Publication Series No. 7

Approaches to Pesticide Policy Reform – Building Consensus for Future Action

A Policy Workshop in
Hua Hin, Thailand, July 3 - 5, 1997

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A Publication of the Pesticide Policy Project

Hannover, April 1999

Publication Series No. 7

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Institut für Gartenbauökonomie,
Universität Hannover

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH

**Approaches to Pesticide Policy Reform –
Building Consensus for Future Action**

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Printing: Uni Druck Hannover, 30419 Hannover

Table of Contents

List of Tables

List of Figures

List of Annexes

List of Abbreviations

ADB	Asian Development Bank
BAAC	Thailand's Bank of Agriculture and Cooperatives in Thailand
BPH	Brown Plant Hopper
BT	*Bacillus thuringiensis*
DOA	Department of Agriculture
DOAE	Department of Agricultural Extension
FAO	Food and Agriculture Organization (of the United Nations)
FFS	Farmer Field School
GO	Governmental organization
GTZ	Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)
HYV	High Yielding Varieties
IICA	Instituto Interamericano de Cooperación para la Agricultura
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
IVA	Industrieverband Agrar (German Agrochemical Industry Association)
MOAC	Ministry of Agriculture and Cooperatives
NESDB	National Economic and Social Development Board
NGO	Non-governmental organization
NPV	Nuclear Polyhedrosis Virus
PANNA	Pesticide Action Network North America
TDRI	Thailand Development and Research Institute
UNCED	United Nations Conference on Environment and Development
WEA	World Education, Asia
WHO	World Health Organization
WTO	World Trade Organization
1 rai	= 0,16 hectare
0,037 Baht	= 1 US Dollar (June 1997)

Preface

In July of 1997 the Pesticide Policy Project, in conjunction with FAO and TDRI, sponsored a workshop entitled *Approaches to Pesticide Policy Reform: Building Consensus for Future Action*. The workshop was a significant event in the history of crop protection in Thailand. For the first time experts representing a wide range of institutions and agencies, bringing with them a vast store of experience and expertise, participated in an intensive exercise to evaluate the status of crop protection in Thailand. The focus naturally fell on the most pressing problem: the rising level of chemical pesticide use in Thai agriculture. From the outset the intention was to broaden the scope of the debate, and to reach out beyond the narrow confines of technical specialization. In this the meeting was undoubtedly successful. More than thirty years after Rachel Carson raised public awareness of the importance of the pesticide issue in the United States, we are now witnessing the flowering of public debate on this issue in developing countries. Thailand, like many other Southeast Asian countries, is now taking its first steps along the path of promoting a spirited public debate on the costs and benefits of pesticide use to society as a whole.

The workshop drew on the country's exceptional wealth of knowledge in this area through the participation of high level experts. Well-prepared background material provided a strong basis for the ensuing discussions. The topics addressed included international perspectives on pesticide policy; the legal situation with regards to hazardous substances including pesticides in Thailand; the existing framework of the agricultural research and the extension system as it affects and often pre-determines pesticide use. In going beyond the traditional policy framework of the command and control approach to pesticide policy, innovative thoughts were developed by experts from the Thailand Research and Development Institute on the potential for improving the economic and fiscal framework of pesticide policy in Thailand.

The working group sessions were structured around four broad questions:

1. How should the legal and regulatory framework be set up in order to be effective in realizing policy goals?
2. What economic and fiscal policies are adequate in achieving a level of pesticide use that is optimal from the society's point of view?
3. What re-design is necessary for the extension system if a farmer-oriented program of Integrated Pest Management can be made sustainable?
4. What priorities need to be set up by the Government for crop protection

research if their results shall contribute to existing knowledge gaps to reach sustainable agricultural development?

Broad consensus was reached on the urgent need for a comprehensive crop protection master plan that would lead to an IPM policy situated within the broader framework of agricultural and environmental policy. Among the results of the workshop a few shall be mentioned:

- the need for internalizing the true costs into the price of pesticides
- the complete ban of primarily WHO I chemicals and some selected others that were shown to damage to natural ecosystems and the environment
- the need to encourage foreign investment to support the local bio-control industry
- the re-direction of research towards ecological principles

A wide range of opinions were expressed at the workshop by the various participants. Among those represented at the workshop were government ministries concerned with pesticides, (namely agriculture, environment, and health), scholars and researchers, representatives of the chemical industry and a considerable number of NGOs.

The editors of the report are indebted to a number of people and institutions for making the workshop an educational, spirited and enjoyable event.

First and foremost we would like to thank the participants who set aside a substantial amount of time from their busy schedules to take part in this event.

The German Ministry of Economic Cooperation (BMZ), through its implementing agency GTZ and the Intercountry Program for IPM of the Food and Agriculture Organization of the United Nations (FAO) provided the financial means for the event. The Thailand Development and Research Institute (TDRI) took over the laborious task of organizing venue and logistics. The Ministry of Agriculture and Cooperative represented by Mr. Pitipong Peungboon Na Ayudha, then Deputy Permanent Secretary and the Department of Agricultural Extension (DOAE), the Department of Agriculture (DOA) were instrumental in facilitating resource persons and background material.

The World Education Asia contributed its expertise to facilitate the often highly controversial but extremely fruitful group discussions which really became the "nam prik" of the meeting.

A maximum amount of thanks, however, must go to one person whose wisdom and vision has made this exceptional event to become a reality. We would like to express our sincerest gratitude and respect to Dr. Amar Siamwalla, former President of the Thailand Development and Research Institute, and a leading light in economics and policy both in Thailand and in the international arena. All further steps taken towards building consensus for future action in pesticide policy in Thailand will be taken upon the staircase that he has built.

The Editors Hannover and Bangkok, April 1999

Keynote Address

Directions of Pesticide Policy in Thailand

Dr. Pitipong Peungboon Na Ayuthaya[1]

1 Major Issues

Policy directions for the development of sustainable agriculture expected to be proposed to the ministry should be [2]:

1. The policy on sustainable agricultural development at the moment is not clear as regards the term ’sustainable’. Both expressions ’sustainable farming’ and 'natural farming' exist.
2. The target for the development of sustainable agriculture is stated clearly in the national economic and social development plan. But from the economic perspective the practicability is still in doubt. They are rather visions or dreams. For example, the 8th plan's (1996-2000) goal for sustainable agriculture is 25 million rai.
3. Guidelines for sustainable agriculture exist but the question is how can they be incorporated into society.

2 Policy Problem

The major problem is how the economic, political and technical know-how can be realized and incorporated in policy targets. In order to implement sustainable agriculture effectively and reduce the use of chemical inputs the following factors should be considered.

- ***Data on pesticides usage***

The information on pesticide consumption is very important in terms of accuracy. This is often a major cause for the conflict between ‘pesticide users or pesticide dependents’ and those who refuse pesticide policy statements.

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1 Deputy Permanent Secretary, Ministry of Agriculture and Cooperatives

2 The views expressed in this address are those of the author and do not necessarily represent the views of the Ministry of Agriculture and Cooperatives.

- ***Policy should be synchronized with the economic situation***

The policy of the government to purchase pesticides and distribute them to the farmers free of charge should be seriously reviewed to enhance alternative ways of pest control and reduce the importation and usage of synthetic pesticides.

- ***Data compilation on the adverse effects of pesticides to society and environment***

As information on the impact of pesticides to humans and the environment currently is insufficient, policy makers are not aware of the problem and are not seriously taking action against this matter. Some consumers also still prefer aesthetic products causing farmers to use more pesticides to please this demand.

- ***The pressure from the organic farmers is increasing***

The establishment of sustainable agriculture should be the concern of many agencies', both, GOs and NGOs. However, there are many groups of farmers demanding the development of sustainable agriculture. Thus, if we still keep on thinking about sustainable agriculture as a small pilot project unsuited for large scale production, implementation of the policy will be difficult.

3 Criteria for the Development and Dissemination of Sustainable Agriculture Targets

- ***Restructuring and extension methodology***

Agricultural extension should be more open and work together with other agencies including NGOs. Currently, the DOAE aims mainly at the promotion of single crop cultivation. If the promotion of integrated crop management is accepted, DOAE should improve or modify its strategies in favor of sustainable agriculture as follows:

– Stop promoting projects with favor mono-culture system.

– Extension should include all stages from planting to marketing and be closely coordinated with other agencies.

– Decentralization by delegation to local administration organization (e.g. sub-district council) as much as possible.

– The policy on pesticide subsidy, tax and tariff structure should be reconsidered to comply with economic development, natural resources development and the participation of people in the community.

- ***Cooperation among GOs and NGOs***

There are many NGOs that can assist GOs in terms of better information. Their personnel has better access to the rural community compared to government officers. Besides, the government sector faces many limitations including manpower and time. Thus, it is advisable to collaborate with NGOs and where appropriate the private sector to assist in reaching development objectives.

- ***Creation of network and information exchange***

Formerly, and up to date, the extension system is a "one-way-communication", while integrated pest management requires more information exchange among farmers and between farmers and extension agents. This issue needs to be seriously considered in order to improve the current extension system.

- ***Research approach***

The Ministry of Agriculture and Cooperatives needs to cooperate with various research institutions and give directions and prioritization. Currently, the ministry still has to develop guidelines for the participation with the private sector. GOs, NGOs and other sectors should share the common interest in all research programs regarding sustainable agriculture.

I International Perspective

Pesticide Policy: An International Perspective

Jonathan Pincus[1], Hermann Waibel[2], Frauke Jungbluth[2]

1 Introduction

The international agricultural community today has much greater awareness of the health and environmental hazards associated with pesticide use than it was the case thirty years ago. The range of technically and economically feasible non-chemical crop protection methods and systems has also expanded rapidly during the same period.

Nevertheless, the role of pesticides in agricultural production systems has continued to grow. World consumption of pesticides is still increasing, and the rate of increase is particularly rapid in the developing world. In the mid 1990s, world demand for pesticides was estimated at US$25 billion, 20 percent of which was consumed in developing countries (IVA, 1995). According to World Bank estimates developing countries will account for 40 percent of world consumption by the year 2000.

Greater reliance on pesticides has brought about a trend increase in the incidence of on-farm pesticide poisoning, larger quantities of pesticides ingested by consumers in the form of residue-tainted products and rising levels of contamination of surface and ground water. In addition to the acute health effects of direct exposure to pesticides, new evidence is mounting relating to the endocrine-disrupting effects of chemicals in the environment. (COLBORN et al., 1996).

Paradoxically, the implicit acceptance of these risks by both industrialized and developing countries has not brought about lower levels of production risk for farmers. For example, despite a 33-fold increase in insecticide use in Japan between 1950 and 1974, average rice yields did not rise (KIRTANI, 1979). Reported losses to pests and diseases in North America are now higher than they were thirty years ago despite greater reliance on pesticides.

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1 formerly FAO Intercountry IPM Program, Vietnam

2 Institute of Economics in Horticulture, University of Hannover, Germany

These observations indicate that social costs of pesticides exceed the benefits accruing to society from their use. Pesticide use is characterized by large and measurable externalities in the form of health and environmental risks, destruction of predator populations and pest resurgence and resistance to pesticides. These externalities impose costs on society in the form of illness, increased expenditure on health care, environmental degradation and clean up costs, and increased expenditures on crop protection.

The objective of pesticide policy at the international and national level is to bring social costs in line with social benefits. The available policy remedies include regulation and economic instruments. Regulations, including bans on individual chemicals or classes of chemicals, are an effective means of stopping the introduction of hazardous compounds into the environment. Economic instruments, for example taxes, registration fees and import duties, work to redistribute the costs of pesticide use from the public to pesticide producers and consumers and adjust the private costs to the total social costs occurring for pesticide use. Environmental taxes not only reduce demand for pollutants but also provides the government with revenues that can be used to cover health costs and environmental clean-up activities.

Deciding on the appropriate mix of policies is a complex undertaking in view of the competing interests of the various agents involved. The pesticide industry has a vested interest in resisting restrictions and bans on chemicals and opposing taxation, registration fees and import duties. Politicians are often reluctant to challenge powerful industries or to impose taxes on farmers. At the same time, public demands for safer food are more easily ignored because of the difficulties involved in creating effective consumer organizations. The public also lacks information on the real health and environmental risks of pesticide use.

This paper presents a brief summary of pesticide policy mechanisms on international and national levels.

2 International Policy Framework

Although pesticide policy is primarily a national concern there is a need for regulation on the international level. Pesticides cause externalities on a global scale. A country that imports pesticides does not only import agricultural inputs but also the negative side-effects whose extent is specific to the type of compound. For example, Thailand still imports large quantities of WHO I and II type of pesticides (JUNGBLUTH, 1996).

International guidelines and formal agreements influence the national policy-making process by establishing standards and raising the level of awareness within relevant national agencies. In addition, countries with inadequate pesticide regulations impose costs on countries that import their agricultural products (for example, pesticide residues in food) and other countries in the form of pesticide run-off and accumulation of pesticides in mammals, birds and marine life. International agreements are necessary as a means to reduce the level and extent of negative international externalities.

International activity relating to pesticide policy has increased in recent years as awareness of the hazards associated with pesticide use has grown. Multilateral organizations, such as United Nations agencies are prominent actors in the field. Development agencies such as the World Bank have adopted guidelines and directives that exert a strong influence on pesticide policy formation in developing countries. The international research community makes a contribution by emphasizing the development of non-chemical alternatives and assessing the environmental, health and economic costs of pesticide use. Non-government organizations have also emerged as an important sector working to raise public awareness and share information between countries.

The most important international guidelines are :

- The AGENDA 21 of the United Nations Conference on Environment and Development (UNCED)
- The Codex Alimentarius
- The FAO International Code of Conduct and Prior Informed Consent
- WTO and International Trade with respect to pesticides
- Agreement on Persistent Organic Pollutants
- Guidelines of Major Donor Institutions on the Purchase of Pesticides

Most of these agreements are voluntary and therefore actual implementation depends largely on the willingness of national governments to take action, e.g. to monitor residue levels and impose penalties on violators. For example, although useful as a guide to proper standards of conduct, the FAO Code of Conduct is not legally binding. Furthermore the UNCED document produced by the Rio-Conference, commonly known as ’Agenda 21’, includes a chapter on ’Promoting Sustainable Agriculture and Rural Development’ (Chapter 14) that deals extensively with the problems of

pesticide overuse and the need to promote effective alternatives under the general rubric of integrated pest management. However, although signed by over a hundred countries, the document is not more than an expression of goodwill.

Of a more binding character are the IPM guidelines of international donor agencies. Among those, it is especially the World Bank that exerts a powerful influence on the formulation of pesticide policy in developing countries through its agricultural development project investment portfolio and through financing of pest management programs. Between 1988 and 1995 World Bank projects directly financed pesticide procurements totaling US$361 (WORLD BANK, 1996). The latest World Bank pesticide policy directive was released in 1992. However, according to a recent internal review of IPM implementation in World Bank projects it was found that compliance with these directives has been minimal.

The WTO regulations with regard to pesticides, although aiming at environmental aspects, the promotion of international trade, require the maintenance of quality standards and besides allow the imposition of levies if there are environmental reasons for that.

It is nevertheless obvious from this short overview of the international pesticide policy framework that progress will largely depend on policy interventions at the national level. In the next chapter, therefore, an economic framework is presented forming the basis for a strategy of pesticide policy reform.

3 The Economic Theory as Pesticide Policy Framework

Pesticides impose costs on society, such as health risks and environmental degradation, which are not borne by the user. When evaluating the costs and benefits of pesticide use both the private costs and benefits to the individual farmer as well as social costs and benefits to society as a whole have to be considered.

Much of the debate over pesticide policy in developing countries has posed the issue as a trade-off between farm productivity and environmental protection. A common position put forward in these debates is that developing countries cannot afford to sacrifice productivity increases for the sake of the environment. Yet substantial empirical evidence exists that pesticides are being applied in a technically and economically inefficient manner. Indonesia, for example, banned 57 pesticides for use on rice in

1986 with no adverse productivity effect. Pesticide use went down substantially but aggregate rice production continued to increase without any deviation from the trend. In Europe, three countries, namely Holland, Sweden and Denmark have implemented pesticide reduction plans. Also in Germany, a country where crop protection policy is heavily influenced by the chemical companies it has become evident that pesticides are often applied beyond economic justification and that despite of a sophisticated regulatory framework measurable external costs occur amounting to at least 25 % of the value of pesticides sold in Germany (WAIBEL and FLEISCHER, 1998). Such examples indicate that despite many years of widespread use of these inputs, inefficiencies continue to exist even with farmers of good educational background. These examples suggest that it is erroneous to assume that interventions designed to reduce pesticide use will necessarily have a negative impact on farm productivity.

A simple framework for conceptualizing the economic context of pesticide use is presented in Figure 1. The individual farmer's objective is to maximize profit. With respect to pesticide use, profit maximization implies that the marginal value product of pesticides equals their marginal costs. Taking other inputs as given, the farmer will seek to obtain the maximum level of crop loss prevention subject to the cost of pest control.

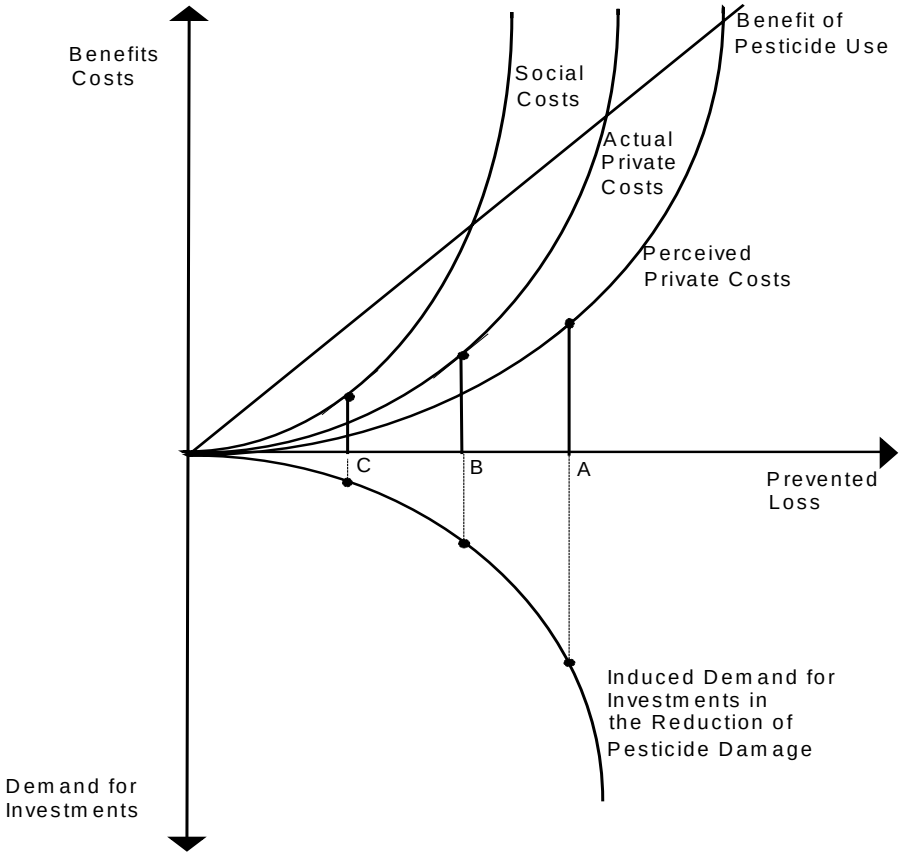
The amount of pesticides applied by the farmer is governed by his or her subjective assessment of the risk of crop loss and the information about alternative methods of control. In most cases, information on the actual risk of crop loss, non-chemical alternatives and the long-term consequences of continued pesticide use is lacking. Given a situation of imperfect information, the farmer will apply more pesticides than is strictly rational from the economic perspective. This level of use is shown as Point A in Figure 1 below. If perfect information about the above mentioned variables were available, the optimum level of pesticide use would be reduced to Point B in the figure. This reduction would increase the farmer's net returns as denoted by the distance between the cost *(actual private cost curve)* and the benefit curve.

