TDRI Quarterly Review
Published in *TDRI Quarterly Review*
Vol. 12 No. 1 March 1997, pp. 16-23
Editor: Belinda Fuller

Analysis of Crop Protection Policy in Thailand*

Frauke Jungbluth**

THE PROBLEM

For several decades pesticides have been used as the primary method to control pests in agriculture. The introduction of intensive monoculture with high yielding varieties and high rates of fertilizer use made adoption of pesticides a cost-effective choice. At first glance, the benefits of following this technological path seemed obvious. However, pesticides themselves have induced changes in agricultural and ecosystems with negative consequences, such as pest resistance, the destruction of beneficial organisms or pesticide residues in food and water. Pesticides, however, are still regarded as important for securing sufficient agricultural production and increasing crop yields. The ongoing subsidization of pesticides in national agricultural policy is one indicator of this belief. This leads to the assumption that the common opinion about benefits of pesticide use has been taken for granted and that the external effects of pesticide use have not yet been taken sufficiently into account in crop protection policies. The hypothesis here is that in many cases the amount of pesticides currently used in various cropping systems has reached a level which is suboptimal from both the farmers' and the societies' point of view. The following three questions are the focus of this report: How did the pesticide market in Thailand develop? To what extent do externalities exist? What factors influence pesticide use?[1] Before concentrating on trends in Thailand's agricultural sector and pesticide market, an introduction of the theoretical background of private and social optimum of pesticide use is given. Evidence of external effects and factors influencing pesticide use will be discussed and a summary and recommendations will conclude the report.

THEORETICAL BACKGROUND

Economic assessment of pesticide use has to be treated within a framework that covers the farmers' as well as the societies' point of view (see Figure 1). The criterion for the farmer is to maximize expected net returns. Gross returns from applying pesticides is equal to prevented crop loss in monetary terms. Costs of pest control are referred to as the amount of farm resources used for every unit of crop loss prevented. The farmer's level of pesticide use is therefore denoted A. This level depends on the farmer's subjective assessment of crop loss, the effectiveness of his control methods and the costs which he perceives *(perceived private costs)*. If perfect information on these parameters were available, the optimal level of pesticide use would be reduced to B which would increase his net returns as denoted in the distance between the cost and the benefit curve in Figure 1.

Society's goal in using pesticides is to maximize net social benefit. This differs from the private optimum because pesticides cause external effects, e.g., through the contamination of ground water or food, which are not taken into account by the farmer. When these negative externalities are included, the cost curve shifts upward *(social cost curve)* and further reduces the optimal level of pesticide use to C.

Additional costs result from the overuse of pesticides. Potential and actual damage caused by pesticides leads to an increased need for government activities aimed at monitoring the implementation of rules and regulations on pesticide use and at reducing the environmental and health damage caused by pesticides. Examples of such activities are the establishment of pesticide residue laboratories, residue monitoring programs and training programs on the safe use of pesticides. There is no doubt that such activities, mostly requiring public funds, are necessary in principal. It must be pointed out that the framework does not exactly determine an optimal level of pesticide use but is meant to guide in judging the pesticide situation in a country as being above or below the social optimum.

DEVELOPMENT TREND IN THAILAND'S AGRICULTURAL SECTOR AND PESTICIDE MARKET

The Agricultural Sector

In 1992, agricultural export as a percentage of total exports was approximately 15 percent (down from 46 percent in 1982); this amounted to roughly 100 billion baht (*Bangkok Post*, 1995). Rice is still the most important crop and is

planted on around 44 percent of arable land. It still has a share of 21.7 percent of agricultural exports.

The most important changes are taking place in the rapidly growing horticultural sector. The Ministry of Agriculture and Cooperatives now strongly promotes fruit production through a restructuring program aimed at transforming land cultivated with rice, cassava, coffee and pepper into fruit orchards.[2] In Figure 2, the increasing importance of fruit and vegetables in terms of crop values is visible, whereas rice has a declining trend. Upland crops which were of major importance in the early 1980s lost their share due to declining prices.

