGEMENT: A.I.D. POLICY AND IMPLEMENTATION*

II. *PESTICIDE USE AND POISONING: A GLOBAL REVIEW*

This publication contains two interrelated reports about pest management in developing countries. The reports were prepared by the Office of Agriculture in the Bureau for Science and Technology, Agency for International Development (A.I.D.). They were submitted to Congress in July 1990 in response to requests in (a) House Committee on Appropriations, Foreign Operations, Export Financing, and Related Programs Appropriations Bill, 1990; House Report No. 101-165 and (b) Senate Committee on Appropriations, Foreign Operations, Export Financing, and Related Programs Appropriations Bill, 1990; Senate Report No. 101-131.

The first report, "Integrated Pest Management: A.I.D. Policy and Implementation," discusses the rationale for supporting programs aimed at decreasing the losses due to agricultural, livestock, and human health pests, describes A.I.D.'s policies and regulations governing pest management activities, outlines the current A.I.D. programs addressing this area, and discusses some possible future programs.

The second report, "Pesticide Use and Poisoning: A Global Review," is focused specifically on the problem of pesticide poisoning in developing countries. A review of the literature reveals that the number of pesticide poisonings in developing countries appears to be disproportionally higher than in the more developed countries. The report discusses possible reasons for the high incidence, and describes the efforts, both by A.I.D. and other organizations, to improve the situation.

Comments on these reports may be sent to: Office of Agriculture
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INTEGRATED PEST MANAGEMENT: A.I.D. POLICY AND IMPLEMENTATION

INTRODUCTION

A.I.D.'s environmental and natural resource policy is based on the premise that protection of the environment and conservation of natural resources are essential to sustained economic and social development. The central objective of this policy is to help developing countries to conserve and protect their environment and natural resources and to manage exploitable resources for sustainable yields.

In most of the developing countries where A.I.D. is active, the development strategy includes agricultural activities and public health programs including control of vector-borne diseases. A.I.D. supports programs that promote sustainable agricultural production to meet the food, fiber, fuel, and shelter needs of increasing populations in these developing countries. Programs include activities to increase the efficiency of water and soil use, improve crop varieties, modify cultural practices, and encourage changes in agricultural policies. Worldwide pre-harvest agricultural crop losses due to pests are estimated at 36% of potential yield, and post-harvest losses are estimated at an additional 14%. Therefore, A.I.D. is interested in and supports activities designed to better manage agricultural pest problems.

Additionally, it is estimated that 500 million people in the world are infected with tropical diseases, many of which (such as malaria) are vector borne. Therefore, A.I.D.'s development assistance strategy for improving human health conditions in developing countries includes support for controlling the vectors that are responsible for spreading the major diseases.

Moreover, A.I.D. gives emphasis to assuring that all supported activities are ecologically and economically sustainable. These considerations are particularly important in agricultural pest management and vector control programs which, if not properly designed and implemented, can have serious negative impacts on the environment.

Several tactics are available for managing pest populations. These tactics include use of biological control, genetic plant resistance, modification of cultural practices, physical and mechanical methods, and chemicals. A.I.D. policy is to promote integrated pest management (IPM) as the primary method of pest control. Integrated pest management attempts to control pests in an economically and environmentally rational manner; it emphasizes non-chemical tactics which cause minimal disruption to the ecosystem. Management of many pests still relies on the use of pesticides. But such use in an IPM context means that the amounts applied are minimized by closely monitoring the pest population to determine the optimal timing, method of application, and dosages used during interventions.

However, A.I.D. recognizes that a well-organized quarantine system is an essential first line of defense against the introduction of exotic pests. Eradication of newly introduced pests may be the best control option in certain restricted situations, particularly when the pest has potentially great economic or human health consequences, and its geographic distribution is limited. The introduction of the New World screwworm into North Africa is an example of a situation where eradication is appropriate. Although not usually considered as part of IPM, eradication is sometimes the most environmentally and economically acceptable approach. Therefore, it is not excluded from the arsenal of pest management approaches supported by the Agency.

A.I.D. POLICY

A.I.D. policy and environmental procedures in pest and pesticide management are governed by the A.I.D. Policy Paper on the Environment and Natural Resources (1988) and the Environmental Procedures set out in 22 CFR part 216, commonly referred to as "Regulation 16". This policy, adopted in 1976 and updated in 1980, was developed in response to the growing awareness in the United States concerning the importance of protecting the environment. A.I.D. policy is to follow not only the letter, but also the intent of these sections, and to improve on them as the state of knowledge and circumstances allow.

A.I.D. is required by Regulation 16 to conduct an Initial Environmental Examination (IEE) for all projects, including those in which pesticides are to be procured or used. At a minimum, the IEE must deal with the topics listed below. A.I.D. is addressing them as noted.

1. **USEPA registration status of the proposed pesticide**: A.I.D. policy gives preference to pesticides registered for the same or similar use in the United States. The rationale for supporting the use of EPA-registered pesticides is that these chemicals have been found to be acceptable after undergoing a thorough risk evaluation. Where use of a pesticide not registered in the U.S. for a same or similar use is proposed, an environmental assessment of the risks of such use is automatically required.

2. **Basis for selection of the pesticide**: This section of the IEE must include an economic and environmental rationale for choosing a particular pesticide, plus a discussion of the effectiveness of all the available alternatives. In general, the least hazardous pesticide to humans and the environment which is effective against the target pest (and has USEPA registration for same or similar use) will be selected.

3. **Extent to which the proposed pesticide use is, or could be, part of an integrated pest management program**: IPM approaches are highly encouraged in A.I.D. supported activities.

4. **Proposed method or methods of application, including the availability of application and safety equipment**: This section discusses in detail how the pesticide will be applied and the measures to be taken to insure safe use. A.I.D. favors ground application over aerial application whenever feasible to minimize pesticide drift outside the target area.

5. **Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use, and measures available to minimize such hazards**: This section examines acute and chronic toxicological data associated with the proposed pesticide. Although not strictly forbidden in Regulation 16, the use of USEPA-restricted pesticides is generally discouraged. In the United States, restricted use pesticides can be applied only by state certified technicians because of their high acute toxicity or the danger they pose to the environment. Comparable certification programs are generally non-existent in developing countries.

6. **Effectiveness of the requested pesticide for the proposed use**: This section provides information similar to that required under issue 2, but the discussion is more specific to the actual conditions of application.. Additionally, issues such as the potential for the development of pest resistance to the proposed insecticide can be considered in this section.

7. **Compatibility of the proposed pesticide use with target and non-target ecosystems**: This section examines the potential effect of the pesticide use on organisms other than the target pest. For example, if bees are kept in the area, the potential for negative impact on bee colonies must be assessed and measures indicated for mitigating this risk.

8. **Conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils**: This section examines the environment in which the pesticide will be used and addresses issues such as the potential for contamination of surface and ground water sources.

9. **Availability of other pesticides or non-chemical control methods**: This section examines other options for control of the pest and weighs the relative advantages and disadvantages of the identified options. Emphasis is given to exploring the possibility for non-chemical alternatives such as biological control, host plant resistance, and cultural tactics. If pesticides are deemed to be necessary for near-term control, recommendations are made for using the safest chemicals available, for following the principles of an integrated pest management approach, and for taking steps to explore non-chemical methods for the longer term.

10. **Requesting country's ability to regulate or control the distribution, storage, use, and disposal of the requested pesticide**: This section examines the infrastructure and human resources existing in the country to manage the use of the proposed pesticide. If the ability of the host country is determined to be lacking, the measures which will be taken to increase the country's capability are identified.

11. **Provision made for training of users and applicators**: A.I.D. recognizes that safety training is an essential component in programs involving the use of pesticides. The need for thorough training is particularly acute in developing countries where the level of sophistication of those applying the pesticides is typically lower than that of developed countries.

12. **Provision made for monitoring the use and effectiveness of the pesticide**: This section reflects the belief that evaluating the risks and benefits of pesticide use should be an on-going dynamic process.

Depending on the responses provided in the IEE to the above issues, Agency environmental officers determine whether a more detailed Environmental Assessment (EA) is required. The EA examines in greater depth the issues discussed above, and provides recommendations on whether the proposed use should be permitted. If pesticide use is recommended, the EA prescribes specific mitigative actions designed to reduce or eliminate the potential risks identified during the review process.

A.I.D. is exempted from fulfilling the requirements of Regulation 16 in certain very limited situations. These include emergencies, as determined by the A.I.D. Administrator, projects where A.I.D. is a minor donor in a multi-donor project, projects using pesticides for research purposes, and non-project assistance. Even under emergency conditions, such as occurred during the recent desert locust and grasshopper outbreaks in Africa, efforts to fulfill the spirit of Regulation 16 were undertaken. A generalized Programmatic Environmental Assessment was conducted to cover all affected countries. Now that the locust and grasshopper problems can no longer be considered an emergency, more in-depth supplementary environmental assessments are being conducted in many of the African countries which may be threatened during future outbreaks. Furthermore, A.I.D. is directly supporting research on non-chemical alternatives for grasshopper and locust control directly through the Africa Bureau, and also collaborates with international organizations, such as FAO and UNDP, conducting similar research.

PEST MANAGEMENT GUIDELINES

In order to provide additional policy and technical guidance to A.I.D. missions and bureaus, A.I.D. is drafting "Pest Management Guidelines" to assist A.I.D. personnel in implementing the requirements of Regulation 16. The document will include chapters on pest management strategies, project design, pesticide management, and emergency situations. Additionally, a chapter will be included which updates A.I.D.'s policy on the use of pesticides.

The chapter on pest management strategies will briefly summarize various approaches, giving emphasis to the concept of integrated pest management. The chapter on project design will encourage A.I.D. personnel to incorporate pest management considerations early in the project design process to insure that safety and environmental concerns are thoroughly addressed. The pesticide management chapter will provide general guidance on safe storage, transport, and disposal of pesticides. Guidance on procedures to follow during major pest outbreaks, such as the recent desert locust plague in Africa, are summarized in the chapter on emergency conditions.

REVIEW OF A.I.D.'s CURRENT PEST MANAGEMENT PORTFOLIO

A recent review of A.I.D. involvement in pest management identified 64 projects with pest management activities in 30 countries in the Africa, Latin America and the Caribbean, and the Asia Near East regions. Two current projects have IPM as their primary focus, while 30 other projects incorporate or support training components in pesticide or pest management. An additional eight projects support research in breeding and screening plants for genetic resistance to pests. Biological control research is being conducted under two projects, and IPM research is being supported as elements in nine projects. Only one project was designed to support pest control based primarily on a chemical approach. This project, funded by the A.I.D. mission in Morocco, was designed in response to the recent locust outbreak in Africa. Now that the locust threat has diminished, resources in this project are supporting research on the environmental impact of locust control programs on non-target organisms. In addition, the mission is examining the need to fund programs for disposing of unwanted pesticides and empty pesticide containers.

An example of A.I.D.'s pest management approach is the IPM component of the Central American Regional Environmental and Natural Resource Management Project (RENARM) financed by the Regional Office for Central American Programs in Guatemala (ROCAP). This project, funded since 1983, is implemented jointly by the Panamerican Agricultural School (EAP) and the Center for Research and Training in Tropical Agriculture (CATIE). Programs have been developed in pest management training, research, and extension. One of the major accomplishments has been the establishment of a well-rounded undergraduate program in pest management at EAP with a strong emphasis on IPM. In 1989, a biological control center was added to the facilities at EAP, the first of its kind in Central America. This center will serve as a focus for biological control and IPM throughout the region.

Another activity which is having major impact on the adoption of IPM is the A.I.D.-supported Agriculture and Rural Sector Support Program in Indonesia. A major component of this program supports IPM training in rice. By 1994 it is estimated that 2,500 IPM field specialists, 14,000 extension workers, and 2.5 million farmers will have received training through this project. The program also supported policy reform initiatives which resulted in a complete elimination of pesticide subsidies, further increasing the incentive to farmers to adopt IPM approaches.

In addition to activities funded by field missions, three centrally-funded projects are administered by A.I.D. bureaus in Washington DC:

1. The Africa Emergency Locust and Grasshopper Assistance Project (AELGA) was initiated by the Africa Bureau as a medium-term response to the desert locust and grasshopper outbreaks in Africa. Several activities in the area of research, training, and technical assistance have been supported through this project. Research has focussed on pesticide effectiveness, the impact of pesticides on non-target organisms, and biological control of grasshoppers and locusts using insect pathogens. The biological control work was conducted in Mali and Cape Verde during 1989. The research in Cape Verde will be continued until December, 1990.