Society's goal is to maximize the net social benefit. Because pesticides cause external effects, this point diverges from the farmer's private optimum. The costs of these externalities and the implied mitigation costs are not taken into account by the farmer. When these negative externalities are included, the cost curve shifts upwards *(social cost curve)* and reduces the optimum level of pesticide use to Point C.

This framework helps to clarify the role of pesticide policy from the perspective of the farmer and society as a whole. In an unregulated environment, society is the clear loser. The costs associated with negative health impact and environmental degradation will exceed the social benefits associated with crop loss prevention. Costly public investment in additional mitigation efforts, such as pesticide residue monitoring, health care facilities and clean-up programs will also be required.

Moreover, in a scenario of distorted information farmers cannot succeed in maximizing profits, since they will apply pesticides beyond the point at which marginal value product is equal to the marginal cost of pesticide use from the point of view of an individual user. Where information on alternatives is limited there is a tendency to overestimate the benefits of pesticide use. The situation is rendered even more complex by the fact that pesticide use in previous periods can influence subsequent use levels, effectively raising the cost of switching to non-chemical alternatives.

Figure 1: Private and Social Optimum of Pesticide Use



Source: Waibel (1994)

4 A Strategy for Pesticide Policy Change

Securing changes in pesticide policies consistent with the basic tenets of welfare theory requires a strategy designed to achieve gradual reductions in economic distortions and recasting of inappropriate procedures. The procedure (Figure 2) starts with a country study on pesticide policy and leads to the formulation of an optimal mix of policy instruments subject to a defined objective in its final stage. The first step is to establish a well-structured overview of the crop protection situation in the country. The Guidelines for Pesticide Policy Studies (AGNE et al., 1995) can serve as a reference in conducting such studies.

4.1 Defining the Factors Affecting Pesticide Use

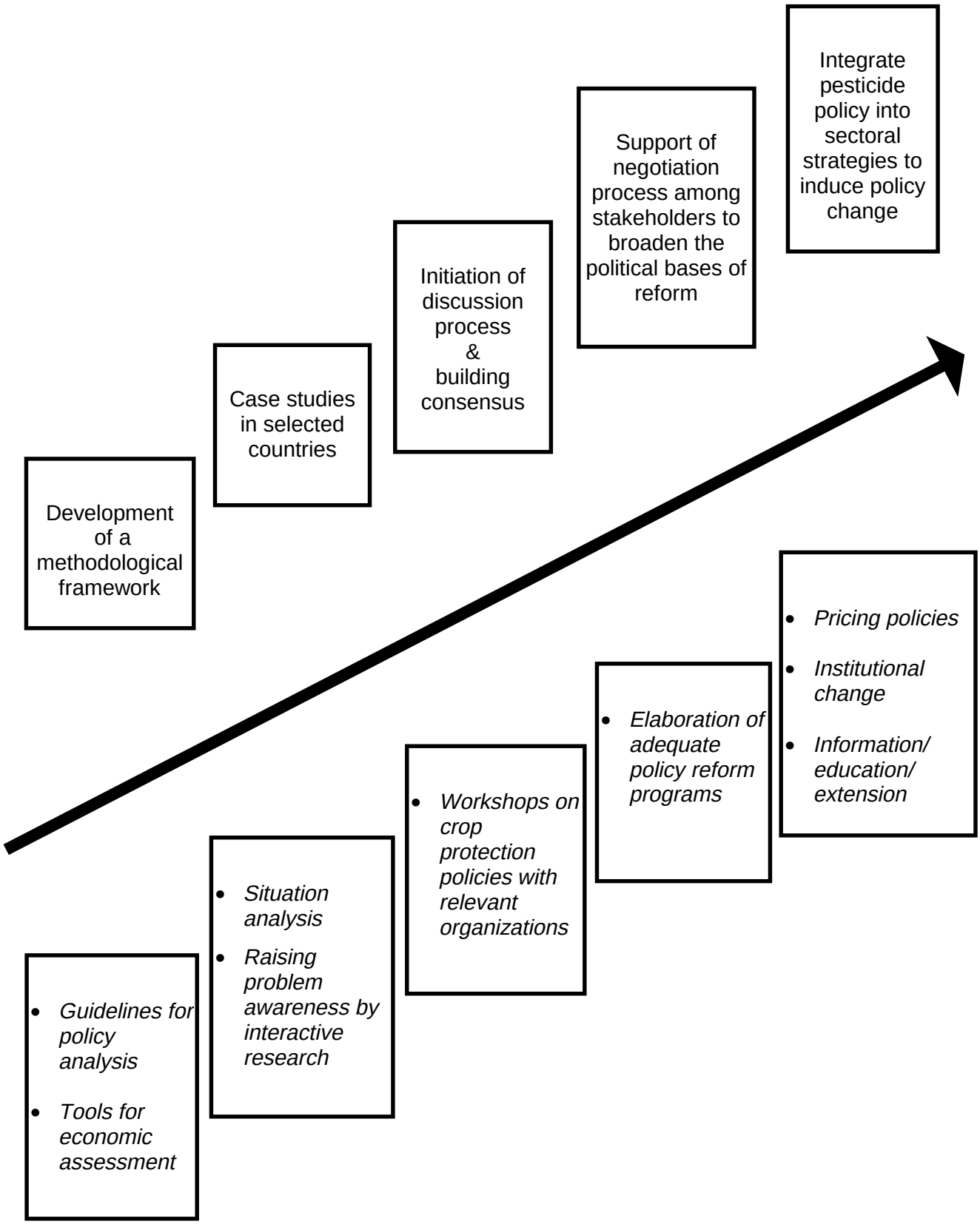
In many countries various types of pesticide subsidies and subsidy equivalents have brought about excessive use of pesticides (FARAH, 1993), presumably exceeding the socially optimal level. These factors consist of price and non-price factors which in one way or another affect levels of pesticide use. Examples of subsidies include direct intervention in domestic pricing, trade policies, lax regulation, and research, education and extension policies that favor pesticide use. There exists an urgent need to modify or eliminate policies that distort pesticide pricing and utilization to levels that depart significantly from the socially optimal levels.

In addition, it is hypothesized that the current legal environment and regulatory enforcement capabilities may be inadequate and dysfunctional, thus exerting a significant impact on current levels of pesticide use.

Finally, an imbalance may exist within the research, education and extension apparatus, such that the curricula and work programs emphasize chemical control at the expense of non-chemical options.

The overall framework of the analysis of existing policies is based on the principles of welfare economics. Quantitative indicators are to be developed in support of the narrative comments concerning the issues described in the following sections. Studies conducted in Costa Rica (AGNE, 1996) and Thailand (JUNGBLUTH, 1996) applied these basic principles and have arrived at a more complete picture of the types of policies that influence levels of pesticide use.

Figure 2: Strategies for Pesticide Policy Change



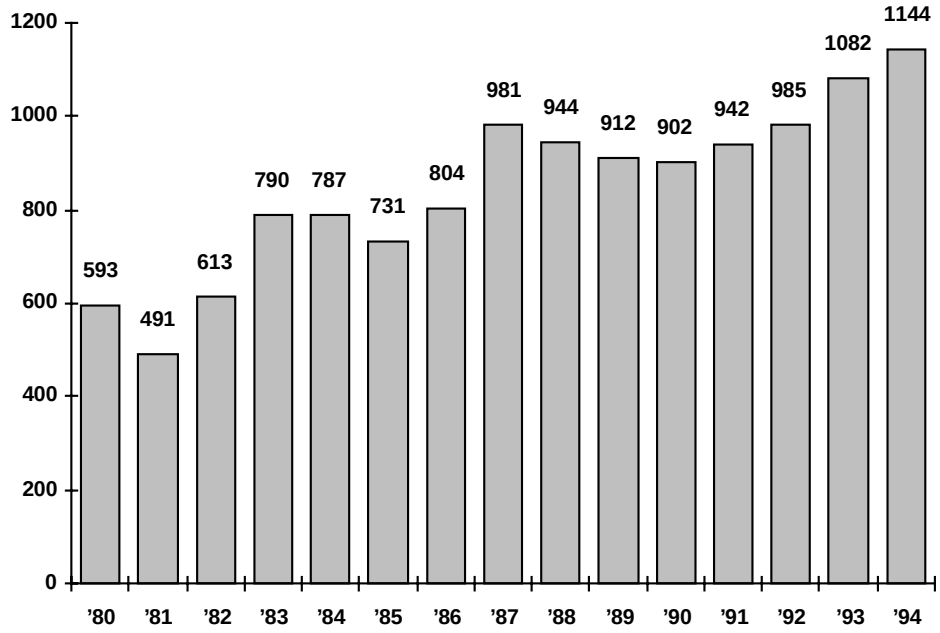
4.2 Selected Country Study Results

Upon completion of the guidelines for pesticide policy studies (AGNE et al., 1995) two country studies have been undertaken, namely Cost Rica (AGNE, 1996) and Thailand (JUNGBLUTH, 1996).

In both countries, a strong relationship exists between structural change in the agricultural sector and pesticide use. The studies also clarify the ways in which general agricultural and environmental policies affect patterns of pesticide use. The inadequacies of the existing regulatory framework, information gaps and institutional rigidities create a bias in favor of pesticide-dependent paths of technological development.

Costa Rica provides a clear case in which despite an expressed policy emphasizing sustainable development, sizable negative externalities imposed by pesticide use are still in evidence. Figure 3 shows the number of reported cases of poisoning caused by agro-chemicals compiled by the Center for Poisoning Control. The figure shows a trend increase in agrochemical poisonings, 99 percent of which are pesticide-related. Among those, 34 percent were classified as occupational intoxications, 43 percent as accidental and 19 percent as self-inflicted.

Figure 3: Agrochemical Poisoning Cases in Costa Rica registered at the National Center for Poisoning Control, 1980 to 1994



Source: Centro Nacional de Control de Intoxicaciones, San José, Costa Rica

For Thailand an attempt has been made to quantify the major externalities relating to pesticide use (Table 1.1). Upper and lower bounds for some of external costs are presented where insufficient information exists to calculate an exact value.

Table 1.1: External Costs of Chemical Pesticide Use in Thailand

Type of costs	Derived from	Estimated costs (mio. Baht) p.a.
Health	– Official health data from Epidemiology Division	1.00
	– Estimated acute poisoning cases related to quantity of pesticide used from case study results	13.00
Residues in food	– Residue analysis in fruit (f) and vegetable (v)	2,067 (v) 2,950 (f)
Resistance and Resurgence	– Costs related to BPH outbreak in 1989/90	57.40
Research budget related to chemical pesticides	– Budget of Entomology Division, DOA, for research in pesticide related issues[1]	25.29
Pesticide quality and residue monitoring budget	– Budget of Toxic Substances Division, DOA[2]	48.47
Budget for pesticide regulation and market monitoring	– Budget of Regulatory Division, DOA[2]	46.00
Budget for governm. extension related to chemical pesticides	– Budget of PPSD, DOAE[3]	284.64
Total		
Lower boundary[4]		**462.80**
Upper boundary[5]		**5,491.80**

1 Annual report, Entomology Division, DOA, around 40% of the total budget (63,235,520 Baht) are spent on pesticide related research;
2 DOA, personal communication;
3 DOAE, personal communication – budget for fertilizer purchase and for Thai-German IPM Project not included; author's calculations;
4 lower boundary includes official health data and excludes residue costs estimations;
5 upper boundary includes all costs listed above and considers the estimated acute poisoning cases.

Source: Jungbluth (1996)

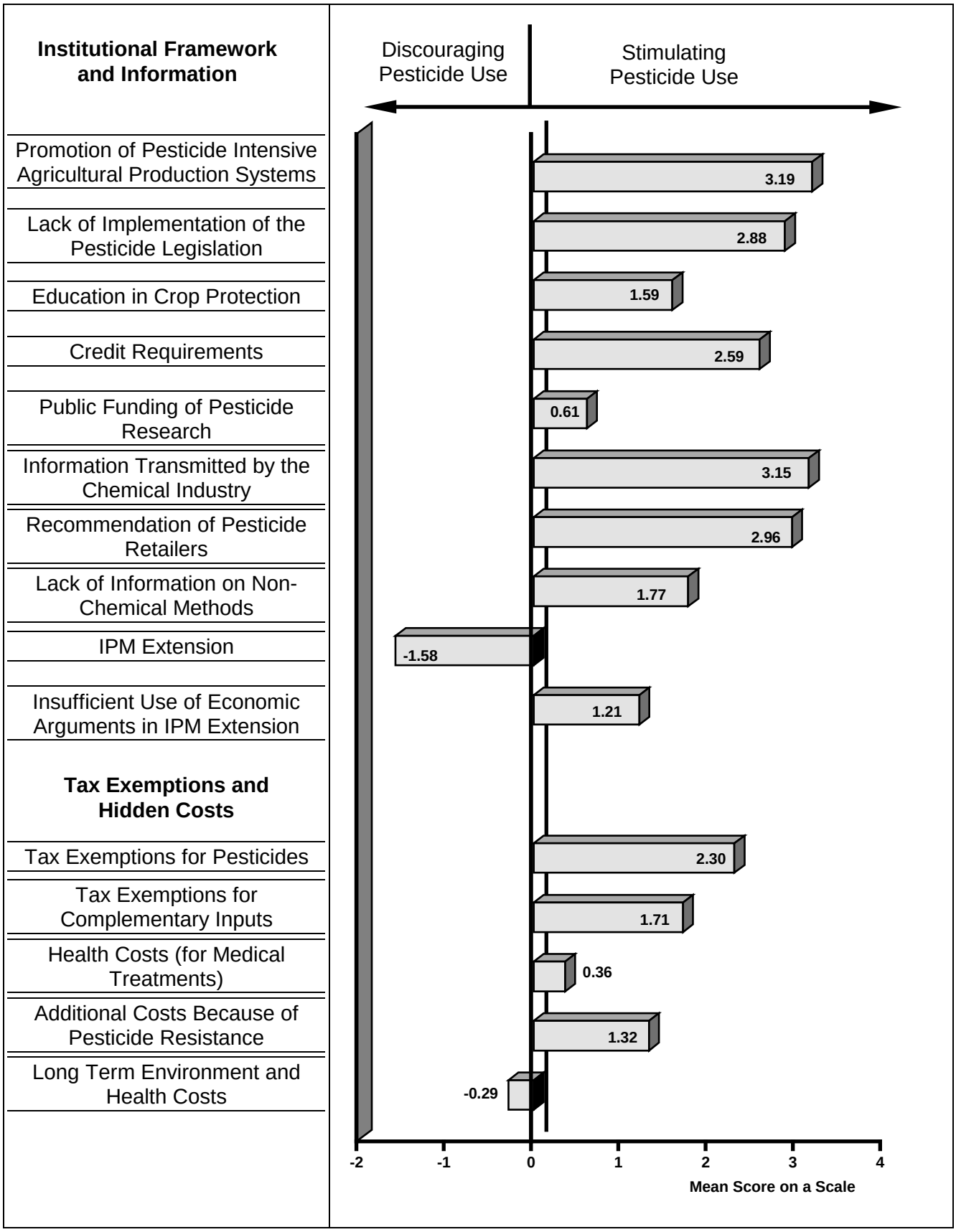
These calculations show that the ratio of pesticide sales to externalities is almost one to one; that is, for every Baht spent on pesticides society incurs external costs of about one Baht. Moreover, the available data cover only a part of the true costs of pesticide use. This finding is consistent with other attempts at calculating the external costs of pesticide use. PIMENTEL et. al. (1993), for example, found a ratio of 1:2, and a study in Germany (WAIBEL and FLEISCHER, 1998) concluded that for every German Mark spent on pesticides a minimum of 0.23 marks is incurred in the form of external costs.

In both countries, it is hoped that the information provided by the pesticide policy studies will form the basis of a renewed discussion on the merits of reform. The aim of such a dialogue with all interested parties is to build consensus for future action in line with the general public interest.

4.3 Building Consensus For Policy Reform

A good example of policy dialogue for the purposes of consensus building can be found in Costa Rica. Some twenty experts from national ministries, research institutes, the private sector and international organizations participated in a seminar-workshop organized by IICA, an agricultural policy institute serving the Central American countries. The experts were asked to identify the factors determining levels of pesticide use in Costa Rica. To facilitate the discussion, participants were asked to rate the different factors on a scale of -5 to +5. A score of -5 indicates that a given factor strongly discourages pesticide use, while a score of +5 strongly encourages use. The list of factors was left open so that the experts could add determinants that they considered important. As shown in Figure 4, the average scores reflect an emerging consensus among the experts. Results show that the majority of factors encourage pesticide use. Among these, institutional arrangements and information constraints were the most important. Tax exemptions for pesticides were also considered key by the experts attending the meeting.

Figure 4: Determinants of Pesticide Use and their Impact According to an Expert Survey in Costa Rica



Source: AGNE (1996)

Further analysis of the opinions expressed by the different participants showed that there was quite some consensus with regard to the identification of important variables. Scientists tended to give the highest scores in either direction, and opinion was most divided among government officials. Representatives of the private sector judged tax exemptions to be of minor importance relative to access to information.