The Pesticide Market

The trend toward agricultural diversification goes along with a tendency toward pesticide intensive crops. The intensity of pesticide use in vegetables and fruit is comparatively high and therefore contributes to the overall trend of increasing agrochemical use in the country. For the years 1982-1992, the annual growth rate of the agrochemical market in Thailand amounted to 8.8 percent, while the rate of increase has slowed down in recent years. An agrochemical market growth of 2.5 percent yearly is forecasted for the next five years (Mackenzie 1993). At the same time, problems with the chemical approach of pest control has become more obvious. Sinchaisri (1988) pointed out some possible reasons for the failure of chemical control: improper pesticide application, use of expired chemicals and incorrect labeling of active ingredients. Resistance problems and pesticide overuse can be added to this list. Based on 1992 data (Figure 3), herbicides hold a pesticide market share of 51 percent, insecticides 38 percent and fungicides 10 percent, while fruit and vegetable contribute with 29 percent to the market share compared to 20 percent for rice production.

Major pesticides used include monocrotophos, metamidophos, methyl parathion, methomyl, glyphosate, 2,4-D, atrazine, ametryn and paraquat. Many companies import and sell pesticides in Thailand. A factor impeding on the transparency of pesticide use and control is the proliferation of trade names. For example, monocrotophos is being sold under 274 different trade names, methyl parathion under 296 and paraquat under 55 (CIRAD 1990). As stated in a report by FAO-JICA (1995), a strong preference for cheap pesticide products exists in Thailand. This partly explains the enormous share of pesticides classified as "most hazardous" in the Thai pesticide market which tend to be cheap in international markets.[3] Songsakul (1991), for example, found that for vegetable production in the Pathum Thani province the pesticide costs amount to an average share of 14.6 percent of total variable costs. Figure 4 gives an overview over the strong increase of pesticide imports to Thailand over the last twenty years.

EVIDENCE OF EXTERNALITIES[4]

Health Hazards

Studies reviewed by Grandstaff (1992) concluded that farmers generally do not care about or are not aware of potential hazards pesticides may cause for themselves and the consumer. The majority of farmers interviewed used to spray pesticides frequently, especially in the vegetable and fruit sector, and harvested their crops for marketing before the end of the recommended waiting period. Good market prices have been mentioned to be more important than accepting the required waiting period. About half of the Thai farmers apply higher than recommended concentrations and do not pay any or very little attention to labels and protective clothing (Sinhaseni 1994). Figure 5 shows the development trend of occupational poisoning cases. However, as not all poisoning cases are reported to the official statistics, it can be assumed that the actual number of pesticide poisoning cases is underestimated.

Residues

A recent study, focusing on pesticide residues in rice, conducted in the central region of Thailand in 1991/1992 states that residues could be found in paddy soil as well as in paddy and run off water. None of them has been found to be over the maximum residue level (MRL) (Tayaputch 1994). Major pesticides analyzed have been monocrotophos, methyl parathion, 2,4-D and carbendazim. The study concluded that there are no implications for short-term effects of these residues.

A study of the Division of Toxic Substances on residues in fruit and vegetables found that around 37 percent of vegetables were contaminated with organophosphorous insecticide residues. About 20 percent of kale and 10 percent of cowpea showed residues exceeding the MRL. Seventy-three percent of tangerine samples were contaminated with pesticide residues (around 10 percent exceeding the MRL) which consisted mainly of malathion, monocrotophos and methyl parathion (Palakool 1995).

Resistance and Resurgence

Setboonsarng (1993) stated that the brown plant hopper (BPH) outbreak is the most recent example of pest resurgence. The BPH was never a serious problem until farmers started to intensify pesticide use, which simultaneously killed the insects which helped to control BPH. Ironically, increasing amounts of pesticides were used to control the BPH, but resurgence of BPH became worse and led to the most severe outbreak in 1990.