Additionally, this project is providing support to the International Institute of Tropical Agriculture (IITA) in Benin in cooperation with other donors to investigate biological control of grasshoppers and locusts with fungal pathogens. Training programs funded through the AELGA project have included safe pesticide application, the development of training and extension materials, and the human health aspects of pesticide use. In early 1990, AELGA also sponsored the participation of seven US scientists at a West African IPM conference, and organized a workshop on pesticide disposal. The project has jointly funded preventative locust surveys through the FAO.

2. The Bureau for Science and Technology's project entitled "Integrated Pest Management and Environmental Protection Project" has been active since 1971 under various names. This project, which is currently implemented by the Consortium for International Crop Protection (CICP), assists A.I.D. to develop, implement, and evaluate projects in pest and pesticide management. CICP is a consortium of 13 US universities and the USDA which is administered from the University of Maryland. CICP has provided technical assistance in pest management, conducted training programs in several developing countries, and is A.I.D.'s primary source for conducting the environmental assessments concerning pesticides. Recently, CICP acquired a database that enables it to provide A.I.D. with rapid and up-to-date information on pesticides, including EPA registration status and food residue tolerances. An expanded program for IPM research is anticipated as a component within the proposed sustainable agriculture Collaborative Research Support Program (CRSP) recommended by the House and Senate Appropriations Committees in FY 1990.

3. S&T also provides core-funding to support the "Vertebrate Pest Management Project" which is implemented by USDA's Denver Wildlife Research Center. This project provides training, assistance in the development of management programs, and development of country-specific research programs aimed at decreasing losses due to agricultural vertebrate pests, primarily rodents and birds.

4. S&T's Office of Health supports the "Vector Biology and Control Project" which is designed to develop and strengthen programs to minimize the debilitating effects of vector-borne human diseases, such as malaria, schistosomiasis, and onchocerciasis. The project recognizes that vector-borne disease control strategies which rely heavily on the use of pesticides are not economically sustainable. After thorough analysis of the sociocultural and biological factors which contribute to vector-borne disease, the project develops management strategies which promote an integrated approach appropriate for given local settings.

Several other projects in the S&T agriculture portfolio include pest management activities. The Collaborative Research Support Programs (CRSPs) support research in integrated pest management, biological control, and host plant resistance. For example, the Bean/Cowpea CRSP is conducting research on fungal pathogens for insect control, and the Peanut CRSP supports research focussed on breeding peanut cultivars resistant to several diseases in Africa and Southeast Asia. These are only two of the many examples of pest management research receiving central support.

CONSTRAINTS TO THE ADOPTION OF IPM

Even though the Agency is active in the area of promoting ecologically-based pest management, a great deal still needs to be accomplished. Progress towards adoption of IPM has been slow in both developing and developed countries. In the United States, only an estimated 8% of cropland is currently enrolled in IPM programs supervised by the Cooperative Extension Service.

Promotion of IPM in developing countries has been even less successful. The rice pest management effort in Southeast Asia is often singled out as perhaps the most successful IPM program in the developing countries. However, IPM approaches are used in only 3.7% of the rice growing area of Asia. If other rice growing areas of the developing world are included, the portion using IPM is smaller. An even more alarming statistic is that while only about 20% of worldwide pesticide use is in developing countries, the incidence of pesticide poisoning is estimated to be much higher than in the developed countries. This indicates that a more intensive training effort needs to accompany the provision of pesticides in developing countries.

There are considerable obstacles to the adoption of IPM in developing countries which A.I.D. must consider in planning new pest management initiatives. Four major constraints which appear to be common to many developing countries are discussed below:

1. **Lack of a research base**: Although the concepts of IPM are universal, IPM systems for a particular crop/pest complex can be developed only after gaining a thorough understanding of the target ecosystem. Agricultural research is often not accorded high priority in national budgets in developing countries. With few exceptions, the number of developing country researchers in crop protection is insufficient for the site-specific research required.

2. **Poor extension infrastructure**: IPM approaches are often more complex, and therefore more difficult to transfer to farmers, than more traditional pesticide-oriented crop protection methods. In general, extension services in developing countries receive even less budgetary and human resource priority than agricultural research institutions. Furthermore, in some countries the promotion of IPM by extension agents may be counteracted by the influence of pesticide salespersons who are less likely to encourage an integrated approach to pest management.

3. **Adverse policy environment**: In some developing countries, pesticides are highly subsidized or provided free-of-charge by the government. Artificially low pesticide prices tend to favor sole reliance on pesticides over IPM and other alternative tactics. There is little incentive for farmers to adopt more complex IPM strategies when the economic benefit is not clear. Massive pesticide donations from developed nations in response to pest outbreaks, such as the recent grasshopper and locusts plagues in Africa, can add to this problem, particularly when pesticide stocks remain after the outbreak has abated.

4. **Complexity**: As discussed above, IPM strategies are generally more complex than conventional pest control methods. This complexity slows the adoption process at many levels. Administrators and policymakers (in developing country governments and donor agencies) frequently misunderstand IPM and lack the patience necessary to support long-term research and extension programs. Farmers are often reluctant to adopt a system which can be more time consuming and difficult to implement than sole reliance on pesticides. Moreover, the general public in developing countries has not yet developed the same level of environmental awareness or concern which is required for making major changes in policies and practices.

FUTURE INITIATIVES

A.I.D. will continue to support integrated pest management activities, and assess the need for future efforts in this area. The constraints listed above will be considered in developing new programs.

One initiative already underway is for increased collaboration with the EPA on pest and pesticide management issues of mutual interest. A.I.D. and EPA have collaborated many times in the past, but this has generally been done on an ad hoc basis. A more formal approach for collaborative efforts has now been established through the creation of a steering committee to coordinate joint EPA/A.I.D. activities. A sub-group of this committee is working on pesticide-related issues. As a first step, the sub-group is developing an agenda for collaboration in Central America. Central America was selected as a priority area because of its relationship to the United States as a major exporter of agricultural commodities. EPA and A.I.D. plan to collaborate on activities designed to minimize the possibility of excessive pesticide residues on crops exported from Central America. Tentatively, the program will include the promotion of IPM, training in pesticide safety and residue analysis, assistance to the governments to increase their ability to monitor and regulate pesticide use, and provision of information to governments and agricultural producer groups on US pesticide and tolerance regulations.

EPA and A.I.D. are also discussing other geographic areas and topics for future collaboration. In the past, EPA has provided technical assistance to A.I.D. in Africa, Asia, and the Near East on proper disposal of obsolete pesticides and pesticide containers. Discussions have been initiated which are likely to lead to closer and more formal collaboration in this area.

USDA is collaborating with A.I.D. to identify areas of mutual interest. Several topics relating to pest management have been discussed as possible areas for increased collaboration. These include the management of specific pests, such as grasshopper, locusts and rodents, pesticide management, and quarantine. USDA and A.I.D. have also been cooperating to provide the technology necessary for eradication of a pest newly introduced to North Africa, the New World screwworm.

A.I.D.'s geographic bureaus will continue to support pesticide and pest management activities in their respective regions as integral components of agricultural productivity and human health programs. This support will be channeled through existing regional projects, such as AELGA, and through initiatives of the individual A.I.D Missions. In future analytical work and support, pest management activities will be closely linked to environmental and natural resource conservation strategies.

The Bureau for Science and Technology is working with other donors to develop improved global programs in IPM and pest resistance management. These will be the subject of an international congress in 1991. The Bureau is currently developing an extensive agricultural strategy to identify priority programs, and establish mechanisms for implementing them over the coming decade. The strategy, in which pest management is a major consideration, will be completed in the next year.

Additionally, S&T has funded a grant to the National Research Council (NRC, National Academy of Science) for design of a sustainable agricultural systems program. Under the scope of work for this grant, the NRC will give specific attention to pest management with the objective of determining methods for incorporating IPM into the new sustainable agriculture initiative.

A.I.D. is also actively participating in an international task force established to review progress in implementing IPM in developing countries, identify gaps in current programs, and recommend future mechanisms for increased international collaboration and support of IPM programs. Participation in the task force initiative has included international organizations, international research centers, and interested donors. The task force notes that, despite the multiplicity of organizations involved in promoting IPM, efforts have typically been fragmented and short-term.

One option being considered by this group is the establishment of a donor consortium to promote implementation of IPM in developing countries. The donor consortium would serve to mobilize resources and coordinate the use of these resources in national IPM programs. Additionally, technical assistance would be provided to national governments in the design and implementation of IPM programs, and sub-regional networks would be created to facilitate the sharing of information among IPM workers.

A.I.D. will continue to give attention to the development of ecologically sound management approaches to the agricultural, livestock, and human health pest problems in the developing countries. A.I.D.'s primary pest management strategy has been, and will continue to be, integrated pest management, and this approach has been incorporated into the Agency's agricultural and environmental strategies. Several activities, as discussed above, are currently being explored to further the Agency's objectives in this area. Future initiatives will address technical, as well as policy constraints to the adoption of environmentally rational pest management approaches, but unilateral efforts will necessarily be modest. A.I.D. is giving increased emphasis to identifying areas for possible collaboration with other donors, non-governmental organizations (ex., foundations, PVOs) and other federal agencies (ex., EPA and USDA).

PESTICIDE USE AND POISONING:

A GLOBAL REVIEW

JUNE 1990

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Annex I (World Resources Institute 1988-89. Agricultural Inputs, Table 17.2)

Annex II (FAO Yearbook - Production, 1987. Tables 119-130)

PESTICIDE USE AND POISONING: A GLOBAL REVIEW

EXECUTIVE SUMMARY

During the last 40 years, pesticides have become an integral component in the global struggle to protect agriculture, livestock, and humans from pests. However, the benefits and the risks associated with pesticide use are not well quantified, particularly in developing countries. These limitations are recognized by A.I.D. in its Integrated Pest Management policy and other approaches to assisting developing countries.

Estimates on the amount of pesticide applied in different geographic areas of the world are difficult to obtain, and those that do exist are of questionable reliability. Accurate figures on the global incidence of pesticide poisoning are nearly non-existent, and estimates which have been made are little better than "best guesses". From the limited information that is available, it is evident that, while the amount of pesticide applied in developing countries represents a relatively small proportion of global use, the incidence of pesticide poisonings in developing countries is disproportionally high.

To put pesticide poisoning in context, it is estimated that pesticides account for less than 4% of worldwide poisoning fatalities. Although the data is very limited, indications are that pesticides poisonings represent a substantially larger proportion of total poisonings in developing countries.

The high incidence of pesticide poisoning in developing countries is illustrative of the type of problem that is often encountered when technology is directly transferred to developing countries without the appropriate supporting infrastructure. The major elements of an effective supporting infrastructure include governmental regulations on pesticide use, enforcement of the regulations, proper training at all levels, availability and use of protective clothing, proper pesticide storage and disposal facilities, and a well organized health care system.

To a great extent, the negative impacts of pesticides to human health may be minimized by A.I.D. and other collaborators' efforts to improve pesticide management infrastructures in developing countries through training and technical assistance. Concurrently, greater emphasis is being given to supporting research on, and implementation of, non-chemical pest management alternatives.

The primary role rests with the government of the country in which the pesticide will be used. Only on the national level can programs be properly designed and implemented to account for the specific economical, social, and ecological conditions in a country. A.I.D. recognizes its responsibility for helping developing countries improve pesticide management in cooperation with the exporting countries, donor governments, international organizations, non-governmental organizations, and the agrochemical industry.

INTRODUCTION

Protecting human health and agricultural produce from pests has been a long and continuous struggle for all people in the world. During the last 40 years, the use of pesticides has become an important element in efforts to control various pest organisms, and was an integral component in the dramatic yield increases achieved through the adoption of green revolution varieties of basic grains. In spite of current pesticide use, preharvest crop losses due to agricultural pests continue to be extremely important. Estimated losses for several crops in South America, Africa, and Asia are presented in Table 1.