In the second part of the workshop, the experts were given the task of developing policy options for reducing pesticide use to assumed socially optimal levels. Participants placed a strong emphasis on command and control-type instruments, generally assuming high effectiveness and moderate administrative costs despite evidence to the contrary. A major criterion for selection was perceived political resistance. Subsidies for environmentally friendly technologies such as biological control were viewed in a more favorable light than disincentives such as environmental taxes. Similarly, a selective tax on the most hazardous compounds was seen as more acceptable than a more general tax.

4.4 Broadening the Political Bases of Reform

Workshops such as the one held in Costa Rica can help to break down barriers between disciplines and overcome the information monopoly often exercised by crop protection specialists. Broadening the base of participants in the policy dialogue, and providing accurate and comprehensive information on the existing situation can help to raise awareness in the issues and the quality of public debate.

The tendency to under-emphasize the economic aspects of crop protection policy partly reflects the lack of involvement of non-specialists in the policy-making process. In many developing countries, food security is viewed as a technical issue requiring strong guidance from experts in fields such as agronomy, plant protection, soil science and hydrology. Experts in these disciplines have a strong professional interest in removing constraints on agricultural productivity associated with their field of endeavor. For example, hydrologists seek to supply agriculture with the maximum amount of irrigation possible, and in doing so may impose costs on other consumers, such as households and industry. Similarly, crop protection specialists place the highest priority on reducing the impact of insect pests and diseases on aggregate farm productivity.

A healthy policy making process requires that these professional interests are balanced by a notion of the public interest. As discussed above, welfare

economics provides some useful tools for measuring the costs and benefits of individual policy decisions for different segments of society. Application of these tools is the sine qua non of successful and balanced public policy. In addition to rigorous analysis, however, it is also important to broaden the political basis of policy decisions by involving the various affected groups in the discussion. With regard to pesticide policy, for example, it is important to reach beyond the community of crop protection specialists to include planning and economic agencies, farmer groups, consumer organizations, environment advocates and representatives of organized labor. Involvement of a broader range of individuals and organizations helps to improve the quality of the debate by introducing new perspectives, discouraging conservatism and territorial behavior, and raising the scientific standards of evidence presented.

An example of the benefits to be obtained from considering the broader economic implications of crop protection policy, and involving non-specialists in the decision-making process, can be found in Indonesia. Food security is of vital economic and political importance for this nation of nearly 200 million people. The experience of massive infestations of rice with brown planthopper (BPH) in the 1970s, in which several million hectares of rice were attacked, had imposed hardship on both farmers and urban consumers. Politicians, anxious to avoid new outbreaks, relied heavily on crop protection specialists in the Ministry of Agriculture, universities and the private sector. Although some dissenting voices could still be heard, the majority of the profession was allied with the pesticide industry in favoring a pesticide-intensive crop protection strategy. This consisted of subsidies on pesticides reaching 85 percent of market prices, and subsidized distribution of pesticides through the cooperative system and credit packages.

At the same time, new scientific evidence was emerging that pesticides were the cause, rather than the solution, to BPH problems. This evidence was largely ignored in Indonesia by the crop protection establishment. It was not until the country was faced by another BPH crisis in the mid-1980s that the conservative's grip on policy was loosened. Predictably, change did not come from within the conservative crop protection establishment, but rather from the Ministry of Finance, which was disturbed by the fact that tens of millions of dollars spend on pesticide subsidies had not succeeded in removing the threat of BPH.

Based on advice from prominent Indonesian and foreign scientists opposing the conservative view, President Suharto decided in 1986 to shift policy

towards Integrated Pest Management and away from a pesticide-intensive strategy. Fifty-seven pesticide formulations were banned for use on rice, and a new emphasis was given to field observation and ecological principles. The Finance Ministry responded by gradually reducing, and then eliminating the subsidy on pesticides.

With the elimination of the subsidy, pesticide use declined dramatically, while paddy production was unaffected. From the perspective of welfare economics, society was the clear winner in this policy change. Food production remained secure while the volume of poisonous substances released into the environment was dramatically reduced. In addition, the government saved an estimated US$ 100 million per year that had previously been spent on the pesticide subsidy.

Indonesia has since launched a comprehensive IPM training program for rice and other farmers to reinforce the shift towards ecologically-based methods of crop protection. By 1998, about one million farmers will have received season-long IPM training in rice. The success of this training program has had a positive impact on policy-makers' perceptions of the role of pesticides in food security policy. In June 1996, for example, 28 active ingredients originally banned for use on rice are now de-registered for general use in Indonesia. These chemicals will be completely removed from the country within two years.

4.5 Integrating Pesticide Policy into Sectoral Strategies

As the Indonesian case shows, assigning responsibility for pesticide policy to crop protection specialists does not automatically result in the formulation of a rational set of policies. Inattention to the economic and environmental implications of policy, parochial attitudes held by the community of specialists, conservatism in the face of new evidence and political motivations for maintaining the status quo can introduce distortions into the process that drive a wedge between the perceived interests of crop protection specialists and the general public.

A major problem confronting many countries is the absence of well-established procedural mechanisms for public involvement in the decision-making process. Without generally accepted procedures of this sort, policies portrayed as serving the public interest may in fact serve only to promote the interests of individuals and selected groups. Indeed, it would not be an exaggeration to conclude that in the most extreme cases a shared notion of 'the public interest' does not yet exist in society. When the mechanisms

required to balance competing interests are not in place or function poorly, public policy is easily dominated by the most powerful players – often to the detriment of the weaker segments of society.

With regard to crop protection policy, we can see several competing interests at stake. On the one hand, farmers, the pesticide industry and policy makers responsible for food security argue for a more liberal regulatory stance. On the other hand, environmentalists, public health workers and consumers demand strict regulation and reduced pesticide volumes. Some people stand in between these two camps, for example rice farmers who are also consumers of pesticide-tainted vegetables.

Developing a set of policies that serve the public interest, as opposed to narrow self-interest, requires institutional changes that allow for the broadest possible public participation in the policy dialogue. Institutions must be involved who can act as neutral arbiters and have no vested interest in the outcome of the policy debate.

Thus, for example, pesticide registration and regulation should be made the responsibility of a neutral agency that is not directly allied with producer groups. Such more neutral organizations could be the ministry of the environment or similar organization. When left to the agriculture ministry, productivity concerns are naturally given precedence over negative environmental and health impacts. Similarly, the economics of pesticide policy, including subsidies and environmental taxation, should be discussed openly and involve the country's main economic agencies as well as agriculture, the environment, health and representatives of farmers and consumers.

In short, pesticide policy needs to be integrated into the broader public policy debate concerning the nation's agricultural, environmental and health strategies. It cannot remain the preserve of specialists in the field of crop protection. Every county has its own unique political tradition and institutions, so it is not possible to formulate specific rules of engagement. Nevertheless, two general principles still apply. First, dispassionate analysis of the costs and benefits of pesticide use provide a useful tool for the formulation of rational policies. And second, the broader and more inclusive the debate, the more likely it is that the outcome will serve the public rather than specific private interests.

5 Conclusions

This paper has not sought to present an international model for successful policy that can be copied and applied universally. Instead, we have argued for a procedural engine that can be used to arrive at a set of policies serving the public interest. This engine consists of complete information, intelligent and impartial application of welfare economics to crop protection policy, and open, transparent mechanisms for public participation in the decision-making process.

Current discussions on the use of pesticides are too often polarized and ill informed. Arguments are presented as extremes, for example as a choice between world famine and environmental apocalypse. The first victim of this tendency towards immoderation is the truth: in presenting extreme views, both the proponents and opponents of pesticide use have been guilty of distorting the evidence concealing facts. Both sides have claimed to speak for the weak and disenfranchised, with neither willing to give much real representation to the groups that they claim to represent.

Real solutions are unlikely to emerge from this sort of public posturing. The urgent task facing us today is to move beyond the rhetoric to address the real issues involved in the formulation of rational pesticide policies. From our perspective, this requires serious attention to the question of the optimal level of pesticide use from the perspective of society. We have argued for the application of welfare economics to this question, and for the use of economic instruments to achieve the desired goals of protecting the agricultural production, human health and the environment.

These goals are not mutually exclusive. Failure to take full cognizance of the economic implications of past policies has resulted in a bias towards chemical solutions to production problems. Often, as in the Indonesian case described above, chemical dependency has imposed unnecessary costs on farmers, consumers and the environment. Direct and indirect subsidies on pesticide use have also discouraged the development of non-chemical alternatives. When these subsidies are removed, technical solutions emerge which negate the supposed conflict between environmental sustainability and secure production.

We have also emphasized the importance of broadening the debate to include non-specialists and representatives of the various interests in society concerned with pesticide policy. In many cases, this will require the establishment of new procedural mechanisms to increase public

involvement and access to information. Pesticide policy must also be integrated into the mainstream of agricultural, economic and environmental policy-making and should not remain the preserve of crop protection specialists. As the evidence continues to mount regarding the pervasive presence of pesticides in the environment, we cannot act as if impact crop protection policy is only of concern to farmers and pesticide producers. As CARSON wrote in 1962, 'The choice, after all, is ours to make. If, having endured much, we have at last asserted our 'right to know', and if, knowing, we have concluded that we are being asked to take senseless and frightening risks, then we should no longer accept the counsel of those who tell us that we must fill our world with poisonous chemicals; we should look about and see what other course is open to us.'

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II Legal and Regulatory Framework of Pesticide Policy in Thailand

Policies and Strategic Measures for an Improvement of Laws and Regulations of the Import and Utilization of Toxic Substances in Agriculture

Dr. Kwanchai Sombatsiri[1]

1 Background and Context

The main law dealing with chemical pesticides in agriculture is the Hazardous Substance Act. It has first been enacted in 1967 (amendment in 1973) and been revised and amended in 1991. This revision included the phased registration scheme which follows closely the International Code of Conduct on the distribution and use of pesticides.

The objectives of the phased registration are as follows:

1. To control all agricultural hazardous substances in Thailand.
2. To detect or prove the efficiency and toxicity of hazardous substances registered in Thailand.
3. To set up the standard data requirement to check and prove toxicity.
4. To obtain experimental data conducted in Thailand in order to assure proper labeling.
5. To reduce pesticide residues in agricultural products and in the environment.

For manufacturers and importers of pesticide into the Kingdom of Thailand the required registration process is as follows:

1. Trial (or experimental) clearance
2. Provisional (or limited) clearance
3. Commercial (or full) registration

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In 1992, the government declared a new Hazardous Substance Act. It includes all hazardous substances and lifted the 1967 Act and its amendment.

According to the 1992 Act, hazardous substances are:

Explosives, flammable substance, oxidizing agent and peroxide, toxic substance, substance causing diseases, radioactive substance, mutant causing substance, corrosive substance, irritating substance, other substance either, chemicals or otherwise which may cause injury to a person, animals, plants, property or environment.

According to the Hazardous Substance Act of 1992 the regulation of hazardous substance in agriculture is under the responsibility of the Ministry of Agriculture and Cooperatives. This includes import registration, production, export, formulation, transportation, container disposal, specification, classification, quality control and others.

After the declaration of the Hazardous Substance Act in 1992 many promulgations were proposed to guide and control all concerning sectors to comply with the law. An important one is the promulgation of 27 September 1995, effective after being printed in the Royal Gazette on 21 December 1995, on the import, sale, and usage of agricultural hazardous substance to be registered by DOA. Therefore, the government can regulate types of agro-pesticides according to their efficacy and safety to man, animals and the environment. Any pesticides found to be highly toxic and to cause danger to human health, either instant or chronic, cannot be registered.

Thus legally, farmers have no access to those hazardous substances. But there is no law to control directly farmers' usage of toxic substances. Currently, they are able to use any agro-toxic substance which is easily accessible on markets across the country. However, the Hazardous Substance Act of 1992 empowers the officers to monitor those agro-pesticides after registration as regards their adverse effects on humans, animals, plants, and assets. If any are found the officers can revoke their registration.

Although there is no law controlling the agro-pesticide usage the official authority can regulate the labeling clarification, i.e. direction how to use, toxicological effects, and restrict the use to certain crops. Yet, the farmers or users may or may not follow the instructions because there is no penalty by law.

2 Current Problems and Recommendations for their Solution

In order to follow the environment conservative tendency and ISO 14000 (International Organization for Standardization) system, Thailand must improve its policies and measurements in producing goods that are free from toxic residues and maintain a sound environment to meet the requirements of the importing countries, mainly USA, EU, and Japan. Hence, the process of importing and controlling the usage of agro-pesticides needs to be revised, otherwise it will severely affect its economy.

In fact, the government policy clearly stated all steps according to Agricultural Hazardous Substance Act of 1992 but in practice the enforcement is not as strict due to problems in the promulgation process or because the law is not applicable on farmer's pesticide usage.

A clear overview on the current situation regarding pesticide control, its weak points and causes of problems as well as suggested criteria for improvement are represented in the following.

Problem 1: Pesticide residues in agricultural products.

Many countries detected higher levels of pesticide residues in agricultural products imported from Thailand resulting in prohibition of such contaminated commodities and some countries issued warning statements to the exporters.

Following DOA's promulgation of 1995, data on pesticide persistence in plants, animals, and the environment are included within the registration process. But there are many factors preventing the consideration process from being strictly implemented.

Proposed Recommendations:

1. To revoke the registration of some agro-pesticides especially those highly toxic and with long persistence. To enact the restriction on usage and handling of agro-pesticides. The Ministry of Agriculture and Cooperative must express a clear policy on banning certain pesticides that have created problems and may cause problems in the future. The ban on importation and the revoking of registration of those highly toxic pesticides should go along with the promotion of crop protection alternatives to the farmers.
2. For expiring pesticides and for new ones applying for registration domestic experiment results of their efficacy and of their residues in

agricultural products should be required. Up to then experimental data from foreign institutions can be used except for those crops grown exclusively in Thailand.

3. The government as well as exporters and local organizations should promote and support pesticide free programs for agricultural products.
4. The use of botanical and microbial pesticides should be promoted to the farmers as an alternative for synthetic pesticides. To enhance the awareness among farmers and consumers a promotion campaign via mass media would be necessary.
5. Pesticide residues in agricultural products should be monitored before export, advising and supervising the pesticide users by cooperation between exporters and government agencies. Routine sampling and analyzing pesticide residues in agricultural products after spraying is another measure that should be encouraged.

Problem 2: Pesticide residues in the environment.

The current situation of pesticide residues in the environment is likely our own national problem and should not be used by foreign countries as condition for barring the importation of Thailand's agricultural products. However, one should not overlook global concern as regards the weakness of pesticide law enforcement. Pesticide dealers' misconduct was always reflected to the public by the media but did not find sufficient response from the authorities and policy makers.

Chlorinated hydrocarbon compounds such as DDT, dieldrin, aldrin, endrin, heptachlor, toxaphen, etc. have been banned because these insecticides are long-persistent in the environment. Furthermore, some other insecticides which pose danger to the environment such as methylbromide and monocrothophos are considered by the government to be banned. Problems on the disposal of pesticide containers are also under DOA's process to be regulated and enforced by department's declaration.

Proposed Recommendations:

The DOA should:

1. Declare the regulation on container disposal, control, eradication, destruction, and handling procedures. The government policy should pay special attention and provide a budget for a special burner to eliminate

agro-chemicals and their containers without causing problems to the environment.

2. Support and cooperate with agrochemical companies to install a special burner in the pesticide toxicity control program.
3. Prohibit the use of persistent organic pollutants in paddy fields or watershed areas.

Problem 3: Hazards to humans and animals.

Pesticides can come into contact with humans and animals by accidental contact when being applied or as contaminants in food, water and air. Many agro-pesticides cause chronic toxicity in animal testing and induce cancer through carcinogenic elements, genetic mutation, and embryonic disorder in the reproductive system. Pesticides proved to have these characteristics must be banned from registration. But many pesticides classified by WHO as extremely hazardous (Ia) are still registered because the toxicological data are not sufficient for a ban. The DOA has appointed a sub-committee to consider the data of pesticides in WHO class Ia regarding all information of hazards to users.

Proposed Recommendations:

1. Class Ia insecticides should be banned.
2. Pesticides less toxic to man and the environment should be standard.

Problem 4: Lack of knowledge in safe use and proper handling of pesticides among farmers.

Chemical control is Thai farmers' most favorite pest control method, it is preferred to other alternatives such as botanical or microbial pesticides. As the use of synthetic pesticides cause many adverse effects and result in increasing insect pest resistance chemical pesticides cannot be the sole solution of pest control.

DOA and DOAE have attempted to train the farmers to use integrated pest management as a sustainable tactic to control pests in the long run. But most farmers are still using old practices or depend on pesticides.

Proposed Recommendations:

1. To decentralize the group of scientists (interdisciplinary) in order to demonstrate IPM throughout the crop production process (from planting to harvesting) or season long training in the provinces.

2. The industry associated with agro-pesticides should recommend the safe and effective use of pesticide to the farmers.
3. To conduct intensive training to farmers, government officers, NGOs and the private sector.
4. To promote and support other crop protection methods to farmers.

Problem 5: The active ingredient of pesticides in the market does not correspond to the amount indicated on the label.

The components of agro-pesticides are active ingredients and inert ingredients. The active ingredient is the toxic substance to pest and the inert ingredient encourages toxicity and delays degradation. The quantity of the active ingredient indicates the price and the dosage. If the amount of active ingredient does not correspond to the information given on the label the standard pest control will not be appropriate. As no accurate dosage of the pesticide is possible economic losses by farmers and problems like insect resistance and ecological imbalance in natural ecosystems are the result.

DOA is in charge of the quality control of pesticides. The variation of active ingredient must not exceed the limit designated by the authority. Any products failing to meet the standard face penalty under the Hazardous Substance Act 1992.

Proposed Recommendations:

1. To improve the quality control inspection of agrochemical products in the market and to impose strict penalties. The media should also be used to disseminate information on sub-standard products.
2. All government agencies concerned should work in close cooperation to solve the problems of inaccurate labeling.
3. To cooperate with the Agrochemical Business Associations to inspect the product standards in the market.

III Economic and Fiscal Framework of Pesticide Policy in Thailand

Pesticide Use in Thai Agriculture: Problems and Policies

Martin Ruhs, Nat Rattanadilok, Dr. Nipon Poapongsakorn[1]

1 Introduction

Before the late 1970s, increases in agricultural labor productivity and crop output were mainly based on the expansion of land area under cultivation, rather than on yield improvements (RUHS, 1996). Because of general land abundance, there was little concern and, thus, relatively little practice of crop protection. However, given the end of the land frontier in the late 1970s/early 1980s, the further enhancement of crop production and labor productivity levels critically depended on raising yields which were very low when compared to neighboring Asian countries. The natural first measure was the attempt to minimize crop losses due to pest infestation, which were estimated at 20 to 30 percent annually and could be as high as 50 to 60 percent during epidemic infestations (ADB, 1987). As a result, Thai farmers' pesticide use has surged over the past 20 years. The estimated consumption of pesticides in 1996 was 90,000 tons, which is about seven times that of 1976.