Sinchaisri (1988) states that within a decade the efficacy of pyrethroids in cotton in Thailand decreased from around eighty to nearly zero percent. The dependency on pesticides can be most clearly shown in the area of vegetables where problems of pest resistance lead to an overdosing of pesticides by a factor of up to eight times the recommended rate (Waibel and Setboonsarng 1993). A recent study in vegetable growing concluded that vegetable growers seem to accept the fact that pests build resistance after a short period of time (Jourdain and Rattanasatien 1995). Other external effects which have to be considered for calculating the social net benefit are the destruction of beneficial insects, reduction of biodiversity, pollution of drinking water, and non-agricultural consequences. However, in Thailand, information on the prevalence and associated costs of these externalities is limited. More knowledge in these fields would be desirable in the future.

PESTICIDE POLICY

Factors Influencing Pesticide Use

Several factors indicate an ongoing support of pesticide use in Thailand, in both the political and institutional framework and in political decision-making processes. Among crop protection experts there is a consensus that pesticides are in many cases either mis- or overused and therefore measures have to be implemented that limit the use of pesticides to an economically viable and environmentally sound level. Waibel (1994) classified factors causing excessive pesticide use into price and non-price factors, as well as obvious and hidden factors.

Tax policy

In general, the total import taxes consist of import duty, business tax and municipal tax and is based on c.i.f. price value. The tax structure related to pesticides has been favorable compared to other inputs and therefore has helped keep pesticide prices low. Since 1991, pesticides have been exempted totally from import duty, business and municipal taxes. This total tax exemption can be clearly interpreted as an indirect subsidy for pesticide imports and pesticide prices. It can also be seen as a subsidy for hazardous products which are cheap on the world market and do not face taxation in relation to hazardousness when imported to Thailand.

Pesticide Regulations

Within the amendment of the Hazardous Substances Act, the regulatory process changed slightly. Thailand agreed to the *FAO Code of Conduct* and the *FAO Prior Informed Consent*. Thailand's liberal pesticide market resulted in a big variety of product names and pesticide companies. Therefore market transparency is lacking and it is difficult for the regulating agency as well as the user to know the products and how to use them.

Research and Extension

The Department of Agriculture (DOA) is in charge of all agricultural research projects and is responsible for developing technologies, which are tested and transferred to the farmers by the Department of Agricultural Extension (DOAE). The DOAE is in charge of extension work and formulates strategies for technology dissemination according to national policy targets. A large share of the governmental research and extension budget is spent on chemical pesticide related issues. Government research has tended to focus more on importable commodities (Siamwalla et al. 1992).

Outbreak Budget

The government maintains a fund for pest outbreaks; under such circumstances, pesticides are given to the farmers for free. Farah (1993) mentioned this as the major pesticide subsidy. The outbreak budget represents an important factor of support for pesticides. The usefulness of such a budget should be further investigated since past experience showed that, first, when a pest outbreak occurs, the budget was not sufficient and, second, the allocation of pesticides to infested areas has been observed to be too slow to effectively limit damages. Alternative use of the money spent on the outbreak budget, for instance, farmers training, might be more successful in the control of pest outbreaks.

Agricultural Credits

The Bank of Agriculture and Agricultural Cooperatives (BAAC) is the key institute for the implementation of agricultural credit policy (TDRI 1995). In 1992, short-term credit for agricultural inputs, including pesticides, were made available by BAAC (Grandstaff 1992). A credit policy which explicitly includes pesticides in its credit program has a supporting effect on pesticide use because pesticides are included without sufficient information about use patterns and other crop protection alternatives.

Information and Training

Two kinds of information related to pesticide use are essential: 1) information about the benefits and costs related to the use of a certain pesticide; and 2) information about possible alternatives. Waibel (1990) states that a lack of information exists on the danger of application and handling of pesticides, about the quality and formulation of pesticides, production date and content of pesticides. Insufficient or incorrect information has also had an indirect supporting effect on the use of pesticides.

Extension and training conducted by the extension service focuses mainly on pest management based on pesticide use. Increasing attention is given to integrated pest management (IPM) methods in recent years. In addition to the governmental extension service, training is also conducted by the pesticide companies in cooperation with GIFAP's (International Group of National Associations of Manufacturers of Agro-chemical Products) "safe use training." As the name indicates, the focus lies on the safe use of pesticides and on application methods training.

Expert Assessment

Toward assessing the current situation in crop protection policy in Thailand, an expert survey was conducted among various key persons in the governmental and non-governmental sectors. Four groups of factors influencing the use of pesticides can be identified: price factors, institutional factors, factors related to information and human resources, and factors related to the lack of consideration of external costs of pesticide use.