Table 1. Estimated losses of potential crop yield from all pests.
(percentages)

Crop	S. America	Africa	Asia
Wheat	31	42	30
Rice	28	36	57
Maize	44	75	42
Sugarcane	44	67	71
Potatoes	44	62	49
Vegetables and Pulses	30	39	36
Coffee	47	56	43
Cocoa	48	52	38
Soya beans	32	42	40
Copra	34	30	50
Cotton	42	45	36

Source: Edwards, 1986

Overall, worldwide preharvest pest losses are estimated to be about 35% of potential agricultural yield, and postharvest losses account for an additional 10-20% (Pimentel & Andow, 1984). If pesticide use were abandoned, it is estimated that worldwide losses would be 30% higher than current levels (Pimentel et al., 1981 WHO (1986a).

Vector-borne diseases, including malaria, dengue fever, river blindness, and others, are an increasing cause of death and disability worldwide. Malaria alone strikes an estimated 200 million people and results in 2 million deaths every year.

Water and agricultural projects, colonization of new areas, road building, and other development efforts have often exacerbated the problem of vector-borne diseases by creating new opportunities for contact between people and the disease vectors (MSCU, 1990). Over the relatively short period of time that synthetic pesticides have been in wide use, efforts to control disease vectors have relied heavily on these chemicals.

Considering the rapidly increasing human population, protecting agriculture from the threat of pests will be a key element in future efforts to feed the world. Additionally, improving human health is critical to enhancing the economic status of developing countries. For the forseeable future, pesticides will continue to be an important tool for solving both of these problems.

Unfortunately, pesticide use is often associated with negative impacts to humans and the environment. By their very nature, pesticides are biocidal, and as such present risks directly to the user, to the consumers of agricultural products, and to other non-target organisms in the environment. The impacts of pesticides on natural enemies of pests often lead to resurgence of key pests, and increased importance of minor pest species. Moreover, pests have demonstrated a remarkable ability to adapt to pesticides through the selection of resistant strains; a situation which is reaching crisis proportion for some pest populations (Georghiou, 1990).

The intent of this report is to focus on one of the detrimental by-products of pesticide use; the direct impact on human health from acute poisonings. The risk of human poisonings from pesticide use can be greatly minimized through proper pesticide management, from production to empty container disposal.

Statistics on the extent of pesticide use are difficult to obtain, and those that are available are of questionable accuracy. Even in the U.S., pesticide use patterns are not well documented. Gianessi (1989) made the following statement:

> "Detailed information on the extent of pesticide use in the United States, that is, on the amount of pesticides used - by active ingredient, by crop, and by region - is critically needed if the quantitative risks and benefits of pesticide use are to be assessed in light of applied issues of the environment, human health, agricultural production, and economic policy goals. Yet, at present, no comprehensive set of pesticide use estimates exists or is under development at either the federal or state level. Until this information is available, accurate assessment of the implications of adopting particular pesticide policies will be impossible."

Considering the above, it comes as no surprise that information on pesticide use in the other areas of the world, particularly the developing countries, is sparse and unreliable. The data available on the incidence of pesticide poisoning are even more sketchy due to poor reporting and difficulties in establishing cause and effect relationships. This report is an attempt to bring together some of the information which is available on pesticide use and poisoning, and suggest some mechanisms for improving pesticide management, thereby minimizing the negative impacts of pesticides on human health.

EXTENT OF PESTICIDE USE

The worldwide pesticide market has been growing at an annual rate of about 5% for the last decade. In 1985 the value of pesticides sales was estimated at $16.5 billion (ADB, 1987) and this had increased to $18.5 billion by 1988 (Table 2) (EPA, 1989).

The expanding pesticide market is not necessarily a reflection of an increase in the amount of pesticides applied, but also involves an increase in the cost of pesticides. This is particularly true in the U.S. and other developed countries where most of the agricultural land which would benefit from pesticides is already being treated. In the U.S. the quantity of pesticides applied has remained fairly constant at about 1.1 billion pounds/year during the last 10 years (EPA, 1989).

Table 2. U.S. and world market conventional pesticide sales at basic producer level, 1988 estimates. ($ in millions)

Type	U.S. Market $	U.S. Market Share	World Market $	World Market Share	U.S. % of World Market
Herbicides	2,770	56%	7,700	42%	36%
Insecticides	1,200	24%	6,100	33%	20%
Fungicides	580	12%	3,500	19%	17%
Other	420	8%	1,200	6%	35%
Total	4,970	100%	18,500	100%	27%

Source: EPA estimates based on NACA annual surveys and other sources.

The U.S. is both an importer and exporter of pesticides; exporting about 450 million pounds and importing about 150 million pounds. U.S. production accounts for approximately 27% of the world market (EPA, 1989). More than 76% of the world's pesticide production occurs in the U.S., Europe, and Japan, but the production of pesticides in the developing countries appears to be increasing. For example, Indonesia produced about 4 times as much pesticide in 1983/84 as they did in 1978/79 (IOCU, 1987). Pesticide sales in Africa increased an estimated 184% during the period of 1980-84. Although not so dramatic, sales also increased during the same period in Central and South America (32%), Asia and the Far East (28%), and the Middle East (26%) (Edwards 1986). This may reflect an increased emphasis in the agrochemical industry on finding new markets as the need for pesticides levels off in the more developed countries.

Worldwide it is estimated that 4.2 to 4.4 billion pounds of active ingredients are applied annually (EPA, 1989). The majority of pesticide use is for the control of agricultural pests, with estimates ranging from 68% (Lotti, 1987) to 90% (Edwards, 1986) of total consumption. Other major uses in the developed countries include household and industrial applications, and the management of livestock and human health pests. In developing countries, the major use besides agriculture is the control of insect vectors of human diseases.

A regional estimate of the amount of pesticide applied on a land unit basis is provided in Table 3 (Edwards 1986). The data show that pesticide use ranges from a high of more than 10,000 g/hectare in Japan to 127 g/hectare in Africa. In general, pesticide use is directly correlated with the developmental status of the geographic region, and with crop yields. However, the return on pesticide use appears to diminish as the amount applied increases.

Table 3. Areas and nations in order of pesticide usage per hectare and in order of yields of major crops.

Area or nation	Pesticide Use (g/ha)	Rank	Crop Yields (Kg/ha)
Japan	10,790	1	5,480
Europe	1,870	2	3,430
United States	1,490	3	2,600
Latin America	220	4	1,970
Oceania	198	5	1,570
Africa	127	6	1,210

Source: Edwards, 1986

The availability and reliability of data on pesticide use on a country-by-country basis is highly variable. Data for developed countries are difficult to obtain, possibly because manufacturers are reluctant to disclose the information for fear that it may be used by competitors (Edwards, 1986). In the developing countries, accurate data are even more difficult to obtain, due to poor record keeping and little governmental control on the use of agrochemicals. With input from UNEP and FAO, the World Resources Institute (1988) attempted to develop a country-by-country compilation of pesticide use, but values are provided for only 3 of 49 African countries (Egypt, Kenya, and Mauritius) (Annex 1). The same data set supplies figures for only two countries in North and Central America (the U.S. and Mexico). Data available from FAO are even less extensive and of questionable value (Annex II). For example, the FAO (1988) data indicate that there was no reported use of organophosphate pesticides (a major pesticide group) in South America in 1986, undoubtedly an indication of a lack of information rather than a lack of pesticide use.

The Batelle Institute has compiled data on pesticide use in 20-30 countries (depending on year) which are made available to interested parties on a cost basis. EPA and FDA jointly subscribe to this data set and have made summary information available to A.I.D. for this report (Table 4). If we assume that these data are accurate and representative of worldwide consumption, it can be used along with FAO data on land use (FAO, 1988) to arrive at estimates of pesticide use per unit of arable land. This analysis indicates that an average of 1.6 kg of pesticide is applied per hectare of arable land in the world. Herbicides represent 49% of the pesticide use, fungicides 30%, and insecticides 20%.

Table 4. Summary of pesticide use (kg/ha) in developed and developing countries.

Type	Developed	Developing	Worldwide
Insecticide	0.46	0.23	0.33
Fungicide	0.70	0.28	0.48
Herbicide	1.03	0.31	0.79
Total	2.19	0.82	1.60

Source: Batelle Europe, World Pesticide Programme. Data from 1984-87.

The same data set shows that the amount applied per hectare in developed countries is about 2.2 kg, whereas in the developing countries the amount is about 0.8 kg, nearly a threefold difference. Moreover, use patterns in developed and developing countries are somewhat different. Herbicides are used to a relatively greater extent in the developed countries (47% vs. 38%). Insecticides represents a greater proportion of pesticide use in developing countries (28%) than in developed countries (21%). Fungicide use is approximately the same (34% in developing vs. 32% in developed).

Other estimates of the relative proportion of pesticide use by target group show a somewhat different pattern. Lotti (1987) indicates that 39%, 33%, and 31% of pesticide use world-wide is for herbicides, insecticides, and fungicides, respectively. Based on market value, EPA (1989) estimates that worldwide, herbicides account for 42% of sales, insecticides 33%, and fungicides 19%. The remainder (8%) includes miscellaneous chemical groups such as defoliants and desiccants. Asian Development Bank (1987) figures for the Asia-Pacific region indicate that insecticide use predominates, accounting for 75.8% percent of use, with herbicides and fungicides accounting for 13.4% and 8.4%, respectively.

The divergence in estimates of use patterns is an indication of the lack of an accurate base of information. However, all sources reviewed indicate that insecticide use represents a relatively larger proportion of overall pesticide use in developing than in more developed countries. This difference in use pattern has important implications for human health, since insecticides are in general more acutely toxic to humans than either fungicides or herbicides (ADB, 1987).

INCIDENCE OF PESTICIDE POISONING

The term pesticide poisoning refers collectively to any disease or death to which a pesticide, or pesticides, may have contributed (Jeyaratnam, 1988). The specific symptoms vary depending on the pesticide agent causing the poisoning (WHO 1986a). Pesticide poisoning can be classified using several different criteria. An important distinction should be made between acute and chronic poisoning. Acute poisoning refers to situations when overt reactions closely follow exposure, whereas chronic poisoning generally follows gradually after repeated exposure to low dosages of pesticides. Another important distinction can be made between intentional (suicides and homicides) and unintentional poisonings. Unintentional poisoning can be further divided into those resulting from occupational and non-occupational exposures.

This report focuses on acute unintentional pesticide poisoning as it typically accounts for the greatest proportion of total reported pesticide poisonings and, more importantly, the number of acute poisonings could be substantially decreased through greater attention to proper pesticide management (WHO, 1986b).

As recently as 1987, EPA indicated that accurate figures on the number of pesticide poisonings in the U.S. do not exist. EPA states that "there is no centralized, nationwide, annual survey to provide this information". Additionally, many of the symptoms of acute pesticide poisoning, particularly mild cases, are non-specific (ex., headache, nausea, and general malaise), and as such, could easily be attributed to other causes.

Despite the lack of a centralized source of information, some estimates on the number of pesticide poisonings in the U.S. are available. Poison control centers in the U.S. received an estimated 85,000 calls due to pesticide poisoning in 1985.

Many of these cases were treated at home, but 24% received some kind of medical treatment. Also in 1985, an estimated 20,000 persons were taken to emergency rooms due to suspected or actual exposure to pesticides. The National Center for Health Statistics indicates that an average of 35 people died each year in the 1970s due to pesticide poisonings. California, which maintains better records than most states, estimates that during the period 1973-82, an average of 150 people per year visited physicians due to symptoms of acute pesticide poisoning (EPA, 1987).

The availability of sound data on the incidence of pesticide poisoning in the developing countries is even more limited. Persons receiving toxic dosages of pesticides are less likely to seek medical attention than in developed countries. This may be particularly true of seasonal agricultural workers who fail to report pesticide related illness for fear of losing their jobs. Moreover, because of the difficulty in diagnosing pesticide poisoning, cases are more likely to be attributed to other causes.

The WHO recognized the paucity of information on pesticide poisoning, and began data collection efforts in the early 1970s. The first estimates, made in 1972, indicated that there were 500,000 cases of pesticide poisoning per year with a mortality rate of about 1% (WHO, 1986b). However, WHO acknowledged that the reliability of the estimates was very low due to incomplete information and the questionable nature of the data which were available. In reference to the availability of reliable information, Copplestone (1985) states:

"the situation has not improved much since 1973 but the small number of reliable studies that have been conducted confirm the validity of the methods used by WHO to estimate pesticide poisonings. If anything, earlier estimates probably fall on the conservative side of the true figure."