Thai farmers' current use of pesticides is highly inefficient. The inefficiency has two aspects. First, the utilization of pesticides inflicts a number of adverse externalities on consumers and the environment, whose costs are not borne by farmers and thus not included in the market price.

Second, the current intensities and practices of farmers' pesticide application are believed to be inefficient, i.e. not profit maximizing – neither in the short, nor in the long run. While the short-run inefficiency may be attributed to an overuse of pesticides beyond the profit maximizing level, the long run inefficiency stems from the adverse effects of pesticide utilization on externalities.

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This paper proposes a number of public policies aimed at reducing/ eliminating the postulated inefficiencies in the use of pesticides in Thai agriculture. While section 2 briefly reviews the evidence and sources of the overall inefficiency and the reasons for its increase over the past 20 years, section 3 discusses and suggests a variety of legal, fiscal, and economic policies which aim to create sufficient incentives to induce farmers to utilize pesticides in a socially and technologically efficient manner. As the actual implementation of the proposed policies crucially depends on conducive institutional settings for policy formulation and enforcement, section 3 further investigates into the necessary restructuring of the current institutional framework for pesticide policy and use in Thailand. The required institutional policies are listed. Section 4 concludes with a summary of the proposed policy package.

2 Problems of Pesticide Use: The Inefficiencies

Problem related aspects to pesticide use in Thailand have been analyzed by WAIBEL (1990), GRANDSTAFF (1992), and JUNGBLUTH (1996). The following discussion draws heavily from the mentioned studies, extending them where found appropriate and where new data have become available.

The most commonly mentioned 'external' or 'social' costs associated with the utilization of pesticides are health and environmental effects. Pesticide-related environmental degradation includes the contamination of groundwater, a reduction of bio-diversity, and the destruction of beneficial insects which help control pests. The concentration levels of DDT and Dieldrin residues in five Thai rivers (Upper Ping, Lower Ping, Wang, Yom, Nan, Chee) have been shown to well exceed acceptable standard levels of water contamination (SOMBATSIRI, 1997). Furthermore, in the late 1980s, the sharp increase of pesticide use in response to the outbreak of Brown Plant Hopper (BPH) had devastating effects on farmers' production environment, greatly reducing the bio-diversity and the number of beneficial insects. In fact, GRANDSTAFF (1992) provided evidence for a clear correlation between the increased use of methyl parathion, a highly hazardous pesticide used to protect rice crops from infestation with BPH, and the area infested with BPH in Thailand.

There are good reasons to believe that Thai farmers applied quantities of pesticides exceeding profit maximizing levels. Various studies have repeatedly shown that farmers often mix pesticides, creating a 'cocktail' of several chemicals, without considering their combination possibilities (TDRI

1989; TDRI, 1996). Furthermore, farmers frequently increase the concentration of pesticides, in the belief that increased intensities lead to greater protection (TDRI, 1989; GRANDSTAFF, 1992).

Evidence for the harmful effects of using pesticides on farmers' health abounds. Within the first seven months of 1996, 1,760 people have been hospitalized and 16 died due to poisoning within the first seven months of 1996. However, as only 2.4% of workers with poisoning incidents consult a hospital (WONGPANICH, 1985), the figure provided by the Ministry of Public Health is certainly a grave underestimation of the actual extent of pesticide poisoning in Thai agriculture.

2.1 Sources of the Inefficiencies

The social inefficiency associated with pesticide use is a classic case of market failure. Pesticides are by design harmful to life. It is impossible to limit their overall impact to protecting crops from pest infestation only. In other words, regardless to overall utilization levels, pesticide use is bound to always cause externalities, thus giving rise to market failure and inefficiency. Hence, inefficient pesticide use may be attributed to the lack of a mechanism which 'internalizes' social costs into farmers' private production costs.

On one hand, there is uncertainty regarding various components of the ecosystem, including the occurrence of a pest outbreak. In their input decisions, farmers therefore need to formulate expectations about the likely pest infestation of their crops. The point is that farmers are likely to overestimate the probability of a pest outbreak. Consequently, farmers generally apply greater quantities of pesticides than required to control the actual, average degree of pest infestation. On the other hand, there is uncertainty about the effectiveness of pesticides. Farmers can observe the effectiveness of a certain pesticide only after repeated application and subsequent observation of the degree of crop protection. Due to constantly changing pests, new pesticides are frequently bought and experienced, meaning that uncertainty regarding the effectiveness of pesticides generally prevails.

2.2 Reasons for the Increase of Inefficiency

2.2.1 Reasons for the Increase of Social Inefficiency

First, Thailand's most pesticide intensive crops, vegetables and fruits, are also its highest value added crops. As farmers have gradually switched from

low value added to high value added crop production, the overall consumption of pesticides has naturally increased. Second, in order to raise yields, farmers intensified pesticide use in the production of all crops, as reflected by increasing shares of pesticide costs in total production costs. Third, with 96 registered producers in 1996 (Regulatory Division, 1997), Thailand's pesticide market is highly competitive. A survey of the retail prices of 18 pesticides showed that, between 1986 and 1996, the average nominal retail price of pesticides remained virtually constant, implying that the average real price of pesticides actually fell by 45 percent. The real price of highly hazardous methyl parathion fell by 23 percent (Table 4.1).

Furthermore have a number of public policies encouraged pesticide use levels. First, as a result of the government's reduction of the import duty on formulated pesticides from 5 percent to nil in 1992, the total effective tax on pesticides is 7 percent, while that on agricultural machinery and active ingredients for fertilizers is 8 percent and 17.7 percent, respectively. Clearly, the abolishment of the import duty on pesticides has subsidized pesticides and increased imports and use of pesticides.

Table 4.1: Development of Pesticide Costs in Thailand

	Real Prices in Baht per kg	
Year	Pesticides (Average Price)	Methyl Parathion
1986	199.70	111.94
1987	187.05	122.33
1988	193.01	135.65
1989	175.95	137.42
1990	171.22	118.00
1991	159.16	111.53
1992	136.29	86.29
1993	124.18	76.66
1994	116.71	75.00
1995	116.11	91.63
1996	109.62	87.07

Second, the Department of Agricultural Extension (DOAE) provides farmers with free pesticides in case of a pest outbreak. The required funds for the government's purchase of pesticides are drawn from a permanent outbreak

budget, which amounted to a cumulative 100 Billion Baht over the past ten years. As may be expected, this relatively uncomplicated procedure of requesting and obtaining free pesticides has led to severe overutilization. However, it should be noted that farmers cannot solely be held responsible for such overuse. Clearly, where marginal cost of obtaining pesticides is almost nil, basic economic theory justifies an increase of pesticide application until the benefit derived from further increases in the quantity of used pesticides is close to zero.

Finally, as one of its main responsibilities, the DOAE provides farmers with information about feasible protection methods. However, right since the inception of its involvement in pest protection, the DOAE has advocated the intensive use of pesticides, with methods of Integrated Pest Management receiving little attention. Clearly, the bias in the government's provision of information about pest control methods has been a major factor inducing increased use of chemical pesticides.

2.2.2 Reasons for the Increase of Technological Inefficiency

The reasons for the rising degree of uncertainty mainly lie with the conduct of pesticide companies which frequently practice deceptive advertising and product adulteration, thereby clearly violating Section 82 of the Hazardous Substance Act of 1992[2].

Intense price and non-price competition on Thailand's pesticide market have encouraged deceptive advertising, as reflected in the large number of trade-names, when compared to the number of common (generic) names. As of 1996, there were 247 common names, but 3,058 registered trade names (Regulatory Division, 1997).

A repacker of pesticides, regardless to its size of operation, is, by legal definition, a producer and is legally entitled to the right to apply for product registration permit. A formulator can easily have as many repackers, and thus registered trade (product) names for the various formulation of

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2 *"Any person intentionally creating a misunderstanding with respect to the origin, nature, quality, or other essences relating to the hazardous substance belonging either to such person or to other persons, making or using the labels of false statements or statement known or ought to be known to cause such misunderstandings shall be subject to an imprisonment not exceeding one year or a fine not exceeding two hundred thousand Baht or both.*
If the offender under paragraph one repeating the commission of the same offense within six month as from the date from the previous commission, such offender shall be subject to an imprisonment not exceeding two years, a fine not exceeding two hundred thousand Baht, or both." (Hazardous Substance Act, Section 82)

pesticides it produces (GRANDSTAFF, 1992). Furthermore, instead of having one name for one formulation, until 1996 a producer could register multiple trade names for the same common-name product. Since 1996, one applicant can only register one product name for one common-name product. However, companies may yet effectively obtain multiple trade names for the same product, by simply marginally changing the concentration of the pesticide, in order to obtain a new trade name for the 'new' product. As a result of the great number of tradenames, quality control is very difficult. Consequently, various surveys have shown that the content and concentration of sample products differ significantly from the specifications on the label (TAYAPUTCH, 1992; SOMBATSIRI, 1997).

The reasons for the occurrence of product adulteration are twofold. First, due to the lack of law enforcement, violators are not prosecuted. With no repercussions to fear, pesticide companies often find it profitable to adulterate products in order to collect economic rent. Second, as Thai farmers are aware of pesticide producers' adulteration practices, they expect the purchased product to be adulterated.

Hazardous pesticides continue to be available in Thailand as the country has become an international dumping ground for highly hazardous chemicals which are banned in more developed and/or more environmentally concerned countries. Evidence in support of this proposition abounds. First, although a number of import bans have reduced the number of highly hazardous chemical available, Thailand still lags behind other countries in the banning of highly hazardous chemicals. For instance, paraquat, parathion, and methyl parathion have appeared on the list of pesticides recommended to be banned on a world-wide basis, yet these pesticides are still widely imported and used in Thailand. Second, once a ban has been announced, imports of that pesticide typically surge right before the imposition of the ban. This clearly indicates that companies generally know about a ban in advance and, consequently, greatly increase imports, accumulating stocks of the hazardous pesticides for later sale (after the chemical has been banned). Third, in 1991, the United States exported 3,249,948 pounds (equivalent to 4.45 tons per day) of banned chemicals to Thailand (PANNA, 1993). Finally, as of 1992, more than 60 percent of all pesticides imports were highly or extremely hazardous. Less than five percent of imports were only slightly or not hazardous. As of 1995, carbamates and organochlorines, two pesticide groups deemed extremely hazardous by the FAO, constituted 29 percent (or 3,145 tons) of total insecticide imports.

3 Policies: Legal, Fiscal, Economic, and Institutional

The present section analyses and proposes ways in which government policies my create sufficient incentives to induce farmers to both internalize external costs, such that pesticide input decisions are based on social rather than private costs, and to utilize pesticides in a technologically efficient (profit maximizing and safe) manner. The required incentives may be created and enhanced by three different policy approaches:

- legal ('command-and-control') policies, referring to pesticide laws and regulations concerning the availability and utilization of pesticides;
- 'market-based' policies, including fiscal and economic policies; and
- the elimination of existing disincentives, i.e. policies which work at cross purposes by actually encouraging rather than reducing pesticide use.

As the actual implementation of the proposed policies requires a conducive institutional framework, the final section lists the necessary institutional policies.

3.1 Legal ('Command and Control') Policies

As enacted by Hazardous Substance Act (1992), which revised the Toxic Substance Act (1967) and its Amendment (1973), Thailand's past pesticide policies have all been of the command-and-control type.

Comparing the content of the Hazardous Substance Act with American and European laws, it is found that the number of banned chemicals in Thailand is much smaller than in the United States and Europe and, in contrast to the USA and Europe, Thai pesticide regulations are primarily aimed at the control of hazardous pesticides, rather than the utilization of pesticides. In fact, the only application regulation contained in the Hazardous Chemical Act is the requirement to observe a safe period between pesticide spraying and harvesting. There are no regulations concerning equipment to be used, frequency of applications, application practices (mixing of pesticides), etc.

Apart from the mentioned deviations, the Hazardous Substances Act adopted most of the pesticide regulations stipulated by American and European laws (even product liability!). As such, Thailand's pesticide laws may be described as quite advanced. Nevertheless, most of the existing command and control policies have been ineffective in reducing pesticide use in Thailand. The problem, of course, lies in the enforcement of the laws generally being low. The lack of enforcement of the regulations establishing

'legal liability' (Sections 63 and 69[3]) and prohibiting the intentional creation of uncertainty regarding product quality (Section 82) are cases in point.

If a polluter knows that he will be held financially accountable for any damages his activities create, then he will have the proper incentive to seek methods to avoid these damages. Thus, if strict legal liability was actually enforced, it would serve to internalize social costs (CROPPER and OATES, 1992). Given the current inefficiencies of pesticide utilization despite of the existence of legal liability, it is clear that the enforcement of liability laws has been minimal, if not absent. The same applies to the regulation regarding the intentional creation of misunderstanding about the quality of pesticides, as enacted by Section 82 of the Hazardous Substance Act.

Two reasons for the lack of the enforcement of many pesticide regulations may be identified. First, the current institutional framework for the formulation of regulations hampers effective implementation. There are strong interest groups both outside and within the government which have repeatedly shown to be in a position to deter enforcement. Second, given the great number of pesticide producers, distributors, retailers, and applicators, the costs of enforcement of command and control policies are very high – prohibitively high, as frequently argued. As indicated by enforcement experiences in other countries, a reform of the institutional framework may eliminate deterring factors, but high enforcement costs can be considered to be an inherent obstacle to the implementation of command-and-control policies. Hence, it is imperative that any modifications of, or additions to the existing regulations be associated with relatively low enforcement costs. Moreover, to be effective in the short term, it is sensible to propose only policies which may be expected to meet with little or moderate opposition from the major stakeholders. With this in mind, the following short-term policies are suggested:

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3 *"The producer, importer, carrier or the person having possession of the hazardous substance must be liable for injury caused by the hazardous substance in his/her possession unless it is proved that such injury is caused by force majeure or fault of the injured person"* (Section 63, Hazardous Substance Act). *"In case where hazardous substance causes injury to the persons, animals, plants, or environments, if the State suffers injury on account of expenses paid in order to rescue move, treat, mitigate, or get rid of the injury and to restore to the original or nearly original condition or if it is the injury to the res nullius, or natural resources, or injury to state property, upon request from the agency assigned to be responsible for the hazardous substance, the Public Prosecutor shall have the power to institute the claim of compensation for the said injury to the state."* (Section 69, Hazardous Substance Act, 1992)

- The government should adjust the list of pesticides banned to an extent which matches bans in developed countries. Furthermore, there needs to be an information unit which closely monitors the import bans of other countries, establishing close links or networks with foreign institutions.
- The government should require pesticide producers, upon product registrations, to make a bank guarantee which will be confiscated in case of proven adulteration of the company's product.

On the other hand, following a successful reform of the institutional framework, the following long-run policies are suggested:

- Enforcement of existing regulations, especially those on legal liability and quality control, to the extent at which enforcement costs do not outweigh enforcement benefits. In other words, where the actual damage to consumers, environment, or farmers may be easily proven and assessed, legal liability should be enforced. Similarly, quality control should be conducted on a regular basis, even though the frequency of controls may be low because of the associated costs.

As argued and shown by HARRINGTON (1988), compliance with regulations does not depend on the frequency of surveillance but on the common knowledge that regular surveillance exists, even though the frequency of surveillance is quite low. Even though for most polluting sources the frequency of surveillance is quite low, and when violations are discovered, fines or other penalties are rarely assessed, sources are, nonetheless, thought to be in compliance a large part of the time.

Regulations should prohibit application methods which deviate from the label specifications and establish minimum requirements for spraying equipment.

The present analysis concludes that, in the short run, there is very limited scope for modifications of and additions to Thailand's existing command-and-control policies for pesticide reduction. Exceptions are the two proposed short-run policies which should be adopted. However, the proposed legal (command-and-control) policies constitute only a subset of an effective pesticide policy package. Rather than relying on expansions or additions to command-and-control policies, Thailand's pesticide policy makers are advised to turn to market-based policies as discussed and proposed in the following section.

3.2 Fiscal and Economic (Market Based) Policies

3.2.1 Excise Tax

The existence of pollution externalities is a well known cause of market failure, calling for the imposition of excise taxes on pesticides. The purpose of such a tax is two-fold. First, it aims to internalize the social costs associated with the use of pesticides into the polluter's privately perceived costs, thereby reducing pesticide use to a socially optimal/efficient level. Second, government revenues are raised. Clearly, increased revenues enable the government to implement a number of facilitory policies which induce farmers to take up less pesticide intensive production methods.

Country experiences with pesticide taxes abound. In his review of the pre-1989 experiences of France, Germany, the Netherlands, and the United States, HAHN (1989) concludes that in all four countries pesticide taxes have generally been designed to raise additional government revenue, rather than fulfill Pigouvian purposes. It is still true to say that pesticide taxes in most countries are levied with the goal of raising revenues, rather than actually reducing pesticide use. One obvious reason why most countries' current pesticide taxes deviate from the Pigouvian textbook model is policy makers' frequent inability to both collect the information needed to establish the correct tax rate, which maximizes social welfare, and a lack of actual implementation plans (BARTHOLD, 1994).

3.2.2 What and who should be taxed ?

The theory of Pigouvian taxes suggests taxes to be imposed on directly polluting activities. Strictly speaking, in the case of pesticides, the polluting activity is farmers' consumption of pesticides (and not companies' production of pesticides). Alternatively, the tax may be imposed on the production of pesticides, with tax collections at producer level. Since there are much less pesticide producers than retailers and middlemen, this latter policy option is clearly superior from an administrative point of view.

It is concluded that, for practical reasons, the excise tax should be imposed on, and collected from producers of pesticides. Because of the competitiveness of the retail market, the tax on producers is likely to be fully passed down to the retail level.

3.2.3 How much should be taxed ?

On a broad basis, pesticides may be divided into groups, according to their toxicity/hazardousness. In fact, Thailand's pesticide regulations requires the

grouping of pesticides into four categories of hazardousness (Section 18, Hazardous Substance Act, 1992). In order to facilitate the determination of Pigouvian (resembling) tax rates, the government first needs to carefully revise its current division of pesticides, and, if possible, increase the number of categories of hazardousness. The excise tax imposed on specific pesticides should depend on the pesticide's hazardousness as determined by its placement in a certain category. In other words, pesticides belonging to a category of high hazardousness should be taxed at higher rates than pesticides belonging to a category of low hazardousness.