As major trends for the future development of crop protection IPM, less use of hazardous pesticides and increased use of biological pesticides have been named by the experts. However, some experts believe that widespread and heavy use of pesticides will continue, herbicide use will increase due to labor shortage and that the current situation will not change drastically. The latter statement is based on the fact that nearly all experts see constraints involved in the future trend like ongoing pesticide subsidies, weak enforcement of pesticide regulation and current research and extension practices.

Table 1 summarizes an assessment of the actual versus the preferred policy design in crop protection. Rank one is the subject with the highest priority while rank ten indicates the lowest priority. In a second step the experts have been asked to rank the same subjects according to their own opinion of a preferred ranking.

The ranking of the actual crop protection policy shows a clear priority on pesticide-related issues like the safe use, the outbreak budget and regulatory policies. Chemical crop protection has been ranked as the subject with the highest priority in current pesticide policy by the experts. The first non-chemical issue find its place with IPM training for the extension service. IPM training for farmers and non-chemical control methods are ranked at the end of the scale. The second column in the table represents the preferred ranking of crop protection policies. Here non-chemical issues are gaining more importance which includes IPM training for the extension service and farmers as well as non-chemical control methods. The assessment conducted by the experts shows clearly that in crop protection policy priorities actually given and priorities preferred differ largely. Furthermore, as major factors enhancing pesticide use, the group of price factors and information factors could be observed in the expert assessment. In the group of price factors, the outbreak budget as well as the tax exemption for pesticides have been identified as highly distortional factors. Whereas in the third group information on non-chemical measures and definition of damage and threshold levels have been highlighted as the major lack and therefore contribute to a suboptimal use of pesticides.

SUMMARY AND RECOMMENDATIONS

Pesticide use for high-value crops will continue to increase. Pesticide use for fruit and vegetables is remarkably high because the physical appearance of these crops is a substantial factor in determining good market price. Herbicide use has become more intensive due to labor shortages. Most of the pesticides used still belong to the hazardous category according to WHO classification. As application technology will hardly change in the near future, health effects will not be reduced drastically. Examples show that the misuse of pesticides can result in more pest related crop losses than not applying pesticides at all.

At all levels information plays a very important role in the agricultural decision making process. Biased or missing information hinders the spread of alternatives to pesticides, as well as limits the political decision making process. Farmers' perception of crop loss is usually higher than their actual crop loss. Decision making is often based on information given by retailers, other farmers, extension workers and pesticide companies.

The liberal pesticide market resulted in many companies importing, trading and selling pesticides. Control of this market is difficult and the implementation of existing rules is lacking. Tax reduction increases the profitability of this market.

Many factors support the use of pesticides directly or indirectly. It can be assumed that the current price for pesticides does not include all costs which occur in the ecosystem. Little policy action is implemented to reduce the distortion of pesticide use levels. Information about private and socially optimal levels of pesticide use as well as external costs is hardly available. Efforts are strong toward improving pesticide based management systems on the one hand, and on the other hand more focus is given to IPM methods. Law enforcement of policies for pesticide imports, licensing, registration, control and pricing are essential components for successful national IPM programs.

However, further research is needed to analyze the current situation and, more importantly, to draw conclusions for future crop protection targets. To be able to recommend a preferable crop protection policy more information about benefits of pesticide use, external effects related to pesticide use, alternative management systems— especially successful IPM systems— is necessary. For the assessment of external costs more accurate and more natural science based data is essential. Could the money spent on the outbreak budget be more supportive toward farmers if spent on alternative uses, for example farmers' training? Strong support of farmer field school concepts and their adaptation to Thai conditions could be one alternative use. The successful implementation of IPM activities needs more research regarding how adaptable and successful IPM systems in various crops have to be assigned. As shortcomings in the enforcement of pesticide legislation have been identified as supportive of pesticide use, a critical review of forces and structures within the governmental procedures could be a useful step. Overall, use of economic instruments in crop protection policy will help to limit pesticide use toward the social optimum.

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