As indicated by Copplestone (1985), a small number of reliable studies of limited geographic scope have been conducted. Loevinshon (1987) compared non-traumatic mortality data before and after the widespread adoption of pesticides in a major rice producing region of the Philippines, and found an increase in deaths from 2.15 to 2.74 per 1000 persons (27%). These data suggest that the WHO estimates of 3,000-28,000 pesticide related deaths (Table 5) may be a gross underestimate.

A study conducted in Nicaragua was based on the use of cholinesterase monitoring in farm workers (Cole et al. 1988). Low cholinesterase levels are indicative of excessive exposure to organophosphate pesticides. This study found that during a 9 month period of the year when agricultural pesticide use is generally low, cholinesterase inhibition was evident in 1-4% of the farm worker population. However, the number of workers with low cholinesterase increased dramatically to 40% during the season when agricultural pesticides are typically used.

In Sierra Leone, an investigation of non-occupational pesticide poisoning was conducted in 1986 (Baldwin, 1986). Bread contaminated with the insecticide parathion was responsible for 49 acute poisonings, of which 14 resulted in death. The flour was contaminated during transport with a leaking container of parathion. Parathion is a highly toxic pesticide which has been implicated in a large number of accidental poisonings worldwide. This pesticide is banned or restricted in many of the developed countries. However, no African countries, and few countries in other developing regions of the world, have imposed similar restrictions on parathion.

WHO continued to review the worldwide data on pesticide poisonings and in 1986 prepared 4 alternative estimates, each based on slightly different assumptions (Table 5). The estimates range from 834,000 to 1,528,000 poisonings per year with the number of resulting deaths estimated at 3,000 - 28,000, or 0.37 to 1.8% of poisoning cases. Jeyaratnam (1985) estimated a much higher annual toll of 2,900,000 cases of poisoning and about 220,000 deaths.

To put these figures in their proper context, pesticide poisoning accounts for an estimated 3.2% of total unintentional poisonings worldwide (WHO, 1986b). However, this figure may be substantially higher in developing countries. WHO (1986b) indicates that pesticides were the cause of 15% of poisoning cases in Brazil, and suggests that this figure may be more representative of developing countries.

WHO (1986b) figures indicate that 56% of pesticide poisonings and about 72% of pesticide related deaths occur in developing countries. The fatality rate of pesticide poisoning cases (% of acute poisonings leading to death) is estimated to be twice as high in developing countries as in the developed countries (Goulding, 1988). In Sri Lanka, the case fatality rate has been estimated at 9.4% (Jeyaratnam et al. 1982). These figures are particularly alarming when considering usage, which show that only about 20% of pesticides are applied in developing countries (Copplestone, 1985). With the predicted increase in pesticide consumption in developing countries (Edwards, 1986), the incidence of pesticide poisoning will undoubtedly rise if not accompanied by increased efforts in pesticide safety training.

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Table 5. WHO estimates of unintentional pesticide poisonings

Estimate	Number of poisonings	Deaths	Primary data source and method
A	1,111,000	20,000	area surveys of mortality: method used in 1977 study
B	1,528,000	28,000	area surveys of morbidity: method used in 1977 study
C	1,056,000	20,000	mortality statistics reported to WHO; method used in 1977 study
D	834,000	3,000	estimate based on a wide range of of mortality statistics reported to WHO

Source: WHO/VBC/86.929

REASONS FOR A HIGHER INCIDENCE OF PESTICIDE POISONING IN DEVELOPING COUNTRIES

Several reasons have been suggested for the considerably higher incidence of pesticide poisoning in the developing countries. One fundamental reason is that approximately 60% of the workforce in the developing countries is employed in agriculture, and since pesticides are often used, the proportion of the population occupationally exposed may be much higher than in the developing countries (Jeyaratnam, 1985). Additional reasons are briefly discussed below.

1. **Lack of pesticide regulations and enforcement**: Many developing countries have not established effective regulatory and enforcement mechanisms to control pesticides. In principle, all aspects of pesticide management, from production to the disposal of empty containers ("cradle to grave"), should be conducted within the confines of regulations developed to insure safe and effective use. At a very minimum, governments should move to restrict the use of highly toxic pesticides by the general public.

2. **Perception of the problem**: In some developing countries, decision-makers have not acknowleged the importance or urgency of the problem of pesticide poisoning. Health workers sometimes feel that other health-related issues are of much greater importance. However, this is not necessarily the case. In 1978 in Sri Lanka more than 1000 deaths were caused by acute pesticide poisoning, whereas 572 deaths were attributed to poliomyelitis, diphtheria, tetanus, and whooping cough. Malaria, which receives much attention, did not cause a single death in Sri Lanka in 1978 (Jeyaratnam et al. 1982).

3. **Training**: In many cases, pesticide users in developing countries have little knowledge of the inherent dangers associated with pesticide use and typically receive little or no training before application. This may be particularly true of agricultural applicators, who in many cases are seasonal workers. In contrast, pesticide application in the public health sector is generally a full time occupation, and therefore workers tend to be more experienced and thoroughly trained. Additionally, in developed countries the pesticide label is relied on to communicate key information on safe and effective pesticide use to users. However, many of the people using pesticides in the developing countries are not able to read the labels. This is either because of illiteracy, the label being written in an inappropriate language, or complete absence of a label; not an uncommon occurence with locally formulated pesticides.

4. **Multiplicity of products**: In many developing countries safe pesticide manipulation is greatly complicated by the number of products available to users. For example, a survey conducted in Mexico found that there were 238 formulations of 75 insecticide active ingredients on the market in 1982, including 16 formulations of malathion, 19 of parathion, and 10 of carbaryl (Arata, 1984). A recent Environmental Assessment conducted by A.I.D. in Niger identified 23 insecticides in one regional warehouse which are provided by the government at no cost to farmers (USAID/Niger, 1990). The excessive number of products is a serious impediment to training users in proper pesticide application. In principle, each product is applied at a different rate and requires different levels of safety precautions. In the Niger example, much of the problem is due to developed country donors, who, rather than harmonizing their efforts, each provide pesticides in accordance with their own policies and biases. Efforts to remedy this situation are being actively supported through the OECD Development Assistance Committee.

5. **Unavailability of, or inappropriate protective clothing**: The type of protective clothing and equipment required for a particular pesticide varies with toxicity, formulation, and the type of application. In the U.S., precise information on the recommended type of protective clothing is provided on the pesticide label. Even if the developing country user is able to understand the label, the protective clothing is often unavailable. Moreover, protective clothing recommended for use in temperate areas of the world may not be well-suited to hotter tropical zones (Litchfield, 1988)

6. **Poorly-maintained application equipment**: Pesticide application equipment which is not properly maintained may begin to leak. This can result in dermal exposure, particularly in developing countries where much of the pesticide is applied with knapsack sprayers. Inadequate training, improper storage, and lack of replacement parts can all contribute to the poor condition of application equipment.

7. **Availability of medical facilities**: As would be expected, the health care infrastructure in the developing countries, particularly in the rural areas where much of the pesticide use occurs, is not nearly as well developed as in the developed countries. Where available, the quality of care may also suffer due to inadequate training of health care workers in the diagnosis and treatment of pesticide poisoning, and due to a limited availablility of antidotes.

8. **Health status of the human population**: Poor nutritional status, effects of concomitant disease, and parasitic body load may also be responsible for an increased susceptibility of people in the developing countries to the effects of pesticide exposure.

RESPONSIBILITIES FOR IMPROVING PESTICIDE MANAGEMENT

Proper pesticide management, from production to end use, is a responsibility that must be shared by several segments of society, including the national governments in countries where pesticides are used, the agrochemical industry, governments in pesticide exporting countries, donor governments, and international assistance organizations. The differing roles of these groups are briefly dicussed below.

1. **National Governments**: The primary responsibility for managing pesticides in a particular country rests with the national government in that country. Governments must establish and enforce regulations designed to insure the safe and effective use of pesticides. A major part of this legislation should be focused on defining which pesticides can be marketed in a country, their acceptable uses, and availability to each segment of the population. Unfortunately, many developing countries have not yet enacted appropriate pesticide legislation (Bottrell, 1984), and a number that have, do not effectively enforce their regulations (Whittemore et al. 1982). Governments which have not estabished effective pesticide legislation should be encouraged to do so without delay.

2. **The Agrochemical Industry**: The agrochemical industry also has a responsibility to take an active role in assuring that their products are used in a manner consistent with human and environmental safety. The role of the agrochemical industry is particularly important in those countries which have not established, or do not enforce, effective pesticide legislation. The industry's responsibilities should include making certain that all products have been thoroughly tested for safety and effectiveness, and that they are properly labeled in a language appropriate to users. The industry should also take an active role in training users on the proper and safe application methods. GIFAP (International Association of Agrochemical Producers) has supported a wide variety of training programs in pesticide safety, and should be encouraged to continue doing so.

3. **Governments of Exporting Countries**: Opinions differ on the extent of the responsibility of governments in pesticide exporting countries to insure safe pesticide management in the country of destination. The fact that a pesticide is not registered in an exporting country is not necessarily an indication of hazards to users or the environment. The crops, climate, ecology, and pest problems can be vastly different between the exporting and importing country, and therefore the choice of pesticides may also differ. The decision on which pesticides are appropriate for use in a particular country can be best made in the context of the environment of the importing country.

The export of banned pesticides is a more controversial issue which has been the subject of intensive debate. Reasons for banning in a particular country are generally based on chronic toxicity or negative environmental effects. The basis for the banning of a pesticide in a given country must be made available to importing countries, and should receive serious consideration by the importing country. A system to notify importing country governments before the shipment of pesticides which are banned or severely restricted in the exporting country has been proposed by FAO (discussed below).

However, differences between countries may lead to divergent conclusions on the need for a particular pesticide. For example, DDT, which has been banned in many developed countries because of its long-term impacts on non-target animals, is still widely valued for use against mosquito vectors of human disease in developing countries. DDT's advantages include low acute mammalian toxicity and relative inexpense; both are important considerations to developing country decision-makers.

The U.S. position on the export of pesticides not registered for use in the U.S. is defined in sections 17(a) and 17(b) of the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). Section 17(a) requires the notification of foreign governments that a particular pesticide product is not registered for use in the U.S. Section 17(b) requires EPA to notify foreign governments and appropriate international organizations about significant changes in the regulatory status of a pesticide in the U.S., such as cancelation or banning. A proposal to further strengthen these sections was published in the Federal Register on February 12, 1990.

4. **International Organizations**: Development banks, organizations of the United Nations, and non-governmental organizations (NGOs) have had substantial involvement in assisting developing countries improve pesticide management practices. The FAO has played a particularly useful role through the development and promotion of the "International Code of Conduct for the Distribution and Use of Pesticides" (FAO, 1986) and the publication of a series of guidelines to assist governments and industries implement the Code. The Code consists of 12 articles outlining voluntary standards of conduct for all those connected with pesticide distribution and use. Through promotion of the Code, the FAO is assisting many countries establish regulations for the safe use of pesticides.

One article of the FAO Code of Conduct (article 9) recommends a formal procedure, referred to as "prior informed consent" (PIC), for notifying importing governments before the shipment of pesticides which are banned or severely restricted in the exporting country. Severely restricted refers to "pesticides for which virtually all registered uses have been prohibited by final government regulatory action for health or environmental reasons, but specific registered use or uses remain authorized". The intent of PIC is fulfilled by the US in sections 17(a) and 17(b) of FIFRA, mentioned above.

The United Nations Environmental Programme (UNEP) has supported numerous cooperative programs with FAO, UNDP, and other international organizations to promote integrated pest management strategies in the developing world. UNEP also provides information to governments and other institutions on hazardous chemicals through publication of the "International Register of Potentially Toxic Chemicals", and was instrumental in developing the concept of PIC.

The World Health Organization (WHO), although primarily mandated to control human disease, has historically taken an interest in pesticide-related issues. WHO's "Recommended Classification of Pesticides by Hazard", which classifies pesticides based on their acute oral and dermal toxicities, has been widely accepted as an international standard (WHO, 1986c). WHO also publishes guidelines on the prevention, diagnosis and treatment of insecticide poisoning (Plestina, 1984) and "Specifications for Pesticides in Public Health" which outlines the physical and chemical properties of the major insecticides used in the control of vectors of human disease, and provides recommendations on packaging, labeling, and handling.