Optimal tax rates cannot be determined due to the impossibility to collect all the information necessary to determine the value of a specific pesticide's adverse effects on the environment. A study by PANNA (1994) concludes that 'pesticide risk assessments do not, will not, and cannot consider all the kinds of potential harm [...] being experienced by the organisms exposed to the pesticide.' Hence, the social damage caused by the use of pesticides are too many and too subtle to quantify completely.

As an alternative way of determining tax rates, we first analyze the effects of various excise tax rates on farmers' use of pesticides and government revenue, and then choose an appropriate tax.

3.2.4 The Impact of Pesticide Taxes on Farmers' Use of Pesticides and Government Revenue

Assuming that the increase of producer prices, as caused by the imposition of an excise tax, is fully passed down to the retail price of pesticides, the extent of farmers' reduction of pesticide consumption in response to the imposition of an excise tax depends on the price elasticity of demand for pesticides. Naturally, a high elasticity implies a relatively great reduction of pesticide use in response to a price increase and vice versa.

The greater the ease with which pesticides may be substituted with other agricultural production inputs, the greater will be the elasticity of pesticide demand. In the case of Thai crop production, the opportunities of factor substitution are limited. Imperfect information about IPM methods leaves Thai farmers with little alternatives to pesticides. Hence, possibilities of pesticide substitution are limited demand inelasticity of pesticides can be assumed.

If pesticide costs constitute only a small part of farmers' total production costs, increases in pesticide prices will induce farmers to only marginally reduce the quantity of pesticides consumed, as total production cost will not

be much affected. In other words, a small share of pesticide costs in total production costs induces inelastic demand, while a great share induces elastic demand. In the case of Thai crop production, the relative share of pesticide costs in total production costs is relatively small. In 1990, the shares of pesticide and fertilizer costs in the total value of the production of rice, vegetables, fruits, sugarcane, and rubber were 8 percent, 7 percent, 9 percent, 8 percent, and 9 percent respectively (Input-Output Table for Thailand, 1990). A recent survey of Thai cotton producers (TDRI, 1996) found that the share of pesticide costs in total production costs was generally less than 10 percent. Clearly, the relatively low share of pesticide costs in Thai farmers' total production costs induces relative inelasticity of demand for pesticides.

Considering the relatively low share of pesticide costs in farmers' total production costs, the absence of readily available substitutes, and the relative inelasticity of many crops whose production requires pesticides, it is certainly safe to say that the price elasticity of overall pesticide demand in Thailand is quite low. In his study of Thai orange production, RATTANADILOK (1997) derived a 0.21 percent price elasticity of pesticide demand. This conclusion is consistent with most research estimates of prices elasticity's of pesticide demand in other countries, which usually range between 0.1 and 0.5 percent (PEASE et al., 1996).

In 1996, the total consumption of pesticides was estimated at 90 000 tons, with a nominal sales value of about 8 Billion Baht. In Table 4.2 the reductions of pesticide use and the creation of revenues in response to the imposition of a uniform excise tax (ad valorem) are calculated for different levels of excise tax and price elasticities.

It is assumed that farmers do not change their management system. However, in reality, this would not be the case and reductions of pesticide use would probably be higher due to management system changes.

Table 4.2: Example of the Impact of a Uniform Excise Tax on Pesticide Use

Uniform Excise Tax	Price Elasticity of Demand for Pesticides				
(Ad Valorem)	**e=0.1**	**e=0.2**	**e=0.3**	**e=0.4**	**e=0.5**
t = 5%					
reduction (%)	- 0.5	- 1	- 1,5	- 2	- 2,5
reduction (tons)	-450	- 900	- 1,350	- 1,800	- 2,250
tax revenue (Mio. Baht)	398	396	394	392	390
t = 20%					
reduction (%)	-2	- 4	- 6	- 8	- 10
reduction (tons)	-1,800	- 3,600	- 5,400	- 7,200	- 9,000
tax revenue (Mio. Baht)	1,568	1,536	1,504	1,472	1,440
t = 40%					
reduction (%)	- 4	- 8	- 12	- 16	- 20
reduction (tons)	- 3,600	- 7,200	- 10,800	- 14,400	- 18,000
tax revenue (Mio. Baht)	3,072	2,944	2,816	2,688	2,560
t = 100%					
reduction (%)	- 10	- 20	- 30	- 40	- 50
reduction (tons)	- 9,000	- 18,000	- 27,000	- 36,000	- 45,000
tax revenue (Mio. Baht)	7,200	6,400	5,600	4,800	4,000

In order to eliminate inefficient pesticide use, the prime goal of an excise tax should be the reduction of overall pesticide use, rather than the maximization of government revenue. However, as seen from Table 4.2, assuming an elasticity of 0.2 or 0.3 and the imposition of a relatively low excise tax, significant amounts of government revenue may be raised, while overall pesticide use is reduced at low rates only. The following policy is proposed:

- The government should impose an excise tax on pesticides, with tax collections made at the producer level. The taxes should vary according to hazardousness, as assessed by the product's placement in a certain category of hazardousness. The amount of levied tax depends on the government's goal of pesticide reduction. Initially, the goal should be moderate, in order to ensure short term implementability. Hence, the initial (average) tax should be set at about 20 percent. Assuming an elasticity of 0.2 percent, farmers will reduce pesticide use by 4 percent or 3,600 tons. The generated revenue will amount to 1.536 Billion Baht.

Clearly, substantial reductions in pesticide use may only be brought about by imposing high taxes or increasing price elasticity of demand. As the former

approach is argued to be politically unfeasible in the short run, efforts should be made to enhance elasticity. Hence, the following policy proposal:

- The government should use the revenue created by the initial tax to enhance public research and information about IPM (thereby offering farmers a substitute for pesticides which makes pesticide demand more elastic) and implement a number of facilitory policies which offer farmers financial incentives to switch from a chemical-based protection strategy to IPM.

3.2.5 IPM-related R&D

In principle, the development of, and dissemination of information about IPM may be carried out by the government, private sector or both. However, the experiences of the US, European countries and Thailand show that the private sector generally lacks incentives to undertake research into IPM. Naturally, pesticide companies have little interest in promoting less pesticide intensive protection methods. Therefore, there is clear scope for the government to counter the market's promotion of pesticide-intensive methods with public investment in IPM-related R&D and dissemination of information among farmers.

- The government should concentrate its research efforts exclusively on IPM. The information campaigns conducted by the Department of Agricultural Extension should focus on carefully explaining the feasibility and long term advantages of practicing IPM. National research efforts should be closely linked with those of foreign institutes.
- The activities of NGOs with environmental and agricultural concerns should be subsidized and coordinated.
- In order to adequately inform farmers about the actual effectiveness of specific pesticides, the government should operate farm demonstration plots.

The experience with the actual implementation of policies promoting IPM-related research and information in other countries has generally been positive. Given the current institutional framework, certain interest groups may effectively oppose public research in IPM. As mentioned in section 2, the Department of Agricultural Extension has experienced a number of internal conflicts regarding the content of their information campaigns. To date, the supporters of the promotion of pesticide intensive methods have been winning. Hence, in order to actually implement the proposed policies a restructuring of the current institutional framework is required.

3.2.6 Financial Incentives

Feasible policies creating financial incentives include cost-share programs, tax credits, low interest loans, and the provision of insurance to farmers practicing Integrated Pest Management (STABINSKY et al., 1994). The justification of all four is the need of financial assistance to farmers who voluntarily switch from pesticide intensive crop protection to IPM, whose initial setup and regular practice are associated with high management costs.

A *cost-share* policy aims to encourage farmers to adopt and practice IPM. It may facilitate a number of practices, such as field scouting for insects, crop rotations, biological pest control services, planting host crops and renting or modifying equipment which is needed to implement IPM, cover cropping, and pesticide record keeping, to mention a few. MOORE et al. (1979) mention four factors which determine farmers' actual utilization of cost-share incentives: the time and effort required to establish eligibility, the availability of technical assistance along with financial assistance, the compatibility of the promoted practice with present farm operations, and the profitability of the pollution control investment relative to other investment opportunities.

In Sweden and Switzerland the successful implementation of cost-share policies has resulted in substantial reductions of pesticide use. On the other hand, in the United States, the experience with cost-share programs has been disappointing, as reflected by the small number of farmers joining the program. Researchers identified four explanations: the excessive time required to enroll in the program, lack of technical assistance, insufficiency of financial assistance provided, and the high labor intensity of the economic data requirement (STABINSKY et al., 1994).

In Thailand, there are only limited policies (with lackluster implementation) sharing the cost with farmers taking up and practicing IPM. Therefore, there is a clear scope for the implementation of the following policy:

- The government should offer to share the costs of IPM-practicing farmers. Specific costs to be shared include labor costs and machinery costs.

One way of sharing labor costs would be to share the costs associated with the labor intensive process of scouting, which must be intensive not extensive, requiring a scout that is committed and spends an appropriate time inspecting the field. To this end, public extension workers may act as scouts on farmers' fields, thereby reducing farmers' labor costs. Alternatively, the government may facilitate the development of a market for

'scouting services'. The government could kickstart the development of such a market by inviting private individuals to join short training sessions about effective scouting. Having received the (paid for) education, these individuals become 'scouting consultants' who sell their services to farmers, charging a fixed fee per rai. As reported by FEDER (1979) a study by HALL (1977) concludes on the basis of a survey among cotton and citrus growers in California that pesticide use dropped 33% - 66% for farmers using pest management consultants. A cost-share program could share farmers' costs of hiring private consultants.

Apart from labor cost, the costs associated with the purchase of equipment needed to practice IPM may also be shared. Importantly, the provided assistance should be linked with the requirement to actually utilize the cost-shared equipment for less pesticide intensive protection methods. A major drawback, however, are the associated control costs. To avoid the necessity of extensive monitoring, equipment which may technically be used for IPM only should be cost shared. Naturally, the specific equipment to be cost shared depends on the crop under cultivation.

Tax credit programs refer to tax exemptions for farmers practicing IPM. In contrast to cost share programs, tax credits reward all farmers practicing IPM, rather than only those who join the (cost-share) program. The exempts may apply to farmer's income tax or to value added taxes on machinery needed to practice IPM.

In Thailand, there are currently no tax exemptions for farmers practicing IPM. The following policy is suggested:

- Farmers practicing IPM should receive partial income tax exemptions. Alternatively, farmers should receive tax credits for the purchase of equipment required to practice IPM (exemptions of value added tax on machinery). Again, machinery which may technically be used for IPM only should be tax exempted.

Low interest rate loans to farmers practicing IPM are commonly mentioned as an incentive to reduce the application of pesticides. As summarized in SIAMWALLA et al. (1990), Thailand's Bank of Agricultural Cooperatives (BAAC) has a long history of providing input credits (i.e. low interest rate loans) to farmers. However, the problem with this policy lies with the farmers' biased perception of production risks as a result of the low interest rate. In general, the level of an interest rate on a loan indicates the investment project's riskiness. Loans for projects with a high risk of failure are usually associated with relatively high interest rates. If the BAAC offers low interest

rate loans to farmers practicing IPM, farmers' perceived risking of their investment project (the switch to and practice of IPM) is lower than the actual risking. As a result, farmers may start a run on the low interest loans and the practice of IPM without really being adequately informed about the actual risks involved and efforts required for successful implementation. To avoid such a situation, it is imperative that the provision of low interest rate loans goes hand in hand with the provision of detailed information about actual production risks. The following policy is suggested:

- The government should provide low interest loans (input credits) to farmers practicing IPM. However, the extension of the loan must be coupled with detailed information about the production risks associated with IPM and its requirement of labor-intensive management.

The effects of the provision of *insurance against crop loss* incurred from the switch from pesticide intensive crop protection to IPM has been widely debated. Supporters of this generally argue that, in the initial stages of IPM, farmers generally experience smaller gains due to greater crop losses. Therefore, farmers need to be insured against such crop reductions, in order to have any incentive to abandon pesticide intensive control strategies. On the other hand, opponents of insurance as a policy to reduce pesticides base their arguments on the well known problems of moral hazard associated with the provision of insurance. Once farmers know they will be compensated in case of crop loss, they are likely to put in less effort into the avoidance of pest outbreaks and effective practice of IPM. In their study of the effects of insurance on the use of pesticides of American corn farmers, HOROWITZ and LICHTENBERG (1993) found that insurance induces farmers to apply significantly more nitrogen per acre (19%), to spend more on pesticides (21%), and to treat more acreage with both herbicides (7%) and pesticides (63%). Analyzing the effects of crop insurance (as exemplified by cotton) in Thailand, TRIVITHAYACUN (1980) concludes that the program was moderately successful. Because of the ambiguous effect of insurance on pesticide use, the following policy is suggested:

- The government should assists farmers who are just about to switch from a chemical-based control strategy to IPM in purchasing private insurance against crop loss. However, the assistance in obtaining crop insurance should be offered in the first year only.

3.3 Elimination of Disincentives

In order to enhance the effectiveness of the proposed policies it is imperative that existing disincentives, i.e. policies which work at cross purposes, are eliminated.

- The government should eliminate the current tax differentials among agricultural inputs. This may be achieved by either raising the import duty on pesticides or removing the import duties on active ingredients for fertilizers and agricultural machinery. As the long run aim is the abolishment of all import duties, the latter policy option is to be preferred.
- The government should significantly reduce the outbreak budget and stop purchasing and distributing pesticides at no cost. The remaining outbreak budget should be used to assist farmers in case of pest outbreak through the provision of cash loans or rice, rather than pesticides.
- In order to reduce farmers' imperfect information about the effectiveness of pesticides, the government should aim to prevent pesticide companies' deceptive advertising. To this end, the existing antifraud laws should be implemented rigorously or to the furthest extent possible.

3.4 Restructuring of the Institutional Framework

It has been repeatedly mentioned that the actual implementation of the proposed policies critically depends on a restructuring of the current institutional framework for pesticide use and policy. The institutional reform should strive to reduce and ideally eliminate both opportunities of rent seeking behavior of government officials or agencies and the influence of pesticide companies on the formulation and implementation of pesticide policies.

The elimination of rent seeking behavior requires a clear division of labor among government offices, making sure that the work of a single office or agent is not impeded by conflicting objectives. As of now, the Department of Agricultural Extension acts as both the provider of 'emergency relief' (distributing pesticides) and as the advisor on pest control methods. This constellation naturally gives rise to a conflict in objectives, which has resulted in (toward intensive utilization of pesticides) biased crop protection advise. The following institutional reform is proposed:

- The Department of Agricultural Extension should be discharged of its current responsibility of distributing pesticides to farmers. Instead, the

DOAE should be a purely executing agency with the mandate to educate farmers about feasible crop protection methods with special emphasis on the dissemination of information about IPM. Extension officers should be promoted on basis of new criteria, such as their ability to convince farmers to adopt IPM.

- The task of formulating new pesticide policies, with the aim of reducing pesticide use, maintaining agricultural yield, and reducing environmental and health risks should be assigned to the Office of Agricultural Economics under the Department of Agriculture.
- The regulatory agency, which monitors the implementation of pesticide policies should be an independent agency within the Ministry of Agriculture and Extension (MOAE). It should consist of official representatives from the Food and Drug Office, the Department of Agriculture, the Department of Agricultural Extension, and the Consumer Protection Office.
- Budget allocations should be made based on the joint work of the Department of Agricultural Extension and the Department of Agriculture. Both departments should work closely with farmers.

The following policy package is proposed:

Legal Policies	Fiscal and Economic Policies	Policies Eliminating Disincentives	Institutional Policies
short term: • increase number of hazardous pesticides banned from import • require producers upon product registration to make bank guarantees which will be confiscated in case of proven law violation ***long term:*** • enforce and monitor the implementation of existing regulations • formulate and monitor the enforcement of regulations concerning farmers' application methods of pesticides	***short term:*** • impose an excise tax on pesticides which varies according to hazardousness • use generated revenue to make pesticide demand more elastic through the implementation of the following policies: – more public research on IPM; the public sector should concentrate ALL its research efforts on IPM – subsidize and help monitor activities of NGOs with agricultural and environmental concerns – operate farm demonstration plots of IPM – cost-share labor and machinery costs with farmers practicing IPM – offer tax exemptions to IPM farmers – provide low interest loans coupled with information to farmers practicing IPM	• imposition of uniform tariff structure on agricultural inputs • significant reduction or elimination of outbreak budget • DOAE must stop buying and freely distributing pesticides • enforcement of existing antifraud laws to the furthest extent possible	• restructure institutional framework and divide labor among government offices as follows: ***Department of Agricultural Extension*** • discharging of its current responsibility of distributing pesticides to farmers • purely executing agency with mandate to educate farmers about feasible crop protection methods with special emphasis on the dissemination of IPM • promote extension officers on basis of new criteria, such as their ability to convince farmers to adopt IPM ***Office of Agricultural Economics (DOA)*** • formulate new pesticide policies, with the aim of reducing pesticide use, maintaining agricultural yield, and reducing environmental and health risks

Legal Policies	Fiscal and Economic Policies	Policies Eliminating Disincentives	Institutional Policies
	– assist farmers in obtaining insurance against crop loss, in the first year of the operation of IPM • impose uniform tariff structure on agricultural inputs • stop buying and freely distributing pesticides • eliminate or significantly reduce the outbreak budget • the remaining budget should be used for research in IPM ***long term:*** • impose higher excise taxes on pesticides		***New Regulatory Agency (MOAE)*** • establish this independent agency under the Ministry of Agriculture and Agricultural Extension – to consist of official representatives from the Food and Drug Office, the Department of Agriculture, the Department of Agricultural Extension, and the Consumer Protection Office – to monitor the implementation of pesticide policies – budget allocations should be made based on the joint work of the DOAE and DOA

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IV Research Framework

Agricultural Research for Environmental Conservation: New Dimensions of Plant Protection

Chanuan Ratanawaraha[1]

1 Adverse Effects of Agro-pesticides

1.1 Pest Resistance and Resurgence

Since the first introduction of pesticides 50 years ago, pests developed resistance to pesticides. The farmers were required to increase dosage and frequency of applications. This certainly increased farmers input as well as health hazards and created problems to the environment (WONGSIRI, 1980). Now there are more than 250 insect species that have become resistant to agro-chemicals.

Since the green revolution high yielding varieties (HYV) have been introduced to replace local varieties. The average yield of HYV is higher than that of local varieties but they require more input such as fertilizer and insecticides. In 1980-81 there was a large brown planthopper outbreak in an area of around 1.07 million rai and yield losses were estimated at 300-500 million Bath per year. Agricultural scientists advised the farmers that the easiest way to safe crops is to stop using pesticides and to allow beneficial organisms that are normally abundant in nature to do the job. The prominent example was Mr. Chaiporn Prompand from Suphan Buri province who stopped using synthetic pesticides and used neems, galangal and lemon grass when he observed more pests in his paddy field. The result was that his field was safe from brown plant hopper while his neighbor suffered heavy damage.