The World Bank and Regional Development Banks have also been highly active in pest and pesticide management. The World Bank has developed a set of guidelines on the use of pesticides in projects financed through their institution. Among other policies, the guidelines recommend that WHO Class Ia and Ib (highly toxic compounds) not be made available to small farmers. The Asian Development Bank has supported the publication of an excellent handbook on pesticide use in the Asia-Pacific region (ADB, 1987).

5. Donor Governments: Donors which support activities involving the use or procurement of pesticides in developing countries have a direct interest in assuring these activities are conducted in a safe and effective manner. Moreover, because of the donors' close relationship to the developing countries, they have the opportunity to assist countries establish and implement appropriate pesticide legislation and promote non-chemical pest control methods when available.

A.I.D. involvement in pesticide management is governed by regulations set forth in CFR 22 section 216. In brief, A.I.D. attempts to minimize the dependence on pesticides in developing countries through the promotion of integrated pest management (IPM). In an IPM approach, pesticides are used only when the pest population reaches a level of economic importance, and when other less ecologically disruptive alternatives are unavailable. When pesticide use is proposed in A.I.D.-supported activities, a thorough environmental review is required to ensure that potential dangers to persons or the environment are considered and minimized.

A.I.D.'s pest management program is implemented through projects supported by country Missions and central Bureaus. A recent review of the A.I.D. portfolio identified 64 projects operating in 30 countries which included pest management activities. A summary of A.I.D. involvement in pest and pesticide management, including a discussion of pertinent policies and regulations, is found in the accompanying report "Integrated Pest Management - A.I.D. Policy and Implementation." That report was prepared in response to the House Appropriations Committee Report, "Foreign Operations, Export Financing, and Related Programs Appropriations Bill, 1990" (No. 101-165, page 23).

CONCLUSIONS

The availability of reliable information on the extent of global pesticide use and the incidence of pesticide poisoning is limited. The lack of accurate data is particularly evident in the developing countries because of poor reporting systems and inadequate health care infrastructures.

However, a number of general conclusions can be drawn from the information that is available:

- The use of pesticides will continue to play an important role in efforts to feed the world and control vector-borne diseases in the foreseeable future.

- The great majority of pesticide use occurs in the more developed countries, but use in developing regions of the world is rapidly increasing.

- Insecticides, which are generally more toxic than other major categories of pesticides, account for a greater proportion of pesticide use in developing countries than in the more developed countries.

- The number of pesticide poisonings is inordinately high in the developing countries. Furthermore, information presently available suggests that the number of poisonings, particularly in the developing countries, is probably underestimated.

- The primary responsibility for regulating pesticides rests with governments in consuming countries. Many developing countries do not have effective legislation or enforcement systems, nor do they have the expertise to do so. They will need help from donors, including the United States, to make the needed changes.

- Accurate information on pesticide use and poisoning is limited and unreliable. A more extensive international data collection effort is needed so that mitigative programs can be targeted on areas where they will have greatest impact. Additionally, accurate information is needed so that the benefits of pesticide use can be fairly measured in relation to the negative impacts; human poisoning being one major concern.

Despite international efforts to improve the management of pesticides, the problem of pesticide poisoning persists, and may be getting worse. A.I.D. will continue its efforts to help developing countries to establish effective regulatory mechanisms, improve health care infrastructures, train pesticide users in safe pesticide management, monitor the negative impacts of pesticides on the environment, and conduct research and implement programs in non-chemical pest control approaches. Additionally, A.I.D. will give increased emphasis to working with other donors and international organizations in addressing the environmental and human health problems associated with pesticide use.

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ACRONYMS

ADB	Asian Development Bank
A.I.D.	United States Agency for International Development
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
FAO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration, U.S. Department of Health and Human Services
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GIFAP	Groupement International Des Associations Nationales de Fabricants de Produits Agrochimiques
IOCU	International Organization of Consumer Unions
IPM	Integrated Pest Management
MSCU	Medical Service Corporation International
NACA	National Agrochemical Association
OECD	Organization of Economic Cooperation and Development
PIC	Prior informed consent
UNEP	United Nations Environmental Programme
WHO	World Health Organization

Table 17.2 Agricultural Inputs, 1964–86

	Cropland: Total (thousand hectares)	Cropland: Hectares Per Capita 1985	Fertilizer Use (kilograms per hectare of cropland) 1964–66	Fertilizer Use 1974–76	Fertilizer Use 1983–85	Irrigated Land as a Percentage of Arable and Permanent Cropland 1974–76	Irrigated Land 1984–86	Percentage of Crop Area Planted with High Yielding Varieties: Rice 1970	Rice 1983	Wheat 1970	Wheat 1984	Improved Varieties: Maize 1984	Average Annual Pesticide Use (metric tons of active ingredient) 1970–75	1976–80	1981–85
WORLD	**1,478,483**	**0.31**	**34**	**62**	**86**	**13**	**15**					**71**			
AFRICA	**184,889**	**0.33**	**7**	**13**	**19**	**5**	**5**								
Algeria	7,610	0.35	7	21	27	3	4	X	X	X	20	X	X	X	22[a]
Angola	3,500	0.40	1	2	4	X	X	X	X	X	X	X	X	X	X
Benin	1,838	0.45	1	2	4	0	0	X	X	X	X	X	X	X	X
Botswana	1,360	1.23	2	2	1	0	0	X	X	X	X	X	X	X	X
Burkina Faso	2,633	0.38	0	1	5	0	0	X	7	X	X	X	X	X	X
Burundi	1,325	0.28	0	1	2	4	5	X	X	X	X	X	X	X	X
Cameroon	6,965	0.71	2	2	6	0	0	X	X	X	X	30	X	X	X
Cape Verde	40	0.12	X	2	X	5	5	X	X	X	X	X	X	X	X
Central African Rep	1,983	0.77	0	1	1	X	X	X	X	X	X	X	X	X	X
Chad	3,155	0.63	0	3	2	0	0	X	X	X	X	X	X	X	X
Comoros	97	0.22	X	X	X	0	0	X	X	X	X	X	X	X	X
Congo	677	0.39	3	5	4	0	1	X	X	X	X	X	X	X	X
Cote d'Ivoire	4,090	0.42	4	10	11	1	1	X	X	X	X	10	X	X	X
Djibouti	0	0.00	X	6	X	X	X	X	X	X	X	X	X	X	X
Egypt	2,486	0.05	117	170	357	100	100	X	X	X	X	64	X	22,073[a]	17,157[a]
Equatorial Guinea	230	0.59	3	0	X	X	X	X	X	X	X	X	X	X	X
Ethiopia	13,930	0.32	0	2	4	1	1	X	X	X	X	X	X	X	X
Gabon	452	0.39	X	1	5	X	X	X	X	X	X	X	X	X	X
Gambia	165	0.26	3	8	18	6	7	X	X	X	X	X	X	X	X
Ghana	2,820	0.21	0	7	7	0	0	X	X	X	X	30	X	X	X
Guinea	1,576	0.26	2	1	0	4	4	X	X	X	X	X	X	X	X
Guinea-Bissau	320	0.36	X	1	5	X	X	X	X	X	X	X	X	X	X
Kenya	2,370	0.12	13	23	39	2	2	X	X	X	83	66	X	X	5,774[a]
Lesotho	300	0.20	2	3	14	X	X	X	X	X	X	X	X	X	X
Liberia	371	0.17	2	13	8	1	1	X	X	X	X	X	X	X	X
Libya	2,127	0.59	3	16	38	10	11	X	X	X	X	X	X	X	X
Madagascar	3,040	0.30	2	3	4	17	27	X	X	X	X	4	X	X	X
Malawi	2,376	0.34	2	8	15	1	1	X	X	X	X	26	X	X	X
Mali	2,073	0.26	1	4	9	6	9	X	X	X	X	X	X	X	X
Mauritania	195	0.10	0	4	6	6	6	X	8	X	X	X	X	X	X
Mauritius	107	0.10	245	228	256	14	16	X	X	X	X	X	753[a]	1,065[a]	981[a]
Morocco	8,401	0.38	7	22	31	14	15	X	X	X	30	X	X	X	X
Mozambique	3,090	0.22	2	3	5	1	3	X	X	X	X	X	X	X	X
Niger	7,740	0.61	0	0	1	1	1	X	X	X	X	X	X	X	X
Nigeria	31,085	0.33	0	2	9	3	3	X	X	X	X	40	X	X	X
Rwanda	1,012	0.17	X	0	1	0	0	X	X	X	X	X	X	X	X
Senegal	5,225	0.81	3	8	5	3	3	X	X	X	X	30	X	X	X
Sierra Leone	1,781	0.49	0	1	1	1	2	X	X	X	X	X	X	X	X
Somalia	1,071	0.23	1	2	3	11	17	X	X	X	X	X	X	X	X
South Africa	13,169	0.41	29	57	65	8	9	X	X	X	X	97	X	X	X
Sudan	12,478	0.56	2	6	6	14	15	X	X	X	X	X	X	X	X
Swaziland	180	0.28	35	59	104	34	34	X	X	X	X	X	X	X	X
Tanzania, United Rep	5,190	0.23	2	6	5	1	2	X	X	X	X	12	2,992[a]	5,733[a]	X
Togo	1,427	0.48	0	2	4	0	0	X	X	X	X	33	X	X	X
Tunisia	4,923	0.70	5	11	17	3	5	X	X	5	36	X	X	X	X
Uganda	6,600	0.43	1	0	X	0	0	X	X	X	X	36	X	23[a]	X
Zaire	6,600	0.22	0	2	1	0	0	X	X	X	X	X	X	X	X
Zambia	5,188	0.78	2	12	14	0	0	X	X	X	X	64	X	X	X
Zimbabwe	2,734	0.31	35	56	57	3	6	X	X	X	100	77	X	X	X
NORTH & CENTRAL AMERICA	**274,626**	**0.69**	**50**	**80**	**88**	**9**	**10**								
Barbados	33	0.13	211	157	202	X	X	X	X	X	X	X	X	X	X
Canada	46,780	1.84	17	30	49	1	2	X	X	X	X	100	X	X	X
Costa Rica	605	0.23	59	128	135	7	18	X	X	X	X	20	X	X	X
Cuba	3,236	0.32	134	107	172	19	26	X	X	X	X	X	X	X	X
Dominican Rep	1,470	0.24	12	65	33	11	13	X	80	X	X	X	X	863[a]	X
El Salvador	732	0.13	71	150	114	5	15	X	X	X	X	71	1,310[a]	2,838[a]	X
Guatemala	1,835	0.23	14	43	46	4	4	X	X	X	100	60	X	4,087[a]	X
Haiti	905	0.14	0	2	4	8	8	X	36	X	X	1	156[a]	X	X
Honduras	1,778	0.41	6	13	15	5	5	X	37	X	X	X	193	X	X
Jamaica	269	0.12	62	74	51	12	13	X	X	X	X	X	X	X	X
Mexico	24,750	0.31	15	43	64	20	20	X	92	X	95	42	17,229	24,952	34,390[a]
Nicaragua	1,268	0.39	17	28	47	5	7	X	X	X	X	17	7,068	X	X
Panama	568	0.26	17	46	42	4	5	X	X	X	X	X	X	X	X
Trinidad and Tobago	118	0.10	56	49	53	12	18	X	X	X	X	X	X	X	X
United States	189,915	0.80	63	97	101	9	10	X	X	X	X	100	X	392,816[a]	394,629[a]
SOUTH AMERICA	**140,638**	**0.53**	**7**	**24**	**27**	**5**	**6**								
Argentina	36,050	1.18	1	2	4	4	5	X	20	X	90	100	X	15,580	10,419[a]
Bolivia	3,397	0.53	1	1	2	4	5	X	X	X	30-35	X	X	6,186[a]	X
Brazil	75,780	0.56	5	35	35	2	3	X	X	X	43	70	X	73,832[a]	50,878
Chile	5,528	0.40	26	25	30	24	23	X	X	X	70	81	X	4,965	X
Colombia	5,695	0.20	28	45	59	6	8	X	X	X	X	15	X	13,868[a]	X
Ecuador	2,540	0.27	6	20	29	20	21	X	X	X	X	32	7,964	9,376	X
Guyana	495	0.52	23	34	22	31	26	X	X	X	X	X	X	13	X
Paraguay	2,176	0.59	2	1	5	4	3	X	63	X	20	X	X	298[a]	X
Peru	3,696	0.19	29	39	22	35	33	X	X	X	10	50	X	2,876[a]	X
Suriname	59	0.16	33	89	207	73	89	X	X	X	X	X	X	974	1,720[a]
Uruguay	1,446	0.43	29	44	31	4	7	X	X	X	X	X	1,363	2,236	1,017[a]
Venezuela	3,770	0.22	10	40	63	8	9	X	X	X	X	43	X	6,495[a]	X

World Resources 1988-89

Table 17.2

	Cropland		Fertilizer Use (kilograms per hectare of cropland)			Irrigated Land as a Percentage of Arable and Permanent Cropland		Percentage of Crop Area Planted with					Average Annual Pesticide Use (metric tons of active ingredient)		
								High Yielding Varieties				Improved Varieties			
	Total (thousand hectares)	Hectares Per Capita 1985	1964–66	1974–76	1983–85	1974–76	1984–86	Rice 1970	Rice 1983	Wheat 1970	Wheat 1984	Maize 1984	1970–75	1976–80	1981–85
ASIA	**454,253**	**0.16**	**17**	**36**	**83**	**27**	**30**								
Afghanistan	8,054	0.49	0	5	7	31	33	X	10–15	X	X	X	X	1,000*	605
Bahrain	2	0.00	X	11	222	50	50	X	X	X	X	X	X	X	X
Bangladesh	9,135	0.09	6	22	60	15	22	3	25	8	96	X	X	X	673
Bhutan	102	0.07	X	1	2	X	X	X	X	X	X	X	X	X	X
Burma	10,067	0.27	1	5	17	10	11	3	51	X	X	34	X	X	X
China	100,883	0.10	24	62	76	42	44	X	X	X	34	72	X	X	X
Cyprus	432	0.65	38	33	45	7	7	X	X	X	X	X	X	4,127*	X
India	168,950	0.22	5	17	43	20	26	12	49	30	76	36	X	57,957*	49,144
Indonesia	20,880	0.13	6	25	81	25	33	10	83	X	X	25	X	4,740*	8,328
Iran	14,830	0.33	3	21	69	36	39	X	X	X	X	X	X	X	X
Iraq	5,450	0.34	1	7	22	30	32	X	X	X	X	X	X	X	X
Israel	418	0.10	96	169	198	43	65	X	X	X	X	X	10,064*	12,089*	X
Japan	4,758	0.04	333	389	435	62	61	X	X	X	X	X	X	X	X
Jordan	418	0.12	12	16	39	9	10	X	X	X	X	X	X	X	X
Kampuchea, Dem	3,056	0.42	1	0	2	3	3	X	X	X	X	X	X	X	X
Korea, Dem People's Rep	2,362	0.12	90	218	349	42	46	X	X	X	X	X	X	X	X
Korea, Rep	2,144	0.05	167	351	352	47	57	X	34	X	X	X	X	29,212*	17,244
Kuwait	3	0.00	X	X	358	100	33	X	X	X	X	X	X	X	X
Lao People's Dem Rep	900	0.22	1	0	1	5	13	X	X	X	X	X	X	X	X
Lebanon	300	0.11	69	87	119	26	29	X	X	X	X	X	X	X	X
Malaysia	4,370	0.28	27	61	119	7	8	19	54	X	X	X	X	X	X
Mongolia	1,354	0.71	X	5	13	3	3	X	X	X	X	X	X	X	X
Nepal	2,319	0.14	1	6	17	10	28	4	36	34	92	X	X	X	X
Oman	47	0.04	X	9	74	92	87	X	X	X	100	X	X	X	X
Pakistan	20,500	0.20	5	28	64	69	77	31	46	43	86	28	X	X	232*
Philippines	7,900	0.14	11	27	33	11	18	44	85	X	X	26	X	3,097*	4,571
Qatar	4	0.01	X	83	224	X	X	X	X	X	X	X	X	X	X
Saudi Arabia	1,175	0.10	8	7	220	34	35	X	X	X	X	X	X	X	X
Singapore	5	0.00	185	361	869	X	X	X	X	X	X	X	X	X	X
Sri Lanka	2,205	0.14	51	44	80	23	26	5	87	X	X	X	X	195*	210
Syrian Arab Rep	5,623	0.54	3	12	35	10	11	X	X	3	50	100	X	X	4,892[a]
Thailand	19,620	0.38	3	12	23	14	19	0	13	X	X	70	X	3,081*	2,787
Turkey	27,541	0.56	6	31	58	7	8	X	X	X	40	46	X	956	X
United Arab Emirates	17	0.01	X	78	273	42	29	X	X	X	X	X	X	X	X
Viet Nam	6,795	0.11	12	52	55	17	26	X	X	X	X	38	X	X	X
Yemen	1,351	0.20	0	2	10	8	18	X	X	X	X	X	X	324[a]	2,510*[a]
Yemen, Dem	167	0.08	X	6	12	29	37	X	X	X	40	X	X	X	X
EUROPE	**139,625**	**0.28**	**123**	**200**	**229**	**9**	**11**								
Albania	713	0.23	15	99	140	49	55	X	X	X	X	X	X	X	X
Austria	1,525	0.20	180	211	253	0	0	X	X	X	X	X	X	3,995*	4,758
Belgium	806	0.08	466	535	536	0	0	X	X	X	X	X	X	7,207*	9,088*
Bulgaria	4,134	0.46	82	145	232	26	30	X	X	X	X	100	X	3,994*	3,559
Czechoslovakia	5,153	0.33	162	311	341	3	4	X	X	X	X	X	X	19,017*	X
Denmark	2,620	0.51	183	234	257	7	15	X	X	X	X	X	X	6,045	7,414
Finland	2,410	0.49	135	206	218	2	3	X	X	X	X	X	1,947	2,123	2,092
France	18,928	0.35	195	255	308	4	6	X	X	X	X	100	X	82,035*	X
German Dem Rep	4,973	0.30	257	369	303	3	3	X	X	X	X	100	X	18,067*	18,464
Germany, Fed Rep	7,653	0.12	322	433	423	4	4	X	X	X	X	X	X	32,930*	30,374
Greece	3,940	0.40	66	119	165	23	27	X	X	X	X	100	X	31,269*	35,124*
Hungary	5,294	0.49	64	258	284	5	3	X	X	X	X	100	X	33,700	32,500
Iceland	8	0.03	3155	3443	3750	X	X	X	X	X	X	X	X	3	5
Ireland	800	0.22	197	425	727	X	X	X	X	X	X	X	1,166*	1,470*	X
Italy	12,200	0.21	68	114	170	22	25	X	X	X	X	100	X	X	X
Luxembourg	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Malta	13	0.03	30	23	62	8	8	X	X	X	X	X	X	X	X
Netherlands	892	0.06	582	756	787	51	59	X	X	X	X	X	X	X	X
Norway	858	0.21	196	288	290	5	10	X	X	X	X	X	X	1,443	1,465
Poland	14,845	0.40	84	237	231	1	1	X	X	X	X	100	X	9,331*	12,727
Portugal	2,760	0.27	40	65	72	17	23	X	X	X	X	18	X	21,945*	11,839*
Romania	10,622	0.46	25	104	153	15	27	X	X	X	X	X	X	X	X
Spain	20,416	0.53	X	74	75	14	16	X	X	X	X	100	X	X	X
Sweden	2,984	0.36	121	171	154	2	2	X	X	X	X	X	X	9,634	13,882
Switzerland	412	0.06	324	374	432	6	6	X	X	X	X	X	X	X	X
United Kingdom	7,077	0.13	288	258	368	1	2	X	X	X	X	X	5,515	5,099	9,968
Yugoslavia	7,780	0.34	57	89	121	2	2	X	X	X	X	75	24,604[a]	35,713[a]	X
USSR	**232,187**	**0.83**	**27**	**71**	**102**	**6**	**9**	**X**	**X**	**X**	**X**	**95**	**X**	**127,000***	**158,500**
OCEANIA	**50,285**	**2.04**	**39**	**31**	**35**	**4**	**4**								
Australia	48,600	3.10	28	20	25	3	3	X	X	X	X	X	X	X	X
Fiji	240	0.35	32	53	43	0	0	X	X	X	X	X	X	X	X
New Zealand	501	0.15	908	1218	1062	36	51	X	X	X	X	X	X	X	X
Papua New Guinea	383	0.11	1	19	20	X	X	X	X	X	X	X	X	X	X
Solomon Islands	55	0.20	X	X	X	X	X	X	X	X	X	X	X	X	X

Sources: United Nations Food and Agriculture Organization, United Nations Population Division, and other sources.
Note: a. May not be active ingredients.
0 = zero or less than half the unit of measure. X or blank = not available or less than half the unit of measure. * = one year of data.
For additional information, see Sources and Technical Notes.

	D D T DDT DDT CONSUMPTION				B H C HEXACHLORURE DE BENZENE H C B CONSOMMATION				LINDANE LINDANE LINDANO CONSUMO			
			100 KG				100 KG				100 KG	
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
EGYPT	2050											
GUIN BISSAU										37	27	22
KENYA		791				42				55		
LESOTHO	379									•		
MADAGASCAR	82											
NIGER	12				4204				61	530	625	3965
SIERRA LEONE					70				10			
ZIMBABWE	3185											
N C AMERICA												
EL SALVADOR	1269				12							
GUATEMALA	12570								11			
HONDURAS												1371
MEXICO	4000	2000	3000		1833	2500	2500		350	150	150	
US VIRGIN IS												20
SOUTH AMERIC												
\RGENTINA	6				420	60*			1528	1725		
.CUADOR		4000										
SURINAME	33				961							
URUGUAY											5	
ASIA												
BRUNEI DARUS									1			
BURMA	201	466	471	91	17				7251	97	60	
CYPRUS	8				83				12			
INDIA	31157	3900	1770	36620	213900	216000	192520	323850	283			2550
JORDAN						300	300					
KOREA REP					1200							
KUWAIT							45					
OMAN					5	60	3	42				
PAKISTAN	797	1107			1412	518						
PHILIPPINES									300			
SRI LANKA					597							
TURKEY	5275				14087				731			
U A EMIRATES									15			
EUROPE												
AUSTRIA	59	38	5						338	387	355	
CZECHOSLOVAK									7			
DENMARK	12								93	58	84	51
FINLAND									234			
HUNGARY									5429			
ICELAND									1			
ITALY									16869	14776	16229	
POLAND									1313	1662	565	16
PORTUGAL									55	61		
SWEDEN									90	58	45	
SWITZERLAND	30											
OCEANIA												

	ALDRIN AND SIM INSECTIC ALDRINE ET INSECT SIMIL ALDRINA E INSECT SEMEJ CONSUMPTION 100 KG				TOXAPHENE TOXAPHENE TOXAFENO CONSOMMATION 100 KG				OTHER CHLOR HYDROCARBONS AUTRES HYDROCARB CHLORUR OTROS HIDROCARB CLORADOS CONSUMO 100 KG			
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
CENT AFR REP					194				2804			
EGYPT	33283								26793			
GAMBIA	8											
KENYA		1295										
LIBYA										94		
MADAGASCAR	249											
NIGER									1840	239	872	229
ZIMBABWE	345											
N C AMERICA												
BERMUDA									12			
EL SALVADOR	432				5252				1335			
GUATEMALA	1470											
MEXICO		1000	1000		14667	8000	6000		5717	5500	5870	
USA					130000							
US VIRGIN IS				20								25
SOUTH AMERIC												
ARGENTINA	6175	5832							664	435		
ECUADOR		689										
GUYANA	22											
SURINAME	630								834			
URUGUAY	362	152	126						301	71	49	
ASIA												
BHUTAN	20								2			
BURMA	3469	6567	5334	9187								
CYPRUS	23								58			
HONG KONG									168	141	76	142
INDIA	1300	890	250	460					9093	27080	25900	27370
ISRAEL									1660			
JAPAN									1450			
JORDAN									16037			
KOREA REP	424				295				10000			
OMAN									11			
PAKISTAN	105	296			58				4256	1687		
PHILIPPINES	4905								1657			
SRI LANKA	13											
TURKEY									1049			
EUROPE												
AUSTRIA	36	32	28						42	64	62	
CZECHOSLOVAK					472	10			199	80	77	
DENMARK	11								145	25	20	21
FINLAND									38			
HUNGARY					840	545	468	181	665	1458	1666	2168
ITALY									5074	4342	5078	
MALTA	8											
NORWAY									103	69	64	
POLAND						410		205	6283	12801	8863	3424
PORTUGAL	190	138							386	207		
SWEDEN									566	597	338	
OCEANIA												