1.2 Pest Residues in the Environment

The problems of pest resurgence and pest resistance are blamed for higher and more frequent application of pesticides. Consequently, the pesticides that missed the target will remain in the environment for a certain period.

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The Toxic Substances Division of the Department of Agriculture reported that across the country residues of chlorinated hydrocarbon insecticides in the soil range from 0.02-2.0 ppm. Especially in Damneansaduag of Rachaburi province, DDT has been detected in quantities as high as 2.0 ppm. TAYAPUTCH et al. (1976) who conducted a study on pesticide residues in soil and water in several regions of Thailand reported that the average residue of chlorinated hydrocarbon was 0.01-0.03 ppm.

MEKSUD (1980) analyzed the quality and residues of pesticides in three water resources around Sakaerach Environmental Research Institute, Nakhon Rachasima. The pesticide residues detected were mainly chlorinated hydrocarbons which remained in the water resources.

1.3 Pesticide Residues in the Food Chain

The accumulation of pesticide residues in living organisms tends to increase. For instance, plankton accumulates DDT at 0.04 ppm; this is more than their habitat water where it is found at 0.003 ppm. The fish that eats plankton collects more pesticide residue than the plankton (2.0 ppm) and the fish eating bird will accumulate the pesticide residue up to 25 ppm. The accumulation of DDT from 0.003 ppm in water increases to 0.04 in plankton (rise by 13.33 times), from plankton to 2.0 ppm in fish (50 times) and finally to 25 ppm in bird or human consumer (12.5 times).

The accumulation of pesticides in the food chains is affected by the balances of nature. Living organisms gradually absorb pesticides up to a certain level they cannot tolerate and the food chain is disrupted. The result of this phenomenon to human as a omnivorous is the accumulation of pesticides from many sources – both animals and plants.

1.4 Pesticides Residues in Agricultural Products

The over and misuse of pesticides is the main reason for residues in food products. Farmers prefer to use higher dosage and higher toxic pesticides applied in cocktails and sometimes harvest their crops before total pesticide degradation.

TAYAPUTCH (1984) disclosed that approximately 90% of agricultural products such as vegetables, fruit, rice, corn, bean, etc. contained higher residue levels than the Maximum Residue Limit (MRL).

2 Biological Control: New Alternatives for Thai Farmers

2.1 Principle

Biological control can be defined as the study and utilization of predators, parasites, pathogens and other organisms that occur in nature, and their mass production to control pests. Biological control also involves other methods such as improving plant resistant varieties, insect sterilization as well as genetic manipulation and tolerance to pests and diseases.

2.2 Types of Pests

One can distinguish between pests which have been introduced accidentally (exotic pests) causing problems due to non-existent natural enemies and pests existing in the country (endemic pests). Biological success occurs with exotic as well as with domestic pests. Natural enemies are the natural mechanism to control insect pests and to keep its population below the economic threshold level. However, knowledge on utilization of natural enemies has not convinced farmers.

Natural enemies can be classified into predators and insect parasites or parasitoids. While predators are normally large and attack its prey and eat or suck the body fluids of their hosts, parasites are organisms that are usually much smaller than their hosts and may complete their entire life cycle on a single host. They may be free-living and non parasitic during mature stage. Parasitic larvae may feed internally (endoparasite) or externally (ectoparasite).

2.3 Naturally occurring Biological Control

In nature there are many predatory insects for instance, dragon flies and damsel flies. The nymphs feed on a wide range of aquatic insects and other organisms including mosquito larva. In mature stage they capture their prey and tend to prefer mosquitoes, flies and other *Lepidoptera* and *Hymenoptera*.

Beetles are a large order of predatory insects such as carabides, tiger beetle, etc., which commonly feed both as larvae and adults on various insects. Ladybeetles are most important in the control of aphids.

In addition, many families of the order *Diptera* are entirely predators and parasitic insects. There are many families of *Diptera* parasitizing economic

pests. The more common or important families include *Sarcophagidae, Pipunculidae*, *Acroceridae,* and *Bambylidae*. *Hymenoptera* is one of the main group of parasites utilized in biological control of insect pests.

2.4 Natural Enemies – Diversity of Biological Resources

Ecologists are aware of the role of natural enemies (predators, parasites, pathogens) in the control of insect pests and weeds on the top of the food chain. These natural enemies play an important role in keeping the natural balance and preventing the increase of the pest population. Natural enemies are an important component in the diversity of natural resources.

2.5 Biodiversity – The Important Factor of Biological Control

Increasing biodiversity in the agroecosystem enhances the natural pest control by growing various crops in the same area including annuals, perennials, and botanicals for example in multiple cropping systems. There are many crops that can minimize the risk of pest infestation because of some specific properties of each crop. Citronella grass, peanut, marigold, chrysanthenum, onion, sweet basil, and many others release some substances that can prevent the destruction by insect pests. Thus, the mixture of these plants together with economic crops can support the plant protection system. POWER (1988) reported that different cultivars of corn planted together have fewer leafhopper when compared with the monocultivar. This phenomenon can explain that insects cannot identify their food in the genetically non-uniform field of plants.

DOUTT (1964) reported that ecological management towards more complexity is essential for effective pest control. Most ecologists believe that increasing the complexity in ecosystems will induce stability in the system and give less chance to pest outbreak (ELTON, 1958; ODUM, 1964).

2.6 Biological Control and Ecosystem

Biological Control means the utilization of the natural equilibrium which consists of the four following factors:

- Biodiversity of the ecosystem
- Complexity of the ecosystem
- Interaction within the ecosystem
- Natural selection

Human can interfere in this phenomenon by increasing the number of natural enemies in the ecosystem by importation, augmentation, and conservation.

In the case of importation most pests are imported accidentally or by natural migration without the control of natural enemies in the new environment. Many scientists attempt to search the natural enemies in the pest's native home and import and release them into the new place.

The method of classical biological control is expensive and needs government support since it is time consuming (3-5 years). Upon success the result will be highly permanent and stable.

The ecosystem in mono-cropping systems enhances rapid increase of the population of pests while the population of natural enemies rises more slowly. For this reason it is necessary to increase the population of natural enemies artificially by mass rearing and releasing into the natural ecosystem (augmentation).

Generally, most of the modern farmers like to see only their crop growing beautifully without the interfering of other plants. With this practice, however, natural enemies cannot survive and increase to sufficient numbers because farmers have destroyed their food and niches. In order to support the natural enemies' activities it is necessary to prepare their food source and niches in the agricultural system by appropriate management. In this way, proper crop management protects yields and encourages the activities of natural enemies (conservation).

Advantages of Biological Control are the following:

- Biological Control saves money compared to agrochemical control which becomes more and more expensive while farmers obtain only slightly higher yields. Pesticide and application costs are saved.

- The results of bio-control are more sustainable.
- There is no hazard to humans, animals and the environment.

However, biological control needs longer time to establish the natural enemies especially in countries with a long history of prevalent pesticide use. The quality of agricultural products may not meet the market demand.

2.7 Biological Control in Thailand

2.7.1 Vegetable Insect Pest

WATANATANYAKAM (1990) reported that diamondback moth (*Plutella xyloslella* L.) and beet army worm (*Spodoptera exigua* Hubner) have developed resistance to almost all chemicals in the market especially on vegetable plantations in Pathom Thani, Nontaburi and Rachaburi. RATSHATAPAKORNCHAI (1987) studied the application of *Nuclear Polyhedrosis Virus* (NPV) and *Bacillus thuringiensis* (BT) to control beet army worm and diamondback moth, respectively in integrated pest control on vegetable. The results showed that integrated insect pest control on vegetable from nine plantations gave satisfactory control and reduced pesticide expenditure by 1,656 Baht per rai and increased income by 6,589 Baht per rai on average.

2.7.2 Sugarcane Insect Pest

The Integrated Sugarcane Insect Pest Control Project aims to prevent damage of three stem borers, namely striped stem borer (*Chilo infuscatellus* Suellen, *C. sacchariphagus* Bayer), pink stem borer (*Sesamia inferens* Walker), and white stem borer (*Scirpophaga incertulas* Walker). The most important of these insects is *C. infuscatellus* or *C. sacchariphagus*. The Biological Control Research Group (DOA) introduced egg parasite, *Trichogramma confusum* viggiani (*Hymenoptera: Trichgrammatidac*) from China to be tested in 1985 for controlling these sugarcane borers.

Field trials on the mass release of *T. confusum* gave good control of sugarcane borer; as well as in the plot that released egg parasites and spray endosulfan (Thiodan) one time.

2.7.3 Cotton Insect Pest

Cotton bollworm *Heliothis armigera* Hubner is the most serious pest of cotton, the damage occurs on flowers, tips, and balls causing heavy yield losses. Heavy infestation of cotton bollworm forced farmers to spray up to 12-14 times. In addition, government policy required to increase cotton

production to supply domestic demand at about 3,000 million Bath per year. Since 1982, the DOA introduced the Integrated Cotton Pest Control Project under the cooperation of entomology and zoology division as well as other related institutes. This project aimed to reduce production inputs, especially insecticides.

2.7.4 Fruit Tree Insect Pest

Biological control of the longan stink bug project was carried out by mass rearing and releasing in the longan orchard at the proper time. NANTA et al. (1984) conducted a survey for natural enemies of longan stink bug (*Tesaratoma papillea* Drury) at orchards in Lamphun and Chiang Mai provinces between 1981-1984. The important egg parasites were *Anastatus spp. var. Japonicus* (*Hymenoptera: Eupelmidae*) and *Ooencyrtus phongi* (*Hymenoptera: Encyrtidae*).

The success of using biological control for longan stink bug was then transferred to the growers through the extension system. The longan growers appreciated this technology and are now able to reduce production costs, especially on pesticide, and are save from pesticide residues.

2.8 Development of Entomopathogenic Utilization in Thailand

The Biological Control Research Group, Entomology & Zoology Division, Department of Agriculture is responsible for the following:

2.8.1 Research on Nuclear Polyhedrosis Virus (NPV)

Entomopathogenic viruses especially nuclear polyhedrosis virus (NPV) is recognized as the most effective virus used for controlling several economic insect pests like:

- the cotton bollworm, *Heliothis armigera* in cotton, vegetables such as tomato, okra, and asparagus, and in tangerine, as well as
- the beet army worm (*Spodoptera exigua* Hubner).

2.8.2 Biological Control Research on Bacillus thuringiensis (BT)

Currently, the researchers of the Biological Control Group, DOA found many isolates of BT. From several regions in Thailand such as Nakhon Ratchsima, Nakhon Phanom, Ubon Ratchathani, etc. (TANTICHODOK et al., 1980). Research focused on cruciferous insect pests especially diamondback moth (*Plutella xylostella*, L.) that developed resistance to insecticides (WATANATANYAKAM, 1990). A comparative study on efficiency between BT and insecticides for controlling diamondback moth revealed that BT controls

more successfully than insecticides (TANTICHODOK et. al., 1990, RATSHATAPAKORNCHAI, 1990).

Apart from diamondback moth there are many lepidopterous larvae which can be controlled by BT, for instance *Papilio demoleus malayanus* Wallace, *Darna furva* Wileman, *Metanastria latipenis*, *Trichoplusia ni* Hubner, *Spodotera exigua* Hubner.

2.8.3 Biological Control Research on Entomopathogenic Fungi

Fungi are found abundant in nature sequentially from virus (POINAR and THOMAS, 1978). The applicable development of fungi needs to be adjusted to the agroecosystem to be suitable for their growth activities.

Research has identified green muscardine fungus, *Metarhizium anisopliae* to be effective for the control of rhinoceros beetle *Oryctes rhinoceros*. Aside from green muscardine fungus the use of *Beuveria brassiana* in controlling brown planthopper and fruit pests is also possible.

2.8.4 Biological Control Research on Entomopathogenic Nematodes

Biological control research on entomopathogenic nematodes in Thailand succeeded in mass production of *Steinernema carpocapsae* for controlling longan bark eating caterpillar (*Cossus spp.*). The population of cater pillar reduced up to 80% after spraying with nematodes in the field trial. Large scale production of nematode using artificial media was successful. The production technique has been transferred to the extension service and the private sector for commercial production.

Entomopathogenic microorganisms can be a promising alternative or be combined with chemicals as a key element in IPM programs.

2.8.5 Botanical Pesticides

Human has known how to use plant and natural extracts in pest control for a long time. For instance, the Chinese used chrysanthenum extract for more than 2,000 years and the Indians used neem more than 100 years ago. There are many other plants whose extracts can be used in pest control, such as rotenone, tobacco, turmeric, citronella grass, onion, ginger, galingale, sweet basil, chinaberry, etc. They are safe to humans, animals and the environment. Nowadays, investigations of the use of selected plants for pest control purpose are extensively done both in developing and developed countries, especially the USA, Australia, Germany, that developed commercially neem products which are available in the market.

3 Conclusion on the Research in Biological Control

Research on the significance of biodiversity in agro-ecosystems was done extensively in Europe and the USA. But in practice utilization of research results is low because of the following reasons:

1. Current agricultural systems influence the research system, the administration system, and the economic system. On the one hand, there are many experts in the research system such as plant breeders, soil scientists (divided into sections of rice, field crops, horticultural crops, etc.), plant pathologists etc. On the other hand, we lack researchers who study the relationship among living organisms in the agricultural ecosystem. National policy should emphasize not only specific basic research but research and development of biodiversity including the agricultural system and biodiversity as well.
2. The research organization should be changed to widen their vision and provide opportunities for their researchers to do research on biodiversity in agro-ecosystems.
3. At the moment agricultural systems focus on mono-cultural production with negative impact on the environment. The government attempts to solve this problem by using high yielding varieties which are bred by researchers without paying attention to biodiversity and farmers risk.
4. National development policies should emphasize more on environmental friendly and sustainable agriculture. Moreover, plant production research and development programs should stress the application of biodiversity to decrease pest outbreaks.
5. The government should allocate more funds in is budget for biological control research rather than for chemical control. Although government policy focuses on reducing the use of synthetic pesticide the majority of researchers still conduct research on chemical screening.
6. Even though the government has declared a clear policy on pesticide use reduction government agencies still spend many hundred million Baht annually on pesticide purchases to be given to farmers for free.
7. Agricultural business of predator and parasite production of developed countries such as the USA, France, Great Britain, etc. should be persuaded to invest their capital in Thailand.
8. More support to the National Biological Control Research Center to conduct research and to transfer it to farmers.

9. To support the budget for biological control of imported pests e.g. golden apple snail, waterhyacint, giant mimosa, brown planthopper etc., replacing pesticides being a short term solution only.

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V Extension Framework

Agricultural Extension and Pesticide Usage

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Summary

Pesticide use for high-value crops will continue to increase and could lead to undesirable consequences to users and consumers both directly and indirectly as well as to other ecological impacts due to residues in the agro-ecosystem, the environment and agricultural products. This problem involves the agricultural extension structure such as: The Ministry of Agriculture and Cooperatives, especially the Department of Agricultural Extension, agrochemical companies, NGOs, farmers, etc., and their guidelines should be under the sustainable agricultural framework. The government should cooperate with other social groups such as NGOs, consumer groups, etc. aiming to reduce pesticide use and encourage farmer's participation in their activities in the field and on other levels.

1 Introduction

The process of reducing the effect of pesticides to human health, residues in agricultural products and the environment directly involves the Agricultural Extension Department of the Ministry of Agriculture and Agricultural Cooperatives (DOAE), the pesticide industry and other agricultural business, NGOs, and farmers. From history to date farmers are the victims instead of managers in solving crop protection problems.

This report will document about:

1. general problems of pesticide usage,
2. a structure analysis of the pesticide circle in extension programs,
3. the initiation of projects and activities related to reduce/eliminate pesticide usage, and
4. the proposal of principles and practices to support the reorganization of extension structures in favor of human health and the environment.

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2 The Problem

2.1 Pesticide Consumption Tends to Increase

Thailand is one of the major pesticide users in South East Asia. Many formulations of hazardous chemicals are registered in Thailand. Methyl parathion alone has 214 registered trade names. This insecticide is already banned in many countries such as Indonesia, Korea, Malaysia, etc.

Farmers still use pesticides revoked from registration and banned to use in the country. Examples for these pesticides are heptachlor, camphechlor, BHC, 2,4,5–T.

This implies that Thailand has a very weak policy in pesticide control and management of laws as well as of their enforcement.

2.2 Severe Pest Outbreaks Tend to Increase

It has been proven that the consequences of chemical application has encouraged pest and disease problems – especially minor pests will become major ones. The case of the BPH outbreak in 1989/90, for instance, has destroyed 3.5 million rai and caused rice yield losses from the market at about 2.5-3 million tons. The government had to approve 340 million Baht as an 'emergency budget' to help farmers. The money was mainly spent on pesticide purchases and given to the farmers in the affected area for free.

The attempt to use pesticide to control BPH was not successful but created more infestation beyond control. After the BPH disaster in 1991, the DOAE recommended to the farmers to replace BPH susceptible variety Suphan Buri 60 by BPH resistant RD23. The result from using RD23 was the severe outbreak of neck blast infecting over one million rai.

Pest outbreaks were not limited to cereal crops only. Also areas growing fruit trees, especially those using high amounts of pesticides, faced more pest problems. For example the outbreak of phytophthora of durian in the eastern and southern regions damaged over 100,000 plants. In some areas more than 25% of the orchards were severely infected (DOA, 1993).

The green revolution enhanced the change of planting systems from the old style to the form of packages in need of more inputs including pesticides, fertilizers and resistant varieties. Dr. Prapas Weraphat, rice specialist of DOA said that 'the progressive result of the development of plant resistant varieties is not satisfying because pathogen and insect pests can overcome

the plant resistance' (National Economic and Social Development Board, 1997).

2.3 Increasing Trends of Health Hazards to the Public

The Epidemiological Division of the Ministry of Public Health reported that in 1995 3,354 people suffered from pesticide poisonings and 20 of them died. In 1994, for comparison, there were 41 deaths among 3,165 people poisoned.

The Department of Pollution Control of the Ministry of Science, Technology and Environment indicated in 1995 that the data of pesticide poisonings contained only the reportings of the governmental hospitals. The real number of pesticide poisonings should be many times higher than that. JUNGBLUTH (1996) concluded in her study that the number of pesticide poisonings could be estimated at about 39,600 a year, leading to expenses for treatment of at least 13 million Baht per year. A chlorinaterase examination by the Ministry of Public Health's Sanitary Department revealed that 85,140 out of 463,142 or 18% of farmers were on 'unsafe' levels.