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	PARATHION PARATHION PARATION CONSUMPTION 100 KG				MALATHION MALATHION MALATION CONSOMMATION 100 KG				OTH ORG PHOSPH INSECTIC AUTRES INSECT ORG PHOSPH OTROS INSECT ORG FOSFOR CONSUMO 100 KG			
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
BOTSWANA	10											
CENT AFR REP									4070			
EGYPT					2373				8703			
GAMBIA	120								1000			
GUIN BISSAU						75	15					
KENYA						583				3512		
LESOTHO	7499				38							
LIBYA							154				500	
MADAGASCAR	4											
NIGER					478	7	8	1	220	350	273	991
RWANDA	3											
SIERRA LEONE					20							
ZIMBABWE	182				83				3018			
N C AMERICA												
BERMUDA					14							
EL SALVADOR	12144				6				470			
GUATEMALA	905				516							
HONDURAS				1360	391	693	350	236				
MEXICO	40667	38000	46000		5500	5000	6100		38360	32280	46300	
MONTSERRAT					1				1			
USA	118667				11667				181667			
US VIRGIN IS								15				
SOUTH AMERIC												
ARGENTINA	11604	9234			4770	2000			10252	17837		
ECUADOR		584				685				9804		
GUYANA					42				51			
SURINAME					33				464			
URUGUAY	181	134	140		130	87	18		516	490	493	
ASIA												
BANGLADESH									620			
BHUTAN	7				92				172			
BRUNEI DARUS									9			
BURMA					41134	1502	565					
CYPRUS	1341				247				565			
HONG KONG									585	503	338	492
INDIA	19707	23200	15450	15930	7907	8000	10000	33620	37970	70060	80350	106510
ISRAEL									10997			
JAPAN					4110							
JORDAN	4590					35	77	119		380	665	1075
KOREA REP	890				642				29106			
KUWAIT			3				5				6	
OMAN					385				355	96	672	791
PAKISTAN	598	1037			1263	1783			12153	11015		
PHILIPPINES	3467				630				293			
SRI LANKA	523											
TURKEY	2216				951				8665			
U A EMIRATES					32				6			
EUROPE												
AUSTRIA	171	154	148						779	976	807	
CZECHOSLOVAK	80	130	138						4566	4434	6545	
DENMARK	2158	1714	954	568	89	109	86	112	713	1576	974	1707
FINLAND	4				126				867			
HUNGARY	18882	12832	11943	13141	1477	3898	2535	1316	82807	00958	77416	76051
ICELAND	2								2			
ITALY	26486	28045	19819		7211	5003	4315		147557	188867	185415	
MALTA					350				250			
NORWAY									230	273	233	
POLAND					609	659	492	376	4861	7206	5747	5808
PORTUGAL	619	583			151	158			1004	724		
SWEDEN					73	84	67		1125	916	967	
SWITZERLAND	700											
OCEANIA												
NIUE					2	2	4					
TONGA					9				28			

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TABLE
TABLEAU
CUADRO **122**

	PYRETHRUM PYRETHRE PELITRE				OTHER BOTANICAL INSECTIC AUTRES INSECTICID BOTAN OTROS INSECTICIDAS BOTAN				ARSENICALS PREPARATIONS ARSENICALES ARSENICALES			
	CONSUMPTION		100 KG		CONSOMMATION		100 KG		CONSUMO		100 KG	
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
EGYPT					17				20			
GUIN BISSAU								525				
MADAGASCAR	80											
N C AMERICA												
BERMUDA	23											
EL SALVADOR	393											
USA	1000				200							
SOUTH AMERIC												
SURINAME	630				441							
URUGUAY	7								26			
ASIA												
CYPRUS	53											
HONG KONG	10	9	6	21	40	50	56	68				
JAPAN	14				777							
JORDAN												
KOREA REP	15								1066			
KUWAIT			15									
OMAN	210	38	39	282								
PHILIPPINES	1815											
U A EMIRATES	14											
EUROPE												
AUSTRIA	65	53	51		9	2	2					
CZECHOSLOVAK	18	5	5		6	20	10					
DENMARK	9	7	7	6	4	1	1	1				
FINLAND	14	1	1		2	2	1					
HUNGARY	390	2824	3948	5261								
ITALY					415	313	188					
MALTA	1				7							
NORWAY					5	4	4					
POLAND					1	38		5				
SWEDEN	13	23	10		3	1	1					
SWITZERLAND					20							

TABLE
TABLEAU
CUADRO **123**

	CARBAMATES INSECTICIDE CARBAMATES INSECTICIDE CARBAMATOS INSECTICIDA				DINITRO COMPOUNDS COMPOSES DINITRES COMPUESTOS DE DINITRO				MINERAL OILS HUILES MINERALES ACEITES MINERALES			
	CONSUMPTION		100 KG		CONSOMMATION		100 KG		CONSUMO		100 KG	
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
CENT AFR REP	739											
EGYPT									26767			
GUIN BISSAU		45	10	27							18	18
KENYA		340								49		
NIGER		634	783	833								
SIERRA LEONE	5											
ZIMBABWE	5943				9							
N C AMERICA												
MEXICO	25060	14680	12170		7927	150	100					
MONTSERRAT	2											
USA	121667											
SOUTH AMERIC												
ARGENTINA	2766	3037			43	15			27000			
ECUADOR		1919				165				118		
SURINAME	278											
URUGUAY	164	51	88		194	46	71		1795	1471	1932	
ASIA												
BHUTAN					10				93			
BRUNEI DARUS	12											
CYPRUS	100				5				267			
HONG KONG	102	145	85	100								
INDIA	20430	13150	450	24650								
ISRAEL	2323								11893			
JAPAN					100				196310			
JORDAN		110	270	350						103	640	730
KOREA REP	18519								7427			
KUWAIT			15									
OMAN	88	7	14	67					28	70	16	8
PAKISTAN	2629	1727			20				17			
TURKEY	1638								14269			
U A EMIRATES	18											
EUROPE												
AUSTRIA	183	154	169		74	22	22		1703	2434	2272	
CZECHOSLOVAK	802	1180	941		715	516	457		3869	3926	4437	
DENMARK	151	519	530	565		6			410	290	307	222
FINLAND	9	6	7		1	156	120		416	487	450	513
HUNGARY	2048	20395	10012	26665	9073	5175	2856	4481	2975	10027	6969	6398
ICELAND									8			
ITALY	32388	25589	19955						82180	84141	72235	
MALTA	60				5				10			
NORWAY	6	9	18						6	3	3	
POLAND	2719	3730	1582	415		236	2537	1623				
PORTUGAL	345	156							2968	3309		
SWEDEN	124	110	374			20	19		132	60	97	
SWITZERLAND	113								300			
OCEANIA												
NIUE									20	20	20	
SAMOA									2333			
TONGA	4											

	OTHER INSECTICIDES AUTRES INSECTICIDES OTROS INSECTICIDAS CONSUMPTION 100 KG				SULPHUR SOUFRE AZUFRE CONSOMMATION 100 KG				LIME SULPHUR BOUILLIES SULFO/CALCIQUE CAL-AZUFRE CONSUMO 100 KG			
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
ALGERIA	67864	51885	56534									
EGYPT	7337				82543							
KENYA		21485				400						
LIBERIA	826				610							
NIGER	72											
REUNION	3160	4360	4600									
ZIMBABWE	558				211							
N C AMERICA												
EL SALVADOR	2565											
HONDURAS					224							
MARTINIQUE	14000											
MEXICO	5057	2470	2170		11333	12000	12000					
USA	131667											
US VIRGIN'IS				25								
SOUTH AMERIC												
ARGENTINA	6528	2913			7076	18432*						
BRAZIL	233087	170460	186000*	236000*								
COLOMBIA		35230	30120	36710								
ECUADOR	13763	3246				4331						
SURINAME	3451											
URUGUAY	163	53	74		5520	768	956		2180			
ASIA												
GHANISTAN					10000							
JRMA		7931	3705	5778								
CYPRUS	134				20728				178			
HONG KONG	30	21	45	45								
INDIA					30867	35000	35000	22590	8333	18000	18000	
INDONESIA	65077	139074	149798	172368								
ISRAEL	7123				9667							
JAPAN	40179				27090				47437			
JORDAN						5610	1340	1370				
KOREA REP	1821				536				1851			
KUWAIT							1					
OMAN	14	575		120	86	10		12				6
PAKISTAN	650	4839										
PHILIPPINES	9863											
SRI LANKA	3066											
THAILAND	152187	140000	141270	115500								
TURKEY	1300											
U A EMIRATES	19											
EUROPE												
AUSTRIA	49	73	59		7754	8483	8011		6			
CZECHOSLOVAK	178	409	372		4122	3276	3490		343	365	371	
DENMARK		67			908	473				7	279	417
FINLAND	636	1581	1437									
GERMANY FR	22273	23310	15860									
HUNGARY	17289	7365	6892	23032	52732	53745	37731	33852				5849
ICELAND					30							
ITALY	11425	14965	20775		620876	283385	324402					
MALTA	2				1500							
NORWAY	45	54	64									
POLAND	353	4136	1125	538	4052	4819	3386	5651				
PORTUGAL	1480	2298			141505	87312						
SWEDEN	408	120	110		106	1170	20					
SWITZERLAND	83				2800							
OCEANIA												
NEWCALEDONIA			150									

TABLE
TABLEAU
CUADRO **125**

	COPPER COMPOUNDS COMPOSES CUPRIQUES COMPUESTOS DE COBRE CONSUMPTION 100 KG				DITHIOCARBAMATES DITHIOCARBAMATES DITIOCARBAMATOS CONSOMMATION 100 KG				AROMATIC COMPOUNDS COMPOSES AROMATIQUES COMPUESTOS AROMATICOS CONSUMO 100 KG			
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
EGYPT	1983											
KENYA						2500				252		
LIBYA						714						
MADAGASCAR	15											
REUNION	38	30	30									
ZIMBABWE					703				767			
N C AMERICA												
EL SALVADOR	100				87							
HONDURAS	268											
MARTINIQUE	4											
MEXICO	13067	16500	30000		19717	37150	41400		10800			
USA	10000				63333							
SOUTH AMERIC												
ARGENTINA	12047	23059*			13698	8264*			306	292		
ECUADOR		1755				18882						
SURINAME	30											
URUGUAY	1222	8309	8262		2239	2486	2801		538	112	109	
ASIA												
BHUTAN	43				7							
BRUNEI DARUS	10				2				4			
CYPRUS	251				2351				46			
INDIA	31667	48000	48000	27930	14813	23690	26380	25230				
ISRAEL	6783				3050							
JAPAN	23480											
JORDAN		570	670	480		.1120	1370	1030				
KOREA REP	127				15613				1082			
OMAN	37	25	20	61	80	392	422	515				
PAKISTAN	590	90			259	763						
TURKEY	3499				6213							
U A EMIRATES					63							
EUROPE												
AUSTRIA	3165	1038	832		2302	2470	2671					
CZECHOSLOVAK	6023	5450	5849		8038	7189	1407		275	110	95	
DENMARK	260	415	341	196	6268	15804	13601	10078		3535	2310	1270
FINLAND	8	1	2		547	668	586		6			
HUNGARY	53468	59909	73090	78275	34337	37346	35221	33770	9874	25210	28714	27004
ITALY	287198	162844	168823		149719	120781	107408					
MALTA	350				350							
NORWAY	253	311	267		295	428	623		145	45	51	
POLAND	1262	302	940	2205	10225	4863	5099	9427	157	2902	3010	
PORTUGAL	20296	12885			11808	9424			215	135		
SWEDEN	455	865	440		3230	3830	3970					
SWITZERLAND	2283											
OCEANIA												
TONGA	3				115				10			

	OTHER FUNGICIDES AUTRES FONGICIDES OTROS FUNGICIDAS CONSUMPTION 100 KG				SEED DRESS: ORG MERCURIAL PREP P SEM ORGAN MERCUR PREP P SEMILLAS ORG MERC CONSOMMATION 100 KG				SEED DRESSINGS: OTHERS PREP P SEMENCES, AUTRES PREP P SEMILLAS, OTROS CONSUMO 100 KG			
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
ALGERIA	144036	103428	117326									
EGYPT	5147								9187			
GAMBIA									12			
GUIN BISSAU						1						
KENYA		1707				1				84		
LIBYA		628	131							50		
NIGER	300											
REUNION	617	960	1460									
SIERRA LEONE	5											
ZIMBABWE									275			
N C AMERICA												
EL SALVADOR	24								50			
GUATEMALA	12148											
MARTINIQUE	233											
MEXICO	14113	5020	13240		1500				7640	8600	11000	
USA	136667											
SOUTH AMERIC												
ARGENTINA	2582	2440			23	42						
BRAZIL	203903	183110	206000*	291000*								
COLOMBIA		59360	70210	63012								
ECUADOR	14540	2906										
SURINAME	1409											
URUGUAY	1332	732	1488		5				61	6	8	
BANGLADESH		610	710									
BHUTAN	12				3							
BURMA		145	140	402								
CYPRUS	58				57				44			
HONG KONG	70	40	91	118								
INDIA	5477	6640	4530	13970	1653	1430	1910	2150				
INDONESIA	7828	3009	2139									
ISRAEL	1743											
JAPAN	213433									10	85	20
JORDAN					3608				812			
KOREA REP	63114											
KUWAIT			60									
OMAN	10	22	6	37								
PAKISTAN	374	1360			27				87			
PHILIPPINES	5800											
SRI LANKA	91											
THAILAND	26913	35467	37250	36840								
TURKEY	432				522				2930			
U A EMIRATES	19											
EUROPE												
AUSTRIA	4513	5357	5298		33	36	35					
CZECHOSLOVAK	1974	2150	3206		172	137	147		731	680	717	
DENMARK		1287	1836	5721	7	6	8	3	659	2543	2436	333
FINLAND	559	1052	1100	1107	45	60	56		34	90	83	
GERMANY FR	68870	85450	84910									
HUNGARY	42994	13864	13591	16124	413					8904	6306	8321
ITALY	439391	277788	250627									
MALTA	7											
NORWAY	250	332	443									
POLAND	7860	5273	3941	5620	1				11	5472	9087	9825
PORTUGAL	39053	30452										
SWEDEN	1222	1390	1330		16	15	13		1336	1640		
SWITZERLAND	5933								67			
OCEANIA												
NEW CALEDONIA			50									
FIJI	13	12	15									
TONGA	31											
	26											

TABLE
TABLEAU
CUADRO **127**

	2,4-D 2,4-D 2,4-D CONSUMPTION			100 KG	MCPA MCPA MCPA CONSOMMATION			100 KG	2,4,5-T 2,4,5-T 2,4,5-T CONSUMO			100 KG
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
KENYA		1572										
SIERRA LEONE	20											
ZIMBABWE					280							
N C AMERICA												
EL SALVADOR									168			
GUATEMALA					5054				124			
HONDURAS	1415		28									
MEXICO	14500	13500	14000						367	500		
US VIRGIN IS				10								
SOUTH AMERIC												
ARGENTINA	16569	12024			1387	1040*			117			
ECUADOR		8684				438						
SURINAME	525								200			
URUGUAY	1616	2462	1424		65	137						
ASIA												
BRUNEI DARUS	16											
CYPRUS	138				69				1			
INDIA	2560	7670	8300	1920								
JAPAN	2120				2153							
JORDAN	3750	17	90	127								
KOREA REP	56											
KUWAIT			2									
PAKISTAN	98											
SRI LANKA	141				2063							
TURKEY	11472											
EUROPE												
AUSTRIA	2373	2047	1920		1916	1259	1292		383	350	271	
CZECHOSLOVAK	1001	30	37		28632	21830	21840		95			
DENMARK	3272	2449	2413	2205	6673	4884	3991	4764	31			
FINLAND	586	75	60		9447	7244	6625		59			
HUNGARY	19630	14297	12569	9624	33385	39340	36850	30258	267			
ICELAND	3											
MALTA					5							
NORWAY	165	203	189		2249	2052	1865					
POLAND	10145	6030	6541	18331	16704	13503	11284	13339				
PORTUGAL	102	144			347	603						
SWEDEN	475	420	320		14857	11550	10090					
OCEANIA												
SAMOA	10								1			

TABLE
TABLEAU **128**
CUADRO

	TRIAZINES TRIAZINES TRIAZINAS CONSUMPTION		100 KG		CARBAMATES HERBICIDE CARBAMATES HERBICIDE CARBAMATOS HERBICIDA CONSOMMATION		100 KG		UREA DERIVATIVES DERIVES DE L UREE DERIVADOS DE UREA CONSUMO		100 KG	
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
KENYA		448										
LIBYA		98	150			161				758		
RWANDA												
ZIMBABWE	4373				154				40 353			
N C AMERICA												
EL SALVADOR	396											
HONDURAS									170			
MEXICO	5867	7380	9950		868 1383	1370	1750		3927	4000	4380	
USA					198667				75000			
SOUTH AMERIC												
ARGENTINA	2176	9472			6573	15433			344	388		
ECUADOR		6041				877						
SURINAME	2				1320				72			
URUGUAY	411	970	520		210	33	112		109	294	396	
A												
BHUTAN												
CYPRUS	5069								17			
INDIA	297	70	110	1460					59			
ISRAEL	1177								1910	1670	600	390
JAPAN	3310				130				1680			
JORDAN					69491				5200			
KOREA REP	128									1	2	1
OMAN									111			
PAKISTAN	184								2			
EUROPE												
AUSTRIA	6219	7079	7002		327	1278	954		386	638	737	
CZECHOSLOVAK	16536	16200	15140		3344	3321	7619		3309	3573	3675	
DENMARK	2076	6404	7279	7002	192	1153	1272	1368	428	1101	813	652
FINLAND	412	288	246		307				12			
HUNGARY	91206	37003	37802	30757		45696	43369	37620	14648	21870	21174	20586
ICELAND									6			
ITALY	36639	46221	42975		52914	54251	49692		1196	2118	2697	
MALTA	3								5			
NORWAY	180	302	278		144	157	117		126	174	151	
POLAND	9288	3017	5696	7137	1502	2240	5034	12074	4080	4294	13498	
PORTUGAL									147	148		
SWEDEN	879	2260	2700		550	610	746		857	770	850	
OCEANIA												
TONGA									2			

	OTHER HERBICIDES AUTRES HERBICIDES OTROS HERBICIDAS				BROMIDES BROMURES BROMUROS				OTHER FUMIGANTS AUTRES FUMIGANTS OTROS FUMIGANTES			
	CONSUMPTION		100 KG		CONSOMMATION		100 KG		CONSUMO		100 KG	
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
ALGERIA	5648	9983	19249									
EGYPT									460			
GAMBIA									18			
GUIN BISSAU			18	18								
KENYA		2861				1349				13273		
LIBYA		190	516							38		
REUNION	2937	3520	3870									
SIERRA LEONE	30											
ZIMBABWE	3541											
N C AMERICA												
EL SALVADOR	1888				120				70			
GUATEMALA	8067											
HONDURAS			1672				324				7317	
MARTINIQUE	2500											
MEXICO	20930	10880	17060		6983	8000	5100		3127	7360	3650	
MONTSERRAT	1											
USA	705000											
SOUTH AMERIC												
ARGENTINA	19947	31152			1780	1692			236	489		
BRAZIL	217253	199460	179000*	231000*								
COLOMBIA		60010	61130	62565								
ECUADOR	30927	85919				563				557		
GUYANA	71											
SURINAME	1914											
URUGUAY	1914	1133	2244		302	51	45		45	20	32	
ASIA												
BANGLADESH	771	460	700									
BHUTAN	70								5			
BRUNEI DARUS	10											
BURMA		11		317								
CYPRUS	448				394				61			
HONG KONG	247	177	149	120	111	254	247	218				
INDIA	7080	27960	23350	27870	513	1110	1100	1050	4917	10990	9960	1450
ISRAEL	11440				9430				1027			
JAPAN	125532								44838			
JORDAN		151	71	221		3180	1577	2312		20	46	67
KOREA REP	28393				3104				85			
OMAN		2	25	16			25	315				
PAKISTAN	310	904			10	12			166	86		
PHILIPPINES	9333											
SRI LANKA	470											
THAILAND	71233	140000	143340	114960					3563	3240	5840	8130
TURKEY	7032								3000			
U A EMIRATES	1											
EUROPE												
AUSTRIA	8968	11629	11155		21	17	12		711	780	465	
CZECHOSLOVAK	69007	75960	75148		111	15	15		106	89	90	
DENMARK	30990	31024		24319	270	484	467	428	1	51	69	63
FINLAND	10450	16851										
GERMAN DR	184417	187580	181790									
GERMANY FR	204557	188430	173900									
HUNGARY	134717	114446	105817	105042		130	150	60		951	559	1133
ICELAND	8								3			
ITALY	128004	180256	189887		25886	25201	24311		58050	64165	34744	
MALTA	5				80							
NORWAY	9515	9714	9781									
POLAND	20892	20433	32905	25460		2000			219	264	1	
PORTUGAL	9955	9843										
SWEDEN	24326	22540	15100							4	3	
SWITZERLAND	8433											
OCEANIA												
NEWCALEDONIA			50									
NIUE	2	10	15						1	1	1	
SAMOA	12											
TONGA	10											
USSR	1370000	1557000	1600000	1720000								

	ANTICOAGULANTS ANTICOAGULANTS ANTICOAGULANTES CONSUMPTION			100 KG	OTHER RODENTICIDES AUTRES RODENTICIDES OTROS RODENTICIDAS CONSOMMATION			100 KG	PESTICIDES NES PESTICIDES NDA PESTICIDAS NEP CONSUMO			100 KG
	1979-81	1984	1985	1986	1979-81	1984	1985	1986	1979-81	1984	1985	1986
WORLD												
AFRICA												
ALGERIA									18404	7421	6445	
KENYA						109				640		
LIBYA		947					100			542	609	
NIGER		0	19	65	61			12	10			
REUNION									470	240	860	
SIERRA LEONE					6				15			
ZIMBABWE									21467			
N C AMERICA												
EL SALVADOR									389			
HONDURAS											5648	
MARTINIQUE									1700			
MEXICO	50	440	360		333	400	100		4283	3610	2950	
USA									33333			
SOUTH AMERIC												
ARGENTINA	19				8	10*			139	1065		
ECUADOR						403			30927	15859		
GUYANA					26							
SURINAME									123			
URUGUAY									186	181	695	
ASIA												
BANGLADESH						33	50					
BHUTAN					4				251			
BRUNEI DARUS					1				1			
BURMA						17	15	80				
CYPRUS	42				65				431			
HONG KONG									44	62	47	38
INDIA	57	50	40	390	2020	3500	2790		26523	11570	13210	13790
INDONESIA					889	880	824	859				
ISRAEL					33				26293			
JAPAN	14811				7757				106258			
JORDAN		58	129	28	861							
KOREA REP									126829			
KUWAIT											4	
NEPAL									557	711	2956	
OMAN					20	40	26	16	12	1	7	40
PAKISTAN	2				164	12			75	563		
PHILIPPINES					450				1310			
SRI LANKA					1							
THAILAND						156	260	340	3590	6750		
U A EMIRATES									795			
EUROPE												
AUSTRIA	10	43	34		8	7	6		643	368	381	
CZECHOSLOVAK	9	7	7		210	225	393		19609	16371	16389	
DENMARK		2	1	1	2	1	1	1	519	4189	5127	4892
FINLAND	1								689	1730		
GERMAN DR									84440	72270	85520	
GERMANY FR									32470	26750	26060	
HUNGARY					2415	6971	8999	5776	26353	6959	8743	18412
ITALY	1557	1048	869		1920	2759	2005		77490	72302	74516	
NORWAY									410	831	1161	
POLAND	159			2	16	17	9	20	1566	2102	3799	6278
PORTUGAL						1			884	1081		
SWEDEN		2	3						320	1413	1313	
OCEANIA												
NIUE	1	1	1		1	1	1					
TONGA									26			
USSR									1560000	1880000	2020000	1740000