Pesticide residues are dispersed to consumers as residues in food crops. The Department of Medical Sciences reported that, for example, in Chinese kale over 20 formulations of pesticide residues were found, mainly monocrotophos, metamidophos, prophenophos, and trichorfon. Almost 20 percent of the sample exceeded the MRL. The report also detected residues in ipomea, yard long bean, mushroom, tangerine and grapes which were 10, 6, 5, 10, and 26% respectively higher than the MRL.

3 Pesticide Usage Promotion Structure in Thailand

3.1 Department of Agricultural Extension

Agricultural extension is under the responsibility of the Department of Agricultural Extension, and its operational agency being in charge of pesticide issues is the Plant Protection Service Division.

Each year the Plant Protection Service Division spends approximately 200 million Baht to procure pesticides. This budget is called the 'outbreak budget'. However, there are budgets hidden in projects from other divisions and the total amount is much higher. In case of a severe outbreak, DOAE will request the special budget to purchase pesticides provided to farmers for free. For instance, during the BPH outbreak three to four years ago,

DOAE received the 'outbreak budget' of about 400 million Baht and used more than half of it for pesticide purchasing. Thus, annual average of DOAE pesticide purchases amounts to around 300 million Baht (WERAPHAT, 1989).

Aside from pesticide procurement, the Department of Agricultural Extension also encloses the Extension Biological Control Institute which was internally established to use biotechnology for crop protection and integrated pest management projects under the Plant Protection Service Division. However, this institute received less attention and support from the administrators compared to chemical crop protection. This statement was taken from DOAE's own report in 1993 and was announced in the division's policy as follows.

The Plant Protection Service aims to develop a plant protection system by using integrated pest management (IPM) to control the pest problems in rice, field crops, and horticultural crops. The principle of IPM emphasizes on pest surveillance, collected and analyzed pest, natural enemies, and selecting the appropriate pest control, such as plant resistance, botanical pesticides, biological control, mechanical control, cultural control, physical control, etc. Pesticides will be used when the pest population exceeds the economic threshold level (Department of Agriculture, 1993).

Nevertheless, DOAE still subsidizes the use of synthetic pesticides as the principle mean of crop protection. The budget ratio between synthetic pesticides versus IPM (including bio-control) is 10:1. IPM was promoted to farmers in 747,750 rai, biological control in 161,886 rai, but pesticides were provided on an area of 9,255,762 rai (DOAE, Annual Report 1995).

Even the descriptions in the department's annual report are a contradiction between policy emphasized on IPM and continuous subsidization of pesticides. It is obvious that this department does not sincerely intend to promote the appropriate technology towards sustainability. Many officials in the department are still suspicious about the area figure implemented to IPM and also whether the principle of IPM implemented here is compatible to the standard in other parts of the region.

3.2 Agro-chemical Companies

In 1992 TDRI reported that there are 182 agrochemical companies in Thailand. All agro-chemicals are imported in form of finished products and technical grade. Thereafter they will be formulated and repacked for sale in the market across the country. At present, there are 70 local and foreign

formulated pesticide plants in Thailand (LIANJAMROON, 1992). The group of pesticide companies occupying the pesticide market in Thailand is the same that has taken over global trade (LIANJAMROON, 1995).

In general perspective, Thailand's agricultural sector faces many problems because of economic turbulence but the growth rate of agrochemical business still increases dramatically every year – especially the ones of herbicides. The promotion of herbicide usage tends to be a success in Thailand as well as on the global market. The important strategy of these multinational companies is offering herbicides together with introducing herbicide resistant plants.

For example, Monsanto has promoted the 'Round Up' resistant soybean in the USA and Argentina. Figures from 1996 show the planting area 1,000,000 and 250,000 acres respectively. Today Monsanto is actively expanding the development of herbicide-resistance to other crops such as cotton and rice, hoping to transfer the technology to Thailand.

The agrochemical producers dump a huge amount of budget to promote their products using various strategies. For example:

- Entertaining VIP customers costs about 400,000-500,000 Baht each time,
- Oversea trip rewards are offered to retailers who reach the target in sale. Some people complain about this because all members of their family have already been rewarded.
- Promoting that one Baht from every liter sold will be donated to repair the historical ruins in the province (PATANANAN et al., 1996).

It is well known that the agrochemical companies have to pay money between 15-25% of total budget to officers when they sell pesticides to government agencies, especially DOAE. The government money loss through this loophole is expected to amount to about 45-75 million Baht per year.

Good relationships between the biggest agrochemical companies in Thailand, namely Monsanto or Ciba-Geigy, and some extension officers is the main cause for blocking many projects that are feared to effect their pesticide purchasing plan. For example, many officers believe that the integrated pest management project could not be implemented freely in 1995 during the reshuffle period of the department administrators. According to an NGO this may be the reason for the failure of the IPM program in the northern part of central region (MEENAKANIT, 1995).

4 Initiation of Projects and Activities for Reduced Agro-pesticide Usage and Promoting Conservative Agriculture

4.1 The Government Initiation

4.1.1 IPM Project

Because of pest problems and limitations of pesticide usage a concept of plant protection widely known under the term 'Integrated Pest Management' (IPM) was developed. At the early stage IPM was the strategy that aims to reduce losses due to pests, to maximize returns from investment in pest control and to minimize environmental disruptions. IPM was defined as the utilization of control tactics in an harmonious manner. Chemicals are used when the pest population exceeds the economic threshold level (ETL).

Between 1980-1988 with the assistance of the German Agency for Technical Cooperation the Thai-German Plant Protection Program (TG-PPP) was initiated and executed together with DOAE. Total project costs were estimated at about 100 million Baht. However, after termination this project was not regarded as highly successful. One factor may have arisen from the project target that emphasized on pest surveillance and early warning systems rather than improving farmers knowledge on agro-ecosystems. The other point was the project strategy which focused on training of plant protection technicians and insufficient interest in participatory training approaches for farmers.

The IPM concept that has been developed in tropical Asia focuses on ecological analysis and attempts to enhance farmers understanding of the role of natural enemies in the ecosystem and the law of 'balance of nature'. For effective implementation high consideration must be given to improve farmers' decision making through appropriate training programs (MEENAKANIT, 1993).

The second phase of IPM started in 1989 with the assistance of FAO. The introduction of a new philosophy of farmer training used a participatory approach and an experimental learning process under the name of farmers field school (FFS). Unfortunately, this project did not receive support from the administrators but scrapped the project and moved out the officers who were involved during 1993-1995. Since then the technical relation with FAO and other NGOs were faded out (MEENAKANIT, 1993).

According to DOAE's annual report in 1995, IPM has been implemented extensively in rice on an area of 620,000 rai, in upland crops on 1,300,000

rai, in perennials on 74,000 rai and in vegetables on 117,000 rai and was estimated to prevent yield losses of those crops at about 124, 216, 37, and 20 million Baht, respectively. This information was still doubted by extension officers and outsiders.

4.1.2 Pesticide Free Vegetable Project

DOAE originally implemented this project under the name Hygienic Vegetable while DOA used the name Pesticide Free Vegetable, just lately DOAE changed the project name to Hygienic Pesticide Free Vegetable. This project has been running for more than 10 years. However, it has just recently been well-known in public when the minister from Palang Dharmar Party took office.

The cooperation between the two departments does not seem well synchronized. The role of DOA, as known by the public, is to support organic farming technology to farmers and the private sector while DOAE emphasizes the promotion of pesticide free vegetables. The Pesticide Free Project is not regarded to promote lower pesticide usage or to attempt seriously the use of IPM principles (MEENAKANIT, 1993).

4.2 Alternative Agricultural Development by Social Groups

The initial wave of sustainable agricultural development was introduced by NGOs in 1985 as a mean of promoting non-synthetic chemical technology for agriculture. In 1989, the Alternative Agricultural Network was established and their 80 members are subjected to promote and adopt non-chemical technologies. Since 1992, environmental awareness among Thai people has grown when a number of environmental problems became obvious. Sustainable/ alternative agriculture seemed to be a promising option.

The Alternative Agricultural Network raised the controversial issue during 1991-1992 whether organic farming is possible in large scale commercial production or just practical for poor small farmers in rural areas. There are many objections from the Soil Science Society of Thailand and from Chareonpokaphand Company, the largest agro-industrial company for example. However, the controversy was settled later and promoting organic farming was started when they learned about the international trade agreement which was concerned with environment and health.

From 1992, there was an obvious change on the development of organic farming by the cooperation among organic growers and consumers via the increasing number of ’green shops’ in big cities across the country.

Sustainable agriculture was then included in the Eighth National Economic and Social Development Plan (1997-2001). In Indonesia the success of IPM under the Ministry of Agriculture came from the strong political will and the commitment of the government to reduce pesticide usage. In Thailand, the Alternative Agricultural Network (NGOs) was not well coordinated with the government and the international agencies (such as FAO, IRRI, GTZ, etc.) because they were still in doubt whether the agro-pesticide companies would use information and loopholes of the IPM process to protect their interest. In Indonesia, for example, Hoechst Co. advertised its products thiodan and endosulfan to be the recommended pesticides to use in IPM programs (MEENAKANIT, 1994).

4.3 Private Sector Initiation

Because of the International Trade Commitment private companies had to adapt themselves to comply with restrictions from the global society regarding pesticide use during the production process.

Nakhorn Luang rice trader, one of the biggest rice exporting companies in Thailand, for example, began to invest in organic-farming of rice in 110,000 rai in the northern region (Chiang Mai and Chiang Rai). The project started in 1995 and was targeted at the European market.

Another example is the Integrated Farming Project implemented by the CP group in 1995 in 43 villages in Lamphlaymart District, Buri Ram province, using fragrant jasmine rice variety. Pesticide use was minimized but fertilizer was still extensively used (MEENAKANIT, 1993). The company planned to expand this project if the result and response from producers and consumers were positive after the failure of its pilot project in Kanchanaburi in the central region in 1985. Reasons for failure have been double input of pesticides, fertilizer, and machinery compared to ordinary farmers.

5 Proposal for the Improvement of the Agricultural Extension System to Control Pesticide Usage

5.1 Vision: Multi-Agencies' Coordination to Support Sustainable Agriculture

As mentioned earlier the problem of pesticide use is not the responsibility of DOAE alone but also of the private sector, farmers, NGOs, consumers, and international organizations. Of course the importance of the agricultural sector has been substantially declined in terms of national income compared to other sectors. But as regards public health, life quality and environment the public generates an increased awareness on these issues making chemical free products more attractive for higher income groups. The Ministry of Agriculture and Cooperatives has to cooperate with other agencies like farmer organizations, consumers, NGOs, international organizations, as well as the pesticide industry.

The chronic problem of pesticides in agriculture results from the conventional agricultural system. Effective measures to reduce pesticide usage should base on the perception that pest control is just one component of sustainable agriculture. The sustainable agricultural approach offers many alternatives to chemical pest control. Generally speaking, pest control can be done without any hazard under the sustainable agricultural system.

An example of a single angle solution is shown by Monsanto's promotion saying that its herbicide can conserve the soil from the tilling process. It may be true that herbicides can reduce soil erosion but the residues will accumulate in the soil, being washed out into the ground and leaching into surface water.

Another example is the DOAE training manual on the principle of IPM under the line of 'Farmer Field School' explaining that 'growing healthy crops requires sufficient and appropriate fertilizer application such as N, P, K'. This recommendation induced farmers to believe that healthy crops can protect the plant from insects and diseases and increase yield. In fact, past experience of BPH outbreak showed that fertilizer, especially nitrogen, made the plant tissue more succulent and prone to be attacked by BPH.

5.2 Strategies: Comply with the 8th National Economic and Social Development Board Plans and Modify it into Practice

The current problem of extension strategies is insufficient awareness of proper pesticide control which means missing national strategies in this matter. The 7th NESDB Plan (1991-1996) specified the importance of reduced pesticide pollution in the environment using IPM as a strategy. But the master plan of DOAE put less weight on IPM and also no concrete target on IPM implementation (Department of Agricultural Extension, 1992).

Sustainable Agriculture is included in the 8th NESDB Plan (1997-2001). The general conclusion of this plan is to increase more opportunities and other alternatives in agricultural production under the frame of natural farming, organic farming, integrated farming, agro-forestry practices and to expand the sustainable agriculture areas to 20% of total agricultural area or about 25 million rai.

Furthermore, NESDB also plans to set details on the development of sustainable agriculture as follows:

(1) To improve farmers potential in planning and decision making towards sustainable agriculture using experiential learning processes and learning from successful farmers who practice sustainable agriculture.

(2) To promote and support farmers to adopt sustainable agriculture in various aspects:

- provide water resources for small farmers and marketing information through mass media for farmers proper decision making from accurate and updated information;
- promote and provide essential production inputs in harmony with natural ecosystem emphasized on using crop/animal resistant varieties;
- promote and support interdisciplinary research related to agricultural development by considering farmers' indigenous knowledge, biodiversity and biopesticide development;
- support the long-term credit for farmers to improve agricultural systems;
- develop the product quality and coordinate with concerning agencies.

(3) To improve government extension system by changing the role from pure extensionist to be a coordinator and facilitator offering alternatives to farmers according to their needs.

(4) To coordinate with the private sector and NGOs to improve the agricultural system.

Although the 8th NESDB Plan did not clearly state the direction of pest control the target area for sustainable agriculture must be 1/5 of the total agricultural area (ISHII-EITEMAN, 1995).

At the beginning the Agriculture and Cooperative Plan did not comply with the 8th NESDB Plan, especially the promotion of sustainable agriculture. After the movement of Forum of the Poor from March to May 1997, the Ministry of Agriculture and Cooperative improved the plans and inserted the policy on sustainable agriculture. Furthermore, projects and measures are designated to aim for the reduction of pesticide use in agriculture:

(1) Promote and support sustainable agriculture especially for poor farmers

The sustainable agriculture project is projected to cover the area of 25 million rai in 5 years and 8 million farmers in four categories as follows:

Area prone to erosion	5 million rai
Saline/acid soil and low-organic matter area	5 million rai
Reformative area and old shrimp farms	10 million rai
Area needed by farmers to convert to sustainable agriculture	5 million rai

(2) Organic-farming project

The organic-farming project was initiated by DOA and the Ministry of Agriculture and Cooperatives before the demonstration of the Forum of the Poor. This project included research, extension, marketing system development and the support to standardize organic agricultural products. It was the only response to 8th NESDB Plan especially in terms of sustainable agricultural system. The budget was set aside at 5,000 million Baht for operation and 3,000 million Baht as revolving fund for organic farming.

(3) Pilot project for the development of sustainable agriculture for small farmers

This project was demanded by the Forum of Poor Farmers to develop sustainable agriculture. The principle of this project focuses on farmers participation with support from the government. The budget for this pilot area is 950 million Baht covering 24,800 farmer families.

5.3 Measurements to Control Pesticide Promotion by Agrochemical Companies

Agrochemical companies have influenced agricultural extension in Thailand for a long time. The criteria to reduce and control pesticide usage must be coordinated with the agrochemical companies. The policy on seeking alternative methods should be carried out together with pesticide promotion policy. For example, IPM projects and pesticide reduction projects will never succeed if there is no drastic measure to control pesticide promotion.

Essential measurements to be done to support the project are as follows:

(1) Cancellation of all kinds of subsidies for agrochemical business by:

- Cancellation of pesticide purchasing fund (about 300 million Baht p.a.) which gives pesticides to farmers for free. This policy creates adverse effects rather than advantages and confuses with other projects. Farmers do not easily accept IPM because using pesticides is more convenient.
- Cancellation of other indirect subsidies such as promotion of pesticides in the government mass media, etc.

(2) Prohibition of usage and sale of agro-pesticides that:

- do not conform with the IPM or sustainable agriculture approach (such as methylparathion, monocrotophos) because these highly toxic pesticides destroy a wide range of living organisms and the ecosystem.
- Banned or restricted use and sale of pesticide in WHO class Ia and Ib, that is to say, pesticides requiring PIC procedure of FAO, and pesticides which are banned in their producing countries (such as paraquat) and pesticides in the Dirty Dozen Group (such as aldicarb, chlordane, DBOC, lindane, and pentachlorophenol).
- Impose strict measures in controlling the promotion and advertisement of pesticides and their labeling by designated mechanisms according to the FAO Code of Conduct and the Hazardous Substance Act of 1992 (WIDJANARKA and THJADI, 1995).

5.4 People's Participation

Agricultural extension and other rural development projects need people's participation as stated in 8th NESDB Plan.

In 1993, FAO announced the principles of IPM in the 'IPM Manifest' declaration in Bangkok. The three important issues discussed are (WIDJANARKA and THJADI, 1995):

- To empower the farmer to be an expert in IPM.
- IPM should be done by farmers (not for farmers).
- Farmers' participatory research and training approach are the main activities of IPM implementation.

Both, the 8th NESDB Plan as well as the Ministry of Agriculture's master plan include the proposal that farmers and laymen should participate in all projects. However, during implementation these projects were not conducted under the guidelines as advised by the government – especially the participatory training approach. Probably these training methods were new for the extension service. Thus, it is necessary to induce cooperation among farmers, NGOs and government agencies.

Farmers' participation in agricultural extension aims to reduce the usage of pesticides and to sustainable agriculture, for example:

(1) Representatives from farmers, NGOs and consumers have to be included in the committee on pesticide usage and policy making. Currently, there is one NGO representative in the draft committee to prepare the law on flora conservation.

(2) All agricultural projects should include people from NGOs at all levels. Now the project on sustainable agriculture is actively implemented by farmers' participation. This is one issue that complies with 8th NESDB Plan.

(3) Encourage farmers to be the center for implementation of the government programs. The major purpose is to increase farmers' empowerment, evaluation and quality of sustainable agriculture projects.

(4) Farmers participation in the field should be enhanced immediately because we are lagging behind other countries in the region for many years.

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VI Working Report Summary

Working Group Discussion

World Education, Asia (WEA)[1,2]

Four working groups were formed:

Group 1:	Legal and Regulatory Framework of Pesticide Policy in Thailand.
Group 2:	Economic and Fiscal Framework of Pesticide Policy – Current Design and Future Perspectives.
Group 3:	Design of Extension System in Thailand.
Group 4:	Focus of Government Research in Crop Protection.

Overall Recommendations:

1. The outcomes from each group reflect the issues Thailand is encountering and the needs for further development to address the national problems with both immediate and long term efforts in pesticide policy.
2. Some recommendations of each group are overlapping and will require further consolidation by appropriate follow-up actions.
3. There is a need to hold a follow up workshop to further discuss and clarify issues and recommendations that have not been addressed in detail due to the limited time allocated during this workshop. The development of national policies is a sensitive process and requires a broader representation of the mass and/or stakeholders. It may not be appropriate for certain government agencies to carry out this task since there may be some influence from political or external forces; hence, a neutral organization, like TDRI, is highly recommended to further assist with the follow up actions.
4. Future support from FAO and GTZ, the respective international input, is essential for Thailand to further review and establish the policies, especially regarding the development of responsive Integrated Pest Management Programs.

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1 WEA was requested to provide assistance to moderate and facilitate the group discussions of the workshop.

2 The WEA moderator team comprised of the following persons:
1. Mr. Marut Jatiket, WEA Director
2. Mr. Banharn Chantakomuth, IPM officer
3. Dr. Manop Kanato, Professor of Medical Science, Khonkaen University
4. Mr. Vitoon Panyakul, Green Net Director
5. Mr. Klaus Strenzke, CUSO

Group 1: Laws and Enforcement Related to the Use of Chemical Pesticides

A. Major Issues

1. Inadequate law to cover the issues: brand name registration, labels, advertisement, accountability and insurance (to pay for damage by company)
2. ISO 14000 for quality control (long term)
3. Overuse, unnecessary use and misuse of chemical substances
4. Quantification of health hazards in the field
5. Banning of certain types of chemical substances in WHO Ia category (extremely hazardous)
6. Process of registration is deficient:
   - not all new substances are registered
   - not all old substances are re-registered
   - uncontrolled local production
   - new substances: no differentiation of risk group
   - no infrastructure to connect between concerned agencies
   - composition of committee
   - registration and tracking of bio-agent
7. Banning:
   - lack of risk assessment taking conditions into account in order to provide field information (baseline data) to determine the level of toxic products use
   - banning of active ingredients not only formulations
   - the speed of the banning process (there are 6 other substances that have been proposed but not yet banned)
8. Enforcement:
   - mechanism for control and monitoring is not functioning well
   - the sampling of toxic substances by DOA Toxic Substances Division is very slow and inefficient
   - there is no effective controlling and monitoring of selling banned substances in the market

B. Recommendations for Registering of Chemical Substances

a) Pre-Marketing

1. Institutional Framework:
   - Immediate needs:
     - Expand the capacity of the Agricultural Toxic Substances Division to cope with the current work load, and increase the number of experts for toxicity in the committee to review the substances.
     - Strengthen the enforcement of regulations on usage, stocks, and the availability of the banned chemicals in the local market, i.e. the illegal and smuggled substances.
   - Long term:
     - Develop an independent organization/unit to undertake the registration with autonomy and not attached to DOA.
     - Increase the representation of other experts, NGOs, consumers, and farmers.
     - Explore the possibility of merging the Agricultural Toxic Substances Division and Agricultural Regulatory Division and/or privatization of these agencies. Their roles should include evaluating the data from companies, checking GLP, assessing occupational and environmental exposure, and residues.
     - Explore the possibility of incentives and budget for the agencies by taxation of the chemical companies and by registration fees.
2. The Agricultural Toxic Substances Division conducts the Exposure Assessment for
   - substances that are not yet registered
   - substances that are formerly registered, but not re-registered
   - old substances that have never been registered being used
3. Periodic joint committee meetings should be held to review the substances that are highly toxic and have long term residues in preparation for issuing the banning of imported substances and their usage.

b) Post-Marketing

Strengthen the enforcement system by:

- Review the current system and practice to enforce the banned substances still available in the market and illegal substances (that contain incorrect ingredients on the label or are not registered)
- Food and Drug Administration (FDA) should periodically inspect the produce in the local market to identify the misuse and overuse of pesticides.

How:

- Decentralize the authority to local level with a clear policy and implementation guidelines
- Increase the laboratory capacity in the regions and develop mechanisms to allow NGOs to participate in the inspection process
- Develop mechanisms to allow people to participate in monitoring
- Disseminate information to the communities by government and private agencies
- Develop a compliance policy
- Develop a tracking system of distribution (Management Information System)
- Explore the possibility of taxation (Polluter Pays Principle)

Group 2: Economic and Fiscal Framework of Pesticide Policy – Current Design and Future Perspectives

A. Short Term Measures

1. Monitoring/ Inspection (Enforcement)
   - Accelerate the inspection process of illegal pesticide products available in the market including banned chemicals, banned imported chemicals, and mislabeled products. Impose heavier penalty including jail term (not only fine)
   - Promote the development and establishment of more regional inspection centers in order to accelerate the inspection process.
   - Encourage the effective utilization of the FAO Code of Conduct.
2. Budget Allocations:
   - Re-allocate the outbreak budget by banning the distribution of free pesticides to farmers and convert those funds for other activities such as monitoring, extension and training in ecological IPM using FPR (Farmer Participatory Research) approach or FFS (Farmer Field School) training style.
   - Banning of all forms of using chemicals for aid or assistance.
   - Any crop promotion projects by governmental agencies, especially DOAE, should not hide pesticide budget in the form of package assistance offered to farmers.
3. Clearly define and separate roles of governmental agencies regarding extension, monitoring, and registration of pesticide products by establishing independent agencies to be responsible for each role, and develop a structure for an effective collaboration process.
4. Ban importation, production and distribution of highly toxic chemicals for agricultural uses (classes Ia and Ib) and develop criteria/ measures utilizing information from WHO and FAO.

5. Eliminate conditions that force farmers to buy and use chemical pesticides as part of the credit schemes, especially those offered by governmental agencies and DOAE, by allowing farmers to make their own decision.

B. Long Term Measures

1. Revise the import duty for pesticides by allowing the rate to be comparable with other products and other production factors.
2. Accelerate the utilization of taxation on environmental impacts of pesticides by calculating the tax from the level of toxicity of the substance and the impact on health and environment (externalities).
3. Consider the increase of registration fees for pesticides and avoid creating problems of business monopoly by manipulation of the specification in favor of the buyer which will effect the small scale business.
4. Regulate bank guarantees of private companies as part of the registration process in order to control manufacturers and distributors of the sub-standard products.
5. Enhance the utilization of bio-pesticides or botanical pesticides by increasing tax or setting restrictions for toxic synthetic pesticides, while lowering or exempting the tax for bio-pesticides. Divert the outbreak budget to accelerate the promotion of bio-pesticides and also research and development.

Group 3: Design of Extension System in Thailand

1 Government

Issues:

1. Government's support of the Green Revolution Policy
2. Lack of clarity for the implementation of sustainable agricultural development indicated in the 8th National Plan

Recommendation:

Develop a national master plan for the development of sustainable agriculture and Integrated Pest Management (IPM)

2 Manufacturer/ Distributor/ Retailer

Issues:

1. The lack of control and enforcement of market competition and advertisement encourages farmers' behavior to misuse, unnecessary use and overuse chemicals and the tendency for increasing the use of chemicals.
2. The lack of business ethic by
   - influencing the government system, i.e. collusion.
   - selling sub-standard products.
3. The perception that there are no other alternatives for farmers except the use of chemicals.

Recommendations:

1. Enforce measures to control the advertisement and public campaigns of pesticide companies in accordance with the Code of Conduct. Re-enactment of the law to impose heavier penalty for violators
2. Encourage the proper retailer classification between chemical/hazardous products and other consumable/non-consumable items.
3. Provide proper training in agricultural chemical products for small retailers and their stuff.
4. Enforce the chemical manufacturers to initiate the recall of products that have a dangerous impact on the development of sustainable agriculture.
5. Provide support for the development of sustainable agriculture.

3 Agricultural Extension

Issues:

1. Unclear structure and mechanisms for the implementation of IPM within the department
   - Organizational structure
   - Work procedures
2. The resource allocation for agricultural extension still focuses on the use of chemicals
3. Inefficient and proper process of knowledge transfer to farmers and agricultural extension officers
4. Lack of will in collaboration among the involved agencies both at the policy and implementation levels.
5. Lack of clarity of roles and responsibility among field officers including the lack of incentives and motivation to promote sustainable agricultural practices.

Recommendations:

1. The Department of Agricultural Extension must provide a clear policy, a master plan, and allocate its budget to support sustainable agriculture and IPM programs
2. Build collaboration among DOAE, other concerned government agencies, educational institutions, NGOs, and the private sector for the development of sustainable agriculture and IPM programs
3. Develop and train DOAE staff in accordance with the concept of ecological IPM
4. Conduct participatory action research to evaluate IPM implementation
5. Administrators pay more attention on technical issues rather than personal and financial management.

4 Farmers

Issues:

1. Farmers continue to receive information primarily focusing on the use of chemicals. Alternatives to synthetic pesticides are still not widely available.
2. The knowledge of sustainable agriculture and IPM has not been efficiently transferred to farmers.
3. Farmers still value the use of chemicals because of its effectiveness and less use of manpower.

Sustainable agriculture and IPM practices require a lengthy period of time; thus, farmers are afraid to take the risk to experiment with this practice.

Recommendations:

1. Government must support credit schemes and the marketing management in favor of alternatives to synthetic pesticides.
2. Conscientiously provide the opportunity for farmers to participate in setting goals, developing work plans, and conducting research projects.
3. Build capacity of farmers' organizations to enable them to manage their own and external resources, and also provide them with the power for decision making concerning sustainable agriculture and IPM programs.

5 Consumers

Issues:

1. Lack of real interest and information in consuming chemical-free produce
2. Lack of trust in chemical-free products
3. Lack of consumers' groups or organizations to propel the production, consumption, distributions and inspection of chemical-free products

Recommendations:

1. Encourage the establishment of consumer organizations
2. Government should launch a public campaign to promote the consumption of chemical-free products.

6 Other Agencies

6.1 Non-governmental Organizations (NGOs)

Issues:

1. Lack of collaboration among NGOs in promoting IPM due to their non-acceptance of the IPM concept which still allows the use of chemicals. Some NGOs totally resist the use of any chemicals including fertilizers and synthetic growth hormones.
2. Lack of NGOs to take the responsibility of inspecting and monitoring the current situation of chemical usage

Recommendations:

1. Government agencies should collaborate with NGOs to promote sustainable agriculture and IPM.

2. Encourage NGOs to participate in the inspection and monitoring the use of chemicals.

6.2 Educational Institutions

Issues:

1. Lack of appropriate curriculum for effective learning of sustainable agriculture and IPM practice. The current curriculum still lags behind the dynamic development of ecological IPM.
2. Educational institutions do not aim to solve the problems of chemical usage and to promote sustainable agriculture and IPM practice.

Recommendation:

Educational institutions should collaborate with other governmental and private sectors to develop an appropriate curriculum for effective learning of sustainable agriculture and IPM practice.

7 Action Plans

1. MOAC should establish a joint committee to develop a master plan for sustainable agriculture and IPM practice.
2. DOAE should be the core agency to establish a joint committee formed by various government organizations and the public agency representatives to develop sustainable agriculture and IPM programs
3. Conduct research and studies on the results of previous IPM implementation programs.

Group 4: Priorities of Government Research in Crop Protection

A. Major Issues:

1. Lack of clear policy and direction on bio-diversity research especially in agro-ecosystems.
2. The lack of research on socio-economic factors of agriculture.
3. No establishment of an identification zone for each type of crop (crop zoning).
4. The lack of analytical laboratory test results for setting standards for chemicals and toxic residues. (Currently standardized for 8 types). Laboratory work should be handed over to private companies, and research and studies should not be conducted by government agencies.
5. The technology transfer to farmers via extension process is ineffective. Farmers still lack basic knowledge and perceptions of IPM practices and are unable to implement the IPM by themselves.
6. Lack of economic analysis for non-chemical alternatives for the agricultural sector.

7. Unclear direction of research and lack of prioritization of research topics. The research on pest management should use a more interdisciplinary approach.

B. Recommendations:

1. The directions of each research area should reflect its holistic composition and utilize a multi-disciplinary approach.
2. Farmers should receive research results and be allowed to lead and participate in the implementation and dissemination.
3. The Department of Agriculture should use the international standards as a guideline to establish the standards of chemical use for Thailand, or encourage privatization of conducting research and utilize the results for setting the standard. Cooperation between DOA and DOAE in research and development of IPM should be more seriously strengthened.
4. Research should be more open and based on farmers' real problems which reflect specific characteristics of each locality, and give attention to the validity of research results. Cooperation with international organizations e.g. FAO, IRRS etc.
5. Issues for future research:
    - Bio-diversity, especially agro-ecosystem
    - Pest management (concepts, philosophy, procedures, and implementation)
    - Technology transfer and Research & Development including Research & Extension.
    - Reduction of chemical usage, studies to improve current efforts and search for other alternatives, including the analysis and comparison of investment and returns.
    - Farmers' reception of information, two-way communication, and dialogue engaging.
    - Policy and institutional research
    - Technical assistance and academic support for education, e.g. curriculum development and training for all levels from management to practitioners.
    - Bio-technology
    - Commercial and business research
    - Human risk assessment
    - Environmental impact assessment
    - Social and environmental costs

C. Institutional Framework in Policy Formulation

1. Government should improve the budget allocation for research following holistic and interdisciplinary approaches.
2. The composition of researchers should include the following:

- Experts from various government departments and divisions and universities
- Private and business sector
- Non-government organizations
- Farmers and other concerned parties

3. All research projects must integrate monitoring and evaluation in every step and should set up an agency responsible for progress monitoring and evaluating research projects such as,

Level	Responsible agency
• National level	National Research Institution
• Ministerial level	Office of Agricultural Economics
• Departmental level	Practitioners and implementing officers, should use internal mechanism to increase the effectiveness of monitoring system

4. All parties should begin to be involved in planning, budgeting, implementing and evaluating the research results
5. When conducting research, all parties involved should comply with the following guidelines:
   - upgrade farmers' knowledge to the requirements of the development or research
   - the characteristics of research projects should provide linkages in the form of networking
   - all steps of research must be based on farmers' problems and clearly involve the four parties in the steps of studies, laboratory tests, and field tests of the results which emphasize experimenting and studying with farmers

D. Future Plan

1. Develop a master plan to study pest management of agricultural export products and environmental protection. The emphasis of the studies should be placed on the following:
   - improvement of genes to standard
   - studies of diseases and pests based on ecological basis
   - reduction of chemical residues in the produce
   - analysis of market competition and production of chemicals
   - revision of the management structure for international trade
2. The master plan for research should consist of the following:

   vision, mission, goals and objectives, work plans and strategies, activities, time frame, budget/finance

3. Human resources development must be considered as the heart of the master plan especially for the integration of IPM in all activities

Annex 1:

Workshop Schedule

Thursday, July 3, 1997

18:20 - 20:00	Registration, Check-in at the Royal Garden Resort, Hua Hin

Friday, July 4, 1997

Session 1	Opening Ceremony by Dr. Ammar Siamwalla, TDRI
8:30 - 8:55	"Pesticide Policy: An International Perspective" Dr. Hermann Waibel, University of Hannover
8:55: - 9:10	Discussion: Pesticide Policy - An International Perspective Dr. Ammar Siamwalla, TDRI
9:10 - 9:40	Open Discussion
9:40 - 10:50	Legal & Regulatory Framework Dr. Kwanchai Sombutsiri, Kasetsart University
10:05 - 10:30	Fiscal & Economic Framework Mr. Martin Ruhs, Mr. Nat Rattanadilok Na Phuket and Dr. Nipon Poapongsakorn, TDRI
10;30 - 10:50	Coffee Break
10:50 - 11:05	Discussion: Legal & Regulatory Framework Ms. Yupa Leelaprut, Ministry of Health
11:05 - 11:20	Discussion: Fiscal & Economic Framework Dr. Supachitr Manopimoke, Thammasart University
11:20 - 12:00	Open Discussion Moderator: Dr. Nipon Poapongsakorn, TDRI
12:00 - 13:00	Lunch Break

Session 2	**Presentations and Working Groups**
13:00 - 13:25	Extension Framework Mr. Witoon Lianjumroon, Institute of Social Science
13:25 - 13:50	Research Framework Mr. Chanuan Ratanawaraha, Ministry of Agriculture and Cooperatives
13:50 - 14:05	Discussion: Extension Framework Mr. Charoen Suknanthapong, Ministry of Agriculture and Cooperatives
14:05 - 14:20	Discussion: Research Framework Dr. Banpot Na Pompeth, Kasetsart University Moderator: Mr. O-Cha Prachubmoh, DOA
14:20 - 14:40	Coffee Break
14:40 - 16:30	Four Working Groups
18:00 - 20:00	Dinner
20:30 - 21:30	Working Groups (cont.)
21:30 - 22:00	Coffee - Tea
	Saturday, July 5, 1997
Session 3	**Summary of Working Groups**
9:00 - 10:30	Summary of the four Working Groups by their Chairmen
10:30 - 11:00	Coffee Break
11:00 - 12:30	Panel Discussion: The Future Path of Pesticide Policy Panelists: Mr. Pitipong Peungboon Na Ayuthaya, Ministry of Agriculture and Cooperation Mr. Annop Tunskul, Rungsit Settakit Kan Kaset Ltd. Mr. Chalat Sripicharn, World Environment Centre Mr. Sanya Bhumichitr, Monsanto (Thailand) Ltd. Moderator: Dr. Chermsak Pithong, Thammasat University
12:30 - 13:30	Lunch Break
13:30 - 14:00	Summary of the Workshop
14:00 - 14:15	Closing Ceremony
14:15 - 14:45	Coffee

Annex 2:

List of Participants

	University		
1.	Dr. Chapika	Sangkapitak	Faculty of Agriculture, Kasetsart University
2.	Dr. Vichien	Hengsawatt	Faculty of Agriculture, Chiangmai University
3.	Dr. Adis	Israngkura	School of Development Economics, National Institute of Development Administration
4.	Ms. Prapinwadee	Sirisuppalak	Faculty of Agriculture Economics, Kasetsart University
5.	Ass. Prof. Dr. Palarp	Sinhaseni	Medical Science Research Institute, Chulalongkorn University
6.	Ass. Prof. Dr. Somnuk	Wongthong	Faculty of Agriculture, Kasetsart University
7.	Ass. Prof. Manop	Kanato	Department of Medicine, Kon Kaen University
8.	Dr. Kwanchai	Sombutsiri	Kasetsart University
9.	Dr. Banpot	Na Pompeth	Kasetsart University
10.	Dr. Suppachitr	Manophimoke	Thammasart University
11.	Dr. Chermsak	Pinthong	Thammasart University
12.	Dr. Supanee	Pimsamarn	Faculty of Agriculture, Kon Kaen University
	Government Agency		
13.	Mr. Chanuan	Rattanawaraha	Ministry of Agriculture and Cooperatives
14.	Mr. Charoen	Suknanthapong	Ministry of Agriculture and Cooperatives
15.	Ms. Yupa	Leelaprut	Ministry of Public Health